Historic Furnishings Report

Volume 1: Historical Data and Furnishing Plan

EDISON LABORATORY

EDISON
National Historic Site/New Jersey

U.S. Department of the Interior/National Park Service

HISTORIC FURNISHINGS REPORT

EDISON LABORATORY

Edison National Historic Site
West Orange, New Jersey

Volume 1
Historical Data and Furnishing Plan

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LIST OF ILLUSTRATIONS

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ADMINISTRATIVE DATA

Edison National Historic Site was added to the National Park Service system on September 5, 1962, by Act of Congress. The site includes both the West Orange laboratory and Glenmont, Edison's family home. The laboratory, established as a National Monument by proclamation of President Dwight Eisenhower on July 14, 1956, was donated to the United States Government by Thomas A. Edison Industries, McGraw-Edison Company. Glenmont, purchased by Edison in 1886, was donated to the Federal government by the Edison family. Glenmont became a National Historic Site under non-Federal ownership on December 6, 1955, and became a Federal property on August 3, 1959.

After Edison's death on October 18, 1931, the laboratory buildings were used by Thomas A. Edison, Inc. Responsibility for maintenance of records and historical collections lay with the company's Historical Research Department, established in 1928.

The laboratory complex consists of Building 5, a three-story building housing two machine shops, a library, stock room, experimental rooms and offices; Building 1, the former galvanometer building, now containing exhibit areas and offices; Building 2, the chemistry laboratory; Building 3, currently housing the pattern shop and NPS facilities; Building 4, formerly the metallurgical building, now containing curatorial work space, and several other support structures. Building 5 is abutted by Building 6, the former power house now serving as a visitor center.

INTERPRETIVE OBJECTIVES

The 1966 master plan for Edison National Historic Site states that the purpose of the site is to:

> preserve and use its unique resources for the benefit and inspiration of the people. This mission must be accomplished in such manner...that the public may be provided...with a sense of reality in understanding the world-renowned life and career of Thomas A. Edison, deepened appreciation for his great contributions to the welfare of mankind, and respect for intellectual effort as an indispensable factor in all human progress and achievements.

The 1969 "Historical Research Management Plan" supported this purpose by stating that the main interpretive theme of the site should be "to memorialize Thomas A. Edison's life, his illustrious career and scientific achievements, and their place in the industrial and economic history of our Nation, as well as the relevance of his character and values to the present age."

The 1991 "Interpretive Prospectus" for the site refined these themes by focusing the current interpretation on Edison's definition of "a new pattern for American industry" in which he "connected the inventive process with the organization of manufacturing [to] produce...final products for distribution to a national mass market."

The three primary themes presented in the Interpretive Prospectus include:

- The role of the West Orange laboratory in the development of science, business and technology.

- The impact of the work done in West Orange on the daily lives of millions of people worldwide.

- The role of Thomas A. Edison as an inventor, entrepreneur, manufacturer, husband and father, and cultural icon.

A secondary theme is "the history of the laboratory since Edison's death in 1931, including the role of the National Park Service in preserving and interpreting the vast cultural resources of the site."

The strength of the interpretation of the laboratory complex lies in the opportunity to link the "perspiration" and "inspiration" of inventing to the development and distribution of Edison's products to the consumer market. Historically furnished areas interpret the site to the period 1910 to 1920 when the Edison laboratory complex was at its most active--creating, refining, manufacturing and promoting new products. The work force at the West Orange laboratory reached its peak during this period, with over 200 experimenters, machinists and laborers employed.

Furnished areas include the chemistry laboratory, pattern shop, library, stock room, heavy machine shop, precision machine shop, and drafting rooms. Interpretation of each room will highlight the development of two of Edison's inventions, the phonograph and the storage battery, so that visitors may easily follow the research and development process. By following the process from idea to final product, visitors should gain a greater understanding of Edison's working method.

The examination of two specific technologies will also encourage visitors to consider the impact of Edison's inventions on their own lives. Visitors should come away from the site with a greater understanding not only of Edison's individual inventions, but also of the process of inventing.

OPERATING PLAN

Visitor access to the Edison laboratory complex will continue to be by guided tour only. Optimal tour size is 30 people. The Edison National Historic Site is open from 9:00 a.m. to 5:00 p.m. daily throughout the year. Interpreters introduce the site in the exhibit area in Building 6 or in the courtyard, then enter the hallway in Building 5. Tours then proceed into the library, where stanchions block off a large area in the center of the room for their use. Interpreters use this area to particular advantage with school groups, encouraging students to be seated on the floor and then using extra time to interpret the area.

When the furnishings plan is implemented for the second floor of Building 5, visitors will exit the library and proceed up the stairs. Installation of an elevator in the office area behind the main staircase to provide access to the second floor is under consideration. Until this elevator is installed, furnished areas on the second floor will be interpreted to visitors with disabilities through historic and contemporary photographs. An interactive computer touch screen program explaining the use of space on the second floor could be developed and installed in the visitor center.

The tour will continue down the north aisle of the precision machine shop and back down the center aisle. Next, the tour enters the drafting room, room 3, through the east door and exits through the west door, nearest the main staircase. Visitors exit the second floor via the staircase and proceed to the stock room. Until the second floor is opened, visitors will proceed directly from the library to the stock room.

Interpreters will enter the stock room, leaving visitors in the hallway and speaking through the fence. Next, tours enter the heavy machine shop, pause by the elevator, and move toward the center aisle for the majority of the interpreter's talk. In the future, when the machines are operated, the visitor path through the shop will be modified to ensure visitor safety.

Visitors exit the machine shop into the courtyard and proceed to the doorway of Building 3 to view the pattern shop. A Lexan barrier will extend several feet into the building, allowing visitors to enter the room. Next, the tour enters Building 2, the chemistry laboratory, where visitors gather in the area in front of the balance room. Depending on the size of tours, interpreters may allow one visitor at a time to enter the balance room. No barriers are required for the chemistry laboratory, but only with restricted tour size, as noted above, can both visitor and object safety be assured.

The tour then proceeds to Building 1, where interpreters demonstrate various phonographs, and discuss the impact of this invention on society. The tour is completed outside the Black Maria; visitors can then return to the Building 6 exhibit area and leave the site.

INTRODUCTION

The historic furnishings report is divided into two parts: a historical data section and a furnishings plan. The historical data section documents the occupancy, use, and furnishings of the laboratory buildings. For rooms in which historic furnishings will be the interpretive media, the furnishings plan provides an item-by-item listing of recommended furnishings and evidence to support inclusion and placement of each object. Edison's laboratory originally consisted of six brick buildings which contained a galvanometer laboratory, chemical laboratory, pattern shop, chemical storage room, metallurgy laboratory, library, stock room, heavy machine shop, precision machine shop, drafting room, experimental rooms, and a power house. This report documents the use and occupancy of all six original buildings. A separate section addresses furnishings and use of the gate house.

Although Edison opened the West Orange laboratory in 1887 and worked there until his death in 1931, the interpretive period for the site has been narrowed to the period between 1910 and 1920. This was a time of great organizational change at the laboratory, and one which saw the research and development of many of Edison's important inventions, such as the storage battery and the improved phonograph. Written and photographic documentation are good for this period; most of the research for this report was conducted using original records located in the site archives.

Analysis of room use, occupancy, and furnishings in the historic furnishings report is organized by building. An overview of the buildings and their functions is provided at the beginning of the report to help the reader place each building or room within the context of the laboratory complex. Discussion of room use and furnishings for each building has been divided into four periods: Period I, 1887 through 1900; Period II, 1901 through 1914; Period III, 1915 through 1931; and Period IV, 1932 through 1962.

Examination of historic occupancy of the six buildings begins with a survey of Periods I, II, and III and continues with a discussion of individuals who worked in each building. Individuals are listed in rough chronological order, according to the dates of their tenure in the building. The section documenting room use and furnishings opens with a further overview of Periods I, II, and III, and continues with an examination of each space presented chronologically. Historic occupancy and furnishings during Period IV (1932-1962) are examined together in a final section which briefly explains use of the laboratory after Edison's death.

The report recommends furnishing the chemistry laboratory, pattern shop, library, stock room, heavy machine shop, drafting room, and precision machine shop. Recommendations for the chemistry laboratory include furnishing each table with a specific experimental project and emphasizing the role of testing in the laboratory. The pattern shop will be cleaned up and will remain essentially unchanged. Similarly, few changes are recommended for the library furnishings--office supplies and desks will be added to reflect the library's function as an administrative space and pictures will be rearranged. The plan for the stock room recommends retaining the post-1916 configuration of the room, clearing away debris, and improving lighting. In the heavy machine shop, seven machines will be removed, and several will be moved to different locations in the shop. In addition, machinists' tools, personal effects, and work in progress are included in the plan to help recreate the historical scene.

In order to interpret the drafting room and precision machine shop, the second floor of Building 5 must be opened to the public. Furnishings for the drafting room include nine drafting tables with appropriate supplies at each. The room will be converted from office space to an exhibit area and nonhistoric partitions will be removed to restore this room to its original configuration. The precision shop plan requires the installation of partitions reconstructing room 5 on the south side of the room, and the acquisition of several new machines.

To fully explain Edison's method of invention it is important to include the second and third floor experimental rooms in Building 5 in the interpretation of the site. These rooms are necessary to illustrate the process of invention, research, development, and production that Edison established at the West Orange site, and documentation of both the second and third floors of Building 5 has been included in the historical data section. Of special interest are rooms 10, 11, and 12 on the second floor. Room 12 is known to have been Edison's room, and rooms 10 and 11 were used throughout the years by employees who worked very closely with Edison, such as Miller Reese Hutchison and John Ott.

Present research, however, has not uncovered sufficient written or photographic documentation to support furnishing these rooms at this time. The report recommends that while research on the second floor rooms of Building 5 continues, other means of interpretation, such as exhibits or an audio-visual presentation, be utilized to explain the use and occupancy of these rooms to the visitor. It is important to retain the original configuration and interiors of these rooms, however, so that if sufficient evidence is located, they can be furnished later.

Implementation of the furnishings plan should take place in at least three stages. Those rooms that require only minimum alterations to return them to their 1910-1920 appearance will be installed first: the library, heavy machine shop, and pattern shop. Existing furnishings in these spaces are largely original and only minor adjustments need to be made to return them to the appearance of the 1910-1920 interpretive period.

The second priority should be implementing the plans for the chemistry laboratory, stock room, drafting room, and precision machine shop. Although these plans require some acquisition of artifacts and reproductions, it will be some time before the second floor will accommodate visitors: visitor access to the precision machine shop and drafting room on the second floor has yet to be established, and planning for installation of an elevator to the second and third floors is in a preliminary stage.

Finally, the report recommends development and implementation of a furnishings plan for rooms 10, 11, and 12 on the second floor of Building 5, in the event that continued research uncovers evidence in which to base a plan.

SUMMARY OF SOURCES

Edison Archives

The Edison Archives contain over 5 million items documenting Thomas Edison's life, work and company activities from around 1850 through the 1950s. The record groups described below were consulted to compile this report. Researchers should note that at the time this report was written, several of these record groups were being processed. Therefore, documents may not be located permanently in the record groups indicated in the footnotes and bibliography.

> **Document File.** This is a collection of incoming correspondence to the West Orange laboratory arranged chronologically and by subject. It represents a large source of information about the activities of the Edison laboratory. Document files are arranged by subject and kept in boxes marked by the corresponding year. Many of these documents will be microfilmed by the Edison Papers Project.
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> **Letter Books.** The letter books contain copies of outgoing letters arranged in chronological order and bound in volumes.
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> **Laboratory Notebooks.** These books were left on laboratory tables so that experimenters could note down results and other experimental information. Edison used them as general purpose

notebooks. They are arranged chronologically and dated by the first written date in the book. Many of these books will be filmed by the Edison Papers Project.

Account Books. These books cover all the accounts of the laboratory and come in many forms. The distribution of labor worksheets provide a good breakdown of the laboratory work force.

Shop Orders. These orders were requests for work to be carried out by the laboratory staff. Each was given a number by which expenses could be allocated to an account. The shop orders are listed in some laboratory notebooks and descriptions of the work sometimes appear in accounts records.

Voucher Collection. This collection contains purchase vouchers for all expenditures at the West Orange laboratory from 1887 through the 1930s. Vouchers indicate the amount paid and account charged for items on the attached invoices. The invoices provide the vendor's name and type of business, date of transaction, description of purchase, and purchase price. Vouchers cited as evidence in the report are referred to by voucher number and year.

Batchelor Diaries. These are the bound diaries of Edison's closest associate, Charles Batchelor, in the 1870s and 1880s.

Hutchison Diary. This is the diary of Miller Reese Hutchison, a former chief engineer of the laboratory and one of Edison's closest associates. The majority of the entries are from the period 1907 to 1915.

Jones Collection. This group of records was collected by Mark M. Jones, chief of personnel at Thomas A. Edison, Inc. from 1916 to 1921.

Edison Pioneers Collection. The Edison Pioneers were formed by old Edison associates. Each applicant filed a biography and these forms, with supplemental material, are filed alphabetically.

Historian's Notes. These notes, compiled on 5-by-8-inch notecards and filed numerically, were made by Norman Speiden and cover a wide variety of subjects. Former Edison workers who wrote or visited the laboratory often gave information to Speiden, which he recorded in note form.

Oral Histories. Theodore Edison and nearly two dozen former Edison employees were interviewed in the early 1970s for Columbia University's Oral History Research Office. The tapes have been transcribed. The interviews provide some valuable details, but are used with caution in this report because of possible inaccuracies in some of the subjects' recollections. The Johnson-Ericke interview is credited jointly, because in some instances the manuscript does not indicate which subject answered the question.

National Phonograph Company Records. The records of this important Edison company have been grouped together. They contain correspondence and interoffice memos, and other corporate records.

Engineering Department Files. After the Edison laboratory was reorganized and the engineering department formed, this organization kept some of its own documents. They refer to the operations of the department.

Records of Historical Research Department, Thomas A. Edison, Inc. This is a series of letters to and from the Historical Research Department, which oversaw the care and preservation of the laboratory in the 1930s and 1940s.

Biographical Collection. This collection contains assorted clippings, manuscripts, obituaries, and printed matter by and about various Edison friends, employees, and contemporaries. It is arranged alphabetically.

Ediphone Division Records. As one of the few divisions which maintained operations in the 1930s and 1940s, the records of this organization are an important source of information.

Newspapers and Magazines

By the time Edison erected his West Orange laboratory in 1887, he was a nationally known personality, with news of his activities and opinions reported regularly in the national and local presses. Sources used in this report include the *New York Times* and the *New York Sun*. From the time he moved his operations to West Orange until his death in 1931, Edison's organization was described repeatedly in newspaper and magazine articles. Aside from reports written around the opening of the laboratory in the late 1880s, however, descriptions of the laboratory buildings in general are usually incidental to a larger story. An exception is the newspaper coverage of Edison's birthday celebration in 1889, at which time his employees refurnished the library in honor of his birthday. The physical structure of the laboratory was also described extensively in many newspapers throughout the nation at the time of the 1914 fire. The national press provided descriptions of the laboratory again in October 1931, when Edison's body lay in state there.

Many periodicals covered Edison's work and life during the West Orange years, tailoring descriptions to fit in with their own subject matter. Particularly detailed descriptions are given in *Cosmopolitan* in 1889 and *Munsey's Magazine* in 1891.

PREVIOUS PLANNING DOCUMENTS

Planning documents affecting the use and management of the Edison laboratory are:

"Historic Site Survey: Edison Home (Glenmont) and Laboratory, West Orange, New Jersey," June 30, 1954.

"Historic Structures Report-Part I, Gate House, Building No. 9, Edison Laboratory National Monument," April 21, 1959.

"Historic Structures Report-Part I, Main Laboratory Building, Building No. 5, Edison Laboratory National Monument," October 28, 1959.

"Historic Structures Report, Physics Laboratory, Building 1." No title page. The first page starts with Historical Data.

"Historic Structures Report-Part I, Chemical Laboratory, Building No. 2, Edison Laboratory National Monument," February 8, 1961.

"Historic Structures Report-Part I, Entrance Gates and Arches, 'Historical Data'," April 10, 1961.

"Historic Structures Report-Part I, Metallurgical Laboratory, Building No. 4, Edison Laboratory National Monument," February 9, 1962.

"Historic Structures Report-Part I, Chemical Stock Room and Pattern Shop, Building No. 3, Edison National Historic Site," October 11, 1962.

"Historic Structures Report-Part I, Power House-Boiler Room, Building No. 6, Edison National Historic Site," May 20, 1964.

"Interpretive Prospectus: Edison National Historic Site." No date.

"Historical Research Management Plan, Edison National Historic Site, West Orange-New Jersey," April 17, 1969.

"Building #2, Chemical Laboratory, Site Study, Edison National Historic Site," May 1973.

"Historic Furnishings Study, Building No. 7, Blacksmith Shop, Edison National Historic Site," April 28, 1975.

"Historic Structure Report, Glenmont and Laboratory Unit, Fire and Intrusion Protection and Replacement of Electrical Systems, Architectural Data, Edison National Historic Site, New Jersey," December 1976.

"Interpretive Prospectus: Edison National Historic Site, New Jersey," May 1991.

IDLCS: 05452/Building 1; 00271/Building 2; 00272/Building 3; 00273/Building 4; 00274/Building 5; 00275/Building 6; 00276/Building 7; 00279/Building 9. Managment Category A, must be preserved and maintained. Entered on the National Register.

HISTORICAL DATA

OVERVIEW OF CONSTRUCTION AND HISTORICAL USE OF THE STRUCTURES

In the early 1880s Thomas Edison began planning the construction of a laboratory that would be the largest and best equipped industrial research facility in the world. The success of his Menlo Park laboratory had proved to him that it was possible to regularize the process of invention and produce a stream of commercial innovations. With the profits of his electric lighting system in hand, Edison was now in a position to embark upon an even more ambitious venture--a research and development facility that would not only create new products but would also refine and perfect their production in factories built next to the laboratory. His associate, Charles Batchelor, was told of this scheme while the laboratory was being built. He wrote in his diary: "Edison's idea now for the future is to get up processes for manufacture and start factories...Immediately the new laboratory is finished these will be commenced in earnest."[1]

The place chosen for this complex was the Orange valley in New Jersey where the newly married Edison had purchased a house in 1886. Glenmont was a fine Victorian residence situated in an exclusive residential estate. In January 1887, he acquired a large parcel of land in Orange just down the road from his house in Llewellyn Park. The site was located in a rural landscape that was considered a resort area by many inhabitants of New York City and Newark. Edison's plan was to turn this pastoral setting into a dynamic industrial center, a place crowded with factories and laboratories and thousands of workers. He wrote, "My ambition is to build up a great industrial works in the Orange Valley, starting in a small way and gradually working up."[2] The inventor was able to turn this dream into a reality during his lifetime. When Edison died in 1931, West Orange was a major manufacturing center, an industrial community full of his factories.

Edison's plans for his West Orange laboratory reveal that he had more in mind than a utilitarian work place of commercial buildings. On May 3, 1887, he retained the services of Henry Hudson Holly, the prestigious residential architect who designed Glenmont, to design the laboratory.[3] Edison's own sketches of the proposed laboratory, executed some time in 1886, show an imposing structure in the beaux arts style that was fashionable for government buildings at that time (figure 2). This three-story building was constructed around an inner courtyard. A

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[1] Charles Batchelor diary, catalog 1336, Sept. 1887, pp. 277-79.

[2] Thomas A. Edison (hereafter cited as TAE), to J. Hood Wright, November 1887, Notebook N-87-11-15.

[3] Charles Batchelor diary, catalog 1337, May 3, 1887.

grand arched entrance led into the laboratory and a monumental tower disguised the smokestack.[4] Here was a building intended to glorify the process of invention and give the laboratory the dignity of a public building. The laboratory that Thomas Edison built at West Orange was to be a statement about the new found prestige of the inventor and the importance of his work in American life.

Holly produced a plan for a three-story rectangular building 250 feet long and 50 feet wide. This was similar to the kind of commercial structure in which Edison had always worked, but it had impressive two story arched windows at one end which gave it the air of a public or academic building. During 1887, Edison began to think about the interior spaces of his new laboratory. He doodled on pieces of paper and in pages of laboratory notebooks. One drawing represents his efforts to crowd all his experimental rooms--chemical laboratory, drafting room, test room, glass blower's room, pump room, and jeweller's room--into one long rectangular building (see figure 3b).[5]

It must soon have been obvious that the 37,500 square feet of floor space was not enough for the kind of laboratory he had in mind. Subsequently more laboratory buildings were added to the master plan, smaller than the main building and positioned perpendicular to it. With more space to play with, Edison began to produce drawings which divided functions among the structures. All these drawings have been gathered together in the 1887 West Orange laboratory folder in the Document File.[6] In one the main building contained a machine shop, engine and dynamo room, a store and instrument room, and a library. The satellite buildings were designated chemical/experimental, private/experimental, and furnace. Another shows a machine shop, instrument room and library in the main building, chemical room in an adjacent building, and experimental rooms in a third building. In all these drawings estimates were made of the amount of space required by each function.

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[4] Notebook N-85-10-01, pp. 62-68.

[5] Notebook N-87-00-00.3.

[6] Document Files hereafter will be cited as DF.

Experimental Buildings: Buildings 1, 2, 3, and 4

Edison specified that four satellite buildings should be erected at right angles to the main building, Building 5. They were to be constructed of "best hard burnt New Jersey brick" and be 100 feet long and 25 feet wide. The front wall of the building that faced Main Street (Building 1) was to be of "Hackensack front brick."[7]

Building 1. Building 1 was known as the galvanometer room or galvanometer building. Electricity had been an important and profitable field for Edison's experiments and his plans for the West Orange laboratory had always included an experimental area for electrical work. His business plan for the West Orange laboratory hinged on a steady income from contract research from the electrical utility industry.[8]

The original drawings made by architect Joseph Taft show a storage space at the front of the building and a line of six pier tables on which to mount the galvanometers and other electrical measuring equipment.

The building was specially constructed out of non-ferrous materials which would not interfere with the sensitive magnetic measuring devices installed in the laboratory. In his instructions to the architects, Edison specified "The Owner will furnish all copper nails."[9] All pipes, fittings and steam apparatus were made of brass.[10]

Building 2. This building served as a chemical laboratory. Its concrete floor was inclined so that liquids would run into two drains. The building was divided into one large room filled with experimental tables and a smaller room on the north end. Within the larger room, a further subdivision was created by the construction of an interior brick room. Vouchers for building materials suggest a possible construction date of 1890 for this interior room, whose purpose is unknown. In his reminiscences Fessenden remembered the chemistry laboratory

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7 "Specifications," in DF 1887, WOL--General, D-87-55, pp. 5 and 7.

8 Draft Agreement between TAE and Henry Villard, Miscellaneous Legal Series, 1887; Agreement made with Edison General Electric Co., October 1, 1890, a continuation of agreements made with the Edison Electric Light Co., March 8, 1881, and November 25, 1887.

9 "Specifications," in DF 1887, WOL--General, D-87-55, p. 13.

10 David Trumbull Marshall, *Recollections of Edison* (Boston: Christopher, n.d.) p. 67.

being divided into three spaces, which could be accounted for by the presence of the interior brick room.[11]

Building 2 differed from Buildings 1, 3, and 4 in that it had eight interior chimneys along its two long walls, four on each side. These were used to draw noxious chemical fumes from the building.[12]

Building 3. The plan for this building shows it neatly divided into two equal parts. The front part of Building 3 was reserved for general storage and the storage of bulk chemicals. This was certainly not the only storage facility in the West Orange laboratory. Chemicals were stored in Building 2, in the main stock room, and in rooms 3, 10, and 11 on the second floor of Building 5.[13]

The rear half of Building 3 was equipped as a pattern shop. This shop had the important task of making the foundry patterns used to cast parts of machines which were going to be installed in the factories to be built next to the laboratory buildings. Edison's grand strategy for the laboratory was to use it to refine the process of mass production of the new products coming from the experimental rooms. He envisaged "the Laboratory supplying the perfected invention(s) models pattern(s) and fitting up necessary special machinery in the factory for each invention."[14] The patterns were to be made in this shop.

The shop's machinery was driven by belts and lineshafts located beneath the floor. These were powered by a single direct current (DC) electric motor which received its current from the dynamos located in Building 6.[15] Although machine shops were almost always powered by overhead shafts and belts, running lineshafting below the floor was common practice in woodworking operations because it allowed long pieces of stock to be maneuvered around the shop. Using electric drive probably had as much to do with Edison's desire to show off the new technology as any practical considerations. His contemporaries would have been more likely to run a steam line from the boiler house across the courtyard to a small stationary steam engine in the pattern shop.

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[11] Fessenden, "The Inventions of Reginal A. Fessenden," *Radio News* 7 (August 1925) p. 156.

[12] National Park Service, "Historic Structures Report, Part I--Chemical Laboratory, Building No. 2, Edison National Historic Site," prepared by Melvin J. Weig and Norman R. Speiden, (1961), p. 5-6, Appendix 4.

[13] Notebook N-89-00-00.

[14] TAE to J. Hood Wright, November 1887, Notebook N-87-11-15.

[15] TAE to Batchelor, [summer, 1887] (in DF 1887, WOL--General, D-87-55).

Edison directed Batchelor to solicit bids for the major machines from two of the country's premier builders of woodworking machinery: Joseph A. Fay (Cincinnati, Ohio), and George Egan. Fay's prices were high, but according to H.M. Livor, manager of the Edison Machine Works in Schenectady, their machines were well worth the money.[16]

Building 4. Edison's interest in metallurgy and his plans to extract ore magnetically were the motives behind the construction of this building. The plan for this building called for a brick floor in a herringbone pattern.[17] It was to be fitted with rock crushers and assaying equipment.

An atlas dated 1890 shows that the back part of this building housed a forge and blacksmith's shop.[18] This was part of Edison's strategy of having everything at hand during an experimental campaign. The forgings that had been acquired from outside suppliers could now be made on site. Edison asked his old employee Francis Upton to help in the construction of the furnace. He wrote to Upton that he wanted a furnace just like the one Upton had at the Edison Lamp Company and mentioned that it was to go into the "metallurgical building."[19]

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[16] Harry M. Livor to Charles Batchelor, August 19, 1887 (in DF 1887, WOL--Suppliers, Edison Machine Works, D-87-57).

[17] The brick herringbone pattern was specified in Edison's instructions to the architect and are represented on Taft's set of drawings of the lab. "Specifications," in DF 1887, WOL--General, D-87-55, p. 8.

[18] National Park Service, "Historic Furnishing Study, Building No. 7, Blacksmith Shop," prepared by Susan A. Kopcznski, (April 28, 1975), p. 3. This source also notes that a reporter from *Frank Leslie's Illustrated Newspaper* noted a blacksmith shop on the site in 1891 but did not give its exact position.

[19] TAE to Francis R. Upton, no date (in DF 1887, WOL--General, D-87-55).

Introduction to Building 5

During the summer of 1887 construction began on the main building, which was later designated Building 5. Its ground floor was given over to a spacious library and a large machine shop. Adjacent to the machine shop was the engine room where boilers and steam engines provided power and heat to the laboratory complex. Engines in the power house also ran the dynamos which generated light and power for the laboratory. A system of overhead shafts and pulleys turned the belts which then drove the machine tools, a system which was typical of the mills and factories of industrial America. Steam was carried from the boilers through pipes which ran along the walls of the laboratory buildings, providing heat during the New Jersey winters.

Edison began to figure out how many experimental rooms he would need in the laboratory. His sketches on scraps of paper show that he planned to put experimental rooms and a stock room on the second floor of Building 5. He also placed a private room for his own experiments on the third floor.[20] These plans, and the instructions given to the architect and builders, were subject to change. This was to be Edison's dream laboratory and he could not resist improving and modifying his original specifications. He continually asked for changes during construction. Some changes were minor, but others involved significant alterations to the structure--such as the addition of a basement to Building 5. This process not only put a strain on the relations between client and builders but also make the original architectural specifications an unreliable source of information about the finished building.

Although Charles Batchelor, a partner in the Edison Machine Works and one of Edison's chief assistants at the time, was available to attend to details, Edison remained very involved in overseeing planning and construction of the laboratory. He fired Holly at the end of July because he was not satisfied with his supervision and felt Holly's contractors were doing bad work. Joseph H. Taft replaced Holly, designing the four one-story laboratory buildings and closely monitoring the work of all the contractors.[21]

By September 1887 the laboratory had begun to take shape. The roof on the main building was nearly complete and work was underway on four satellite buildings next to it. By October, Batchelor began moving equipment from the temporary laboratory in the Harrison Lamp Works, where Edison and a skeleton crew of approximately ten experimenters continued the development of electric light, ore milling, and the phonograph. During October and November loads of

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[20] See drawing in DF 1887, West Orange laboratory (hereafter cited as WOL)--General, D-87-55.

[21] Charles Batchelor diary, catalog 1336, August 4, 1887.

experimental equipment were shipped by horse cart from Harrison.[22] As soon as the experimental apparatus was installed, Edison and his men arrived from Harrison and started work.

Edison moved his operation to the West Orange laboratory in late November or early December 1887.[23] From that point on, the exterior appearance of the original six buildings changed little. In 1890, a gate house was added near the brick entrance gates erected with the original structures. Untouched by the 1914 fire that destroyed much of the Edison plant, the original six buildings had new metal windows and frames installed in 1915.[24] A roof was erected over the west courtyard doorway in Building 5 some time after 1920.

Building 5: Library

The Library functioned as the starting point for many of Edison's research and development projects: industrial research at West Orange began with a thorough search of all written sources on the topic at hand.[25] Edison planned a sophisticated research facility, noting in 1887 that he intended to hire "one person familiar with scientific matters to translate--must understand English, french [sic], German, and Italian."[26] Purchase vouchers and book inventories show that in the early years at West Orange, Edison frequently purchased new books and periodicals to provide his experimenters and other employees with an up-to-date research library. The library also served as Edison's main office area, and from his desk and director's table he administered the various aspects of his organization. Aside from its practical function, the library served as the ceremonial core for operations at the West Orange laboratory. In the library, "a magnificent affair...with three tiers of alcoves and two balconies around the room,

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[22] Charles Batchelor diary, catalog 1337, Sept. 19, Oct. 7, Nov. 10, and Nov. 25, 1887.

[23] National Park Service, "Historic Structures Report, Part I, Main Laboratory Building, Building No. 5, Edison Laboratory National Monument," prepared by Norman R. Speiden, October 28, 1959, p. 4; also Historian's Note 131. Fred Ott's recollection is that Edison moved into the laboratory November 24, 1887, but no other documentation supports this date. Timesheets and payroll records do not indicate any formal opening day.

[24] Ibid., p. 6.

[25] Andre Millard, *Edison and the Business of Innovation*, (Baltimore: The Johns Hopkins University Press, 1990), p. 9.

[26] Ledger book E4294, November 24, 1887, p. 32, West Orange laboratory records, Box 38.

all finished elaborately" Edison entertained visitors, held meetings and gave interviews.[27]

Located in the west end of Building 5, the library's arched windows open on Lakeside Avenue, Main Street, and the laboratory courtyard. It is a large, two-storied room with balconies forming two open tiers above the first floor. Alcoves filled with bookcases line three of the four walls on the main floor and first tier balcony, and surround the entire balcony on the second and highest tier. The cases on the ground floor are open, but several of the cases on the upper two tiers have pane glass doors and were used for exhibiting Edison products or mineral samples. The north wall houses a fireplace, flanked by windows rising to the second tier.

The library is panelled in grain-painted varnished yellow pine throughout; painted iron columns stand in front of the alcove dividers. Four fluted columns capped in brown stone were originally installed, flanking alcoves 2 and 7 and rising through both balconies to the library ceiling. Some time between October 1903 and 1911, additional plain columns were added to the ground floor and first balcony.[28] Four of these plain columns extend from the corners of the first floor through the first balcony, and columns in front of the divider between the southeast office and alcove 5 extend only to the overhang of the first balcony.

An iron railing around the two galleries was originally planned, but at the suggestion of the architect the railing material was changed to wood.[29] Framed prints have hung on the railings, alcove dividers, and columns since the library was first occupied.

The library was not complete in November 1887 when Edison moved his operation to West Orange. Although the ceiling was in place, the fireplace was not yet begun, the stairs were not installed, railings were not in place, and the second floor of the library itself was not installed.[30] The bookcases lining the first floor alcoves and the first and second level balconies were being constructed as late as December 1887 and finishing touches were added the next month.[31] Edison

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[27] J.B. McClure, editor, *Edison and His Inventions*, (Chicago: Rhodes and McClure Publishing Co., 1894; first published in 1889), p. 24.

[28] See figure 56 without columns and figure 62 with columns.

[29] Taft to Batchelor, nd., 1887 (in DF 1887, WOL--General, D-87-55).

[30] Charles Batchelor diary, catalog 1337, November 10, 1887.

[31] P.B. Fairchild and Co., to T.A. Edison, December 5, 1887 (in DF 1887, WOL--General D-87-55); and Voucher 81, 1888.

was billed for the library mantel and arch stone on December 31, 1887, which indicates that work on the fireplace was underway by that time.[32]

Early in the twentieth century, two of the alcoves on the first floor were modified by the addition of two offices, one in the northwest corner, the other filling the southeast corner of the room. These offices were probably added sometime between October 1915 and November 1916.[33]

The lavatory in the library is located under the stairway to the first balcony; its original entrance was from the stairway's first landing. The door was panelled in wood on the bottom half and topped with six glass panes. The glass may have been frosted or a shade may have been hung on the inside of the door (figure 15). Because the entrance was on the first landing of the stairs and the room was at the first floor level, at least one step led down into the lavatory.

Plumbing specifications drawn up for Building 5 show that this lavatory, the "Office Toilet room," was considerably more elaborate than those in other parts of the building. Edison's lavatory sported a "14 in. marbleized wash bowl with...white Italian Marble counter sunk slab...with ogee moulded edges...." In contrast, the remaining sinks in the building were "galvanized iron...with iron legs and Demorest galvanized iron back(s)." The lavatory consisted of two rooms, the outer room containing the marble sink described above, and the inner room planned to house two water closets and a porcelain urinal.[34] Sometime before 1916 the lavatory was remodeled to change the location of the entrance. The original doorway was replaced with pine paneling similar to that throughout the rest of the library, and an entrance way was cut through the alcove closest to the steps. The original door appears to have been used in the new door frame. The configuration of the lavatory room itself was not changed, although only one of the two planned water closets was installed.[35]

During the more than 40 years Edison worked in the library, modifications to the first and second balconies were rare. An exception is the projection booth installed

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[32] Voucher 657, 1887; Edison was still being hounded for payment for the mantel much later, Potsdam Red Sandstone Co. to T.A. Edison, March 10 and March 20, 1888 (in DF 1888, WOL--General, D-88-55).

[33] See figure 76 and figure 4, the 1916 floor plan. Figure 76, a photograph taken on Edison Day, October 21, 1915, shows that at that date the southeast corner had not yet been enclosed to form a separate office. Floor plans drawn in November 1916 show that both offices were in place at that time.

[34] Plumbing specifications drawn up by Henry Hudson Holly's office, June 8, 1887 (in DF 1887, WOL--General, D-87-55).

[35] Floor plan, November 1916, Edison NHS.

on the south side of the first balcony sometime between 1910 and 1912.[36] The booth is a floor-to-ceiling wooden enclosure with framed windows for projection, facing a screen suspended over the fireplace from beams supporting the second balcony. The screen itself was installed some time before April 1895 (figure 50) and may have been used for lantern slide projection or experimental use of early motion picture projectors before the projection booth was installed.

Building 5: Stock Room

The stock room was a vital part of the laboratory and was included, in one form or another, in all of Edison's plans for the new facility. A stock room was established on the first floor of Building 5 between the library and machine shop. It was positioned to serve both machine shops and was fitted with a dumb waiter and an elevator to take supplies up to the second and third floors.

Obtaining supplies needed in an experimental project was a very important part of Edison's method of inventing. Edison the inventor was always a man in a hurry because experience had taught him that the first to produce an innovation was often the one who made the money from it. The patent office's system of emphasizing precedence of invention was a powerful incentive to speedy innovation. Now that he was a man of substance, Edison could afford to equip his laboratory with everything that might possibly be required in the course of his inventive activities. The point of doing this was to reduce the amount of time spent waiting for supplies, and Edison claimed the "inventions that formerly took months and cost a large sum can now be done in 2 or 3 days with very small expense."[37]

Building 5: Heavy Machine Shop

Batchelor and Edison spent many hours browsing through the catalogues of machinery manufacturers and chemical supply houses. A stream of purchase orders began to flow from West Orange and soon loads of equipment and supplies began to arrive at the laboratory. Edison equipped the two machine shops from a variety of sources. Some tools came directly from their manufacturers, others

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[36] The booth is visible in figure 64, a 1912 photograph by Lueder, but it is not mentioned in Dyer and Martins' thorough 1910 description of the library; Frank Lewis Dyer and Thomas Commerford Martin, *Edison: His Life and Inventions*, Vol. 2 of 2 (New York and London: Harper and Brothers Publishers, 1910), pp. 640-45. The 1929 edition of Dyer and Martin, *Edison: His Life and Inventions*, Volume II, with the collaboration of William Henry Meadowcroft will hereafter be the edition referenced throughout this report.

[37] Thomas A. Edison to J. Hood Wright, November 1887, Notebook N-87-11-15.

came by way of dealers such as Manning, Maxwell, & Moore of New York City or E.P. Bullard of Bridgeport, Connecticut.

In late June 1887 Charles Batchelor wrote to John Randolph, Edison's bookkeeper, telling him that machinery for the West Orange laboratory was to be ordered through, and paid for by, the Edison Machine Works and that it would be best to set up a special account for laboratory orders.[38] While the laboratory was under construction, the vast majority of the orders were handled by the Edison Machine Works in Schenectady. In some cases, machines were shipped by other suppliers to Schenectady, where they were stored until needed at West Orange. In other cases the Machine Works simply handled the paperwork. H.M. Livor, manager of the Edison Machine Works, advised Batchelor regarding the quality of machines from different manufacturers, likely availability of replacement parts, and acceptable substitutions.[39]

In addition to handling orders from outside vendors, the Edison Machine Works manufactured most, if not all, of the lineshafts, pulleys, and hangers used in the laboratory. They also built the overhead crane that serves the central aisle of the heavy machine shop. Samuel Insull of the Edison Machine Works had determined that they could make the crane in-house for half the amount bid by Yale & Towne Manufacturing Company. Lathe and planer tools were forged in Schenectady and the Machine Works produced iron castings for the laboratory, ranging from tuyeres and bed plates for the blacksmiths' forge to a huge collar that capped the smokestack.[40]

Edison's original drawings for the laboratory show only one machine shop (figure 3). It is possible that so many machine tools were purchased that they could not all fit into the shop on the first floor and subsequently another shop was created on the second floor of Building 5. Batchelor divided the machine tools between two floors: heavy machinery in the first floor machine shop, smaller machines in the second floor shop.

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[38] Charles Batchelor to John F. Randolph, June 27, 1887 (in DF 1887, WOL--General, D-87-55).

[39] Survey of Voucher Collection, 1887, and correspondence in DF 1887, WOL--General, D87-55.

[40] On the crane see: Samuel Insull to Charles Batchelor, September 24 and 29, 1887 (in DF 1887, WOL--General, D-87-55).

Building 5: Precision Machine Shop

This machine shop contained the smaller and more precise machine tools and consequently was called the "precision shop" or the "precision department." In general its workers were highly skilled tool and instrument makers who could command higher wages than the average machinist.[41] It was located directly above the heavy machine shop on the first floor and looked out onto the courtyard on the north side of Building 5. Belts brought power from the steam engine in the shop below. This shop occupied about half the floor space of the present shop; a line of experimental rooms took up the south side of the space.

Building 5: Second Floor Experimental Rooms

In November 1887, Charles Batchelor noted in his diary that the "small rooms" were finished at the laboratory except for the locks on the doors.[42] These were probably the experimental rooms on the second floor of Building 5, the heart of the laboratory where the intellectual effort of inventing was carried out. These rooms --their equipment, their location, and their proximity to the precision machine shop--are the embodiment of Edison's method of inventing. Each room housed a different experimental project and the experimenters and helpers assigned to that job.

The locks on the doors may be an indication of the secrecy which had become part of Edison's experimental method. The inventor believed that the patent system could not fully protect his work and subsequently carried out experiments in highly competitive areas, such as electric lighting and motion pictures, in an atmosphere of secrecy.

The experimental rooms ran along both sides of a central hallway on the second floor. On the south side the rooms ran the length of the floor and overlooked Lakeside Avenue. On the north side the precision shop took up half the floor space and the rooms ran from the head of the stairs (from the library) to a point midway along the length of the building.

The rooms were numbered one through nine on the south side and ten through twelve on the north. We know that room 12 was on the north side near the stairs because the room numbers remain on the doors to rooms 10 and 12. Room 5 was on the south side of the building, adjacent to the elevator. Charles A. Brown

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41 W.K.L. Dickson and Antonia Dickson, *The Life and Inventions of Thomas Alva Edison* (London: Chatto and Windus, 1894), pp. 293-95.

42 Charles Batchelor diary, catalog 1337, November 10, 1887.

places it there in 1889 when he complains about the elevator making too much noise for him to work on experiments in room 5.[43]

Each experimental room could be fitted up with equipment as required. The divisions between rooms were made of thin wood panelling which could be removed without too much effort. These "partitions" could be used to create new spaces as the need arose, enlarging or reducing the floor space of experimental rooms. For example, shop order number 2140 was for taking down the partitions in room 6.[44] It was Edison's practice to change the rooms around as he embarked on new projects, although very little is known of the specific changes. Multiple doors opening into the hallway and scars on the ceiling planks suggest that the large room on the south side of the second floor was once several smaller rooms numbered 1, 2, and 3. The row of rooms on the south side of the precision machine shop could also have been altered, for there is evidence on the ceiling of several partitions.

Dyer and Martin locate both John and Fred Ott on the second floor. They note that the precision shop is "the realm presided over lovingly by John F. Ott...[who] oversees the work of the mechanics as [Edison's] productions are wrought into concrete shape." Fred Ott is placed "in one of the many experimental-rooms lining the sides of the second floor."[45]

Room 12. In all his plans for the laboratory Edison indicated that he wanted his own "private" experimental space. Room 12 was established as Edison's personal experimental room. It stood at the top of the stairs that came up from the library on the first floor and the windows looked out onto the courtyard surrounded by the five experimental buildings--this was the ideal place for the supervision of his experimenters' work.

Rooms 10 and 11. No images or plans of these two rooms have been found. The two rooms situated between Edison's room 12 and the precision machine shop might have been the glass blowing and vacuum pump rooms. Although the experimental rooms were primarily spaces to be customized for the job at hand, Edison's plans for the laboratory show that some functions, such as glass blowing and vacuum pumping, were to be permanently assigned to experimental rooms.

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[43] "Deposition of Charles A. Brown," from *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith*, p. 157.

[44] The shop orders were requests for work to be carried out by the laboratory staff. Each was given a number by which expenses could be allocated to an account. The shop orders are listed in some laboratory notebooks. Number 2140 comes from Notebook N-09-01-21 and dates from around 1909.

[45] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 647-48.

In one sketch done in Notebook N-87-00-00.3 these rooms are assigned to the third floor, but a contemporary source located them on the second floor.[46]

Building 5: Third Floor

This floor remained empty when work began in the laboratory in November 1887. It appears that the third floor was divided by two floor-to-ceiling partitions which ran north to south and divided this floor into three large spaces. Within the westernmost room (also known as the music room), Edison established a recording studio shown in figure 132. The enclosed area, whose exact purpose is unknown, abutted the south wall, or Lakeside Avenue. The windows behind and to the right of the piano player overlooked Main Street.

The high ceiling and large open spaces made this floor suitable for a function that Edison had considered when he planned the laboratory--an exhibition hall to show off his latest inventions. The commercial promotion of an invention was an important element in the business of innovation. Edison wanted to bring the products of his laboratory to the public's attention and he also needed to attract capital from financiers. He was an expert at manipulating the press to provide free advertising for his work.

Exhibition and demonstration space was important to Edison at the new laboratory. Experiments on an improved commercial talking machine required such areas, as would the future development of motion pictures. Edison's sketches for the new laboratory included a projection room for lantern slides, but there is no evidence the finished laboratory included a special room for that purpose. Work on motion pictures did not commence until 1888 after the main laboratory building was completed.[47]

The most pressing job for Edison in his new West Orange laboratory was to make up the ground lost to Charles Sumner Tainter and Chichester Bell in improving the tin foil phonograph of 1877. In 1886, Bell and Tainter demonstrated a talking machine using wax cylinders. Edison knew that he had to move quickly to recover the lead in this race to develop a commercial technology of sound recording. Although many details of Building 5 remained unfinished, Edison exhibited a new model phonograph to members of the National Academy of Sciences on November 11.[48] It is possible this demonstration took place on the third floor.

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[46] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, p. 295.

[47] Drawing in Notebook N-87-00-00.3.

[48] Charles Batchelor diary, catalog 1337, November 11, 1887, p. 27.

Experimental rooms were also installed on the third floor. A notebook begun by Charles Wurth in November 1891 has a front cover labelled 'Rooms 5, 13, 14, 29, 30,' which suggests--at least in the early years--at least eighteen (13 through 30) experimental rooms on the third floor.[49] A newspaper article of July 1888 noted "a score of small apartments in the building" along with "an extensive carpenter's shop and a spacious lecture room" on the third floor.[50] The lecture room may have been the music room.

[49] Notebook N-91-11-24.

[50] *New Orleans Picayune*, July 22, 1888.

Building 6

This structure is divided into two rooms, the boiler room (positioned next to Building 5) and an engine house. In 1887, Edison purchased three Babcock and Wilcox boilers of 219 horsepower. These large boilers were made to order, as was the practice at this time, and came with ornamental fronts embellished with the Edison name.[51] One of these was the first piece of machinery to be delivered to the laboratory, arriving on September 19, 1887.[52]

The boilers generated steam to heat the laboratory complex and to drive several steam engines. The first prime mover to be erected was a forty horsepower C.H. Brown engine, which was installed in a pit at the east end of the heavy machine shop. This provided the power for lineshafts on both the first and second floors. The engine had a single horizontal cylinder with an 11-inch bore, a 30-inch stroke, and a ten foot diameter flywheel.[53]

Two Armington and Sims steam engines, one of 125 horsepower and one of 80 horsepower were installed in the power house (as Building 6 was soon called). These ran the dynamos which provided electric light and power to the laboratory. Coal was probably kept in the space between Buildings 3 and 4.

In an attempt to secure a large order for belting, F.H. Underwood, president of the Underwood Manufacturing Company, offered to install his company's patent cotton-leather belting for free. Using a technique that had worked with other vendors to get unusually deep discounts, Batchelor reminded Underwood that "we shall have, as we always have had, a large number of visitors from all parts of the world."[54]

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[51] Contract between TAE and Babcock & Wilcox, August 24, 1887 (in DF 1887, WOL--Suppliers, General, D-87-56).

[52] Charles Batchelor diary, catalog 1337, September 19, 1887.

[53] C.H. Brown & Company to Charles Batchelor, May 7, 1887 (in DF 1887, WOL--Suppliers, General, D-87-56); Voucher 725, October 6, 1887.

[54] F.H. Underwood to Charles Batchelor, October 19, 1887 and Charles Batchelor to F. H. Underwood, October 21, 1887 (in DF 1887, WOL--Suppliers, General, D-87-56). Underwood got the order. For examples, see Vouchers 504, 697, and 698.

By November 25, 1887, all engines had been installed, steam had been raised in the boilers and the large brick chimney rising out of Building 6 was belching smoke--work had begun at the Edison laboratory in West Orange.[55]

The two engines in the power house ran a series of Edison dynamos which were brought to the laboratory in December 1887. Figure 145 is a diagram showing how these were linked up in 1889. Figure 146 is a photograph which shows this arrangement as it was around 1890. The line shaft in the bottom part of the drawing (clearly shown in the photograph) provided a source of power for other dynamos which were brought into the building for testing and experiments.

The Edison Machine Works provided the laboratory with a range of the dynamos in production at the time:

Edison 16 Amp "Municipal" Dynamo
2 #10 "Domestic" dynamos
1 #20 dynamo
1 #2 dynamo with special armature
1 #8 dynamo with special armature

This equipment was delivered with the switches, circuit boards, meters, and regulators required to set up and run a central station system.[56] The switchboards were installed in the basement of Building 5. Batchelor wrote that the laboratory had "a complete Electric Lighting station besides a shop."[57]

Charles Batchelor installed this equipment and with the help of several experimenters began to wire up the laboratory complex. Each laboratory building was wired for several different voltages and amperages. There was a 100 volt direct current system in all rooms running from 3/8-inch wire.[58] Batchelor dug trenches in the courtyard to run underground cables from Building 6 to the rest of the lab.

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[55] Charles Batchelor diary, catalog 1337, November 25, 1887. Although this date has traditionally been the one given to mark the opening of the laboratory it is certainly not the only date that could be used. Batchelor writes "now we can begin work" on October 7, for example, and there are numerous other criterion for marking the opening of the lab.

[56] Samuel Insull (Edison Machine Works) to Charles Batchelor, December 12, 1887 (in DF 1887, WOL--Suppliers, Edison Machine Works, D-87-57). See (D-87-55) for additional correspondence.

[57] Charles Bachelor to F.H. Underwood, October 21, 1887 (in DF 1887, WOL--Suppliers, General, D-87-56).

[58] Edison's drawings of the system are in DF 1887, WOL--General, D-87-55. One of the drawings is in Batchelor's hand.

Not long after the laboratory opened, Edison began to run power lines to Glenmont and other houses in Llewellyn Park, with Batchelor running the first wires on December 1, 1887. Edison now had the means to test dynamos and other central station equipment. This was a time of rapid growth in the electrical supply industry and new equipment was being developed at a hectic pace. It is safe to assume that during the 1880s and 1890s many different pieces of equipment were tested in the power house that the staff knew as the "dynamo room".

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At the end of 1887 Edison and Batchelor could look back on a year well spent. The new laboratory had been constructed and the staff had already begun experiments. The West Orange laboratory was one of the largest industrial research facilities built to that date, perhaps the largest in the world, as some of his employees thought. It provided the realization of Edison's grand plans, and in his words it was "the best equipped and largest laboratory extant."[59]

ANALYSIS OF HISTORIC OCCUPANCY

Period Summaries

Period I: 1887-1900. This period began with a flurry of experimental activity. Edison was full of enthusiasm, full of ideas for experimental projects, and he had plenty of money coming in from the electric utility and manufacturing industries to pay for experiments undertaken on their behalf. Less than a year after its opening, the West Orange laboratory was operating at full capacity, the first great experimental campaign on the phonograph in full swing while other experimenters maintained the effort in electricity and ore milling. Edison's secretary, Alfred O. Tate, reported that he had about 120 men at work on about 60 different experiments around 1888.[60]

The little evidence we have from payrolls indicates a high turnover of employees and a constantly changing work force. Edison was sensitive to labor costs and practiced continual pruning of his staff. David Trumbull Marshall, an Edison

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[59] TAE to J. Hood Wright, November 1887, Notebook N-87-11-15.

[60] A.O. Tate to Frank McGowan, July 2, 1888 (in DF 1888, Edison, T.A.--Outgoing Correspondence, D-88-18).

employee, estimated the number of workers at the laboratory in its early years at around 50, and the payroll for 1890 shows 85 men at work.[61]

In the early 1890s Edison embarked on what would become a 10-year long ore milling venture in the highlands of northern New Jersey. This was a turning point in the history of his laboratory in the nineteenth century. Expanding operations at the Ogden mill led Edison to reduce expenditures in West Orange. His first step was to reduce the labor force. In 1891, the laboratory employed around 65 men and only 160 employees remained in the Phonograph Works--a significant decrease from 1890 when 500 worked there, although a decline in phonograph sales also prompted reductions in the work force.[62]

The West Orange laboratory was hit hard by the panic of 1893, an economic depression which lasted four years. The impact of the depression was felt in Edison's laboratory as phonograph sales remained sluggish and contract research for the electrical industry was cut back.[63] By 1896 the factory inspectors of the state of New Jersey found only ten men at work in the laboratory and just over 100 in the Phonograph Works. The next year there were 28 workers in the laboratory and 144 in the factories around it.[64]

Bearing in mind that it was common practice in Edison's laboratory to move from job to job, and from room to room, the placement of specific employees at specific parts of the site is academic at best. Several employees maintained work benches in different parts of the site; experimenters such as Jonas Aylsworth, J.W. Gladstone, and Franz Schulze-Berge probably had benches in Building 2 and on the top floor of Building 5. Some employees, such as W.K.L. Dickson, had two different jobs in two different parts of the laboratory. Dickson was put in charge of the ore milling project and was installed in Building 4--the center of ore milling experiments. Yet as the laboratory photographer and a leading figure in motion picture research he also had his own room on the second floor of Building 5 and also worked in a special photographic building erected to the south of the laboratory in 1889.

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[61] Marshall, *Recollections of Edison*, p. 58; Payroll of February 6, 1890 (in DF 1890, WOL--General, D-90-64).

[62] New Jersey, *Annual Report of the Inspectors of Workshops and Factories*, 1890-1891 in New Jersey State Library archives at Trenton, New Jersey.

[63] Millard, *Edison and the Business of Innovation*, table 6.1, p. 132.

[64] New Jersey, *Annual Report of the Inspectors of Workshops and Factories*, 1895-1898 in New Jersey State Library archives at Trenton, New Jersey.

Period II: 1901-1914. This period marked the commercial success of Edison's improved phonograph and its pre-recorded cylinders and the introduction of his new alkaline storage battery. These two product lines dominated the work of the laboratory from the turn of the century until World War I. A facility that had been built with electric light and power technology in mind was now fully concerned with the different demands of producing and selling talking machines and batteries. Instead of supplying magnetic ore separators to industry and carrying out contract research for the electrical utility industry, Thomas Edison had identified a consumer market for the phonograph and potential industrial customers for the battery.

Edison originally thought that the improved phonograph would be used by businessmen as a dictating machine. When this marketing strategy failed, (partly as the result of the difficulty of operating the machine), he turned to entertainment uses of the phonograph. The talking machine was now to become a means to bring fine music into the homes of Americans, either on pre-recorded cylinders made at the West Orange site or on cylinders recorded by the users. In 1896 Edison and his team of researchers finally developed a spring motor phonograph which was cheap, durable and easier to use than the models he had sold in the early 1890s. The new line of "Home" and "Standard" machines were put into production at the turn of the century. It was Edison's goal to put one of his phonographs in every home in the United States.

Now Edison finally had an opportunity to realize his dream of a great factory complex in the Orange Valley and test his concept of the laboratory perfecting the system of mass production. The phonograph was a complex machine that posed many problems in large scale manufacture. In 1900, the first shop orders were executed to design and build machines to make parts for the new Home phonograph.[65]

Yet mass produced talking machines could not revive the phonograph business alone; the customers still needed a supply of records. The boom in talking machines that began just after the turn of the century was created and sustained by cheap and plentiful cylinder records rather than by the availability of a cheap and dependable machine.

The development of a technology to duplicate prerecorded cylinders in Building 2 and Building 5 of the West Orange laboratory was therefore of central importance to the Edison enterprise. (It was also a critical factor in the revival of Edison's reputation as the great inventor.) It was of great importance to the talking

[65] Shop Order 984 (1900), Notebook N-87-11-24.

machine industry as a whole, and the introduction of this process was to influence the international development of recorded sound technology.

After his painstaking efforts to find the right chemical combination in an alkaline storage battery, Edison struggled to find a market for it that was large enough to support his plans for large scale manufacture at West Orange. He was an enthusiastic supporter of the automobile and hoped that his battery might power an electric automobile. Unfortunately the public preferred internal combustion engines and the high price and initial poor reliability of his battery deterred general use in automobiles. The storage battery, however, was successfully used in delivery trucks, railroad car lighting, mining locomotives, and emergency lighting systems, and was a successful product line for Thomas A. Edison, Inc. and its successors for several decades.

The West Orange laboratory was not only the location of some experimental work to develop and perfect the alkaline storage battery,[66] but also the place where elaborate marketing schemes, such as the electric automobile rallies, were devised. Edison also hoped that submarines would use his battery to power their electric motors. During this period great efforts were made to produce and market a large battery intended for submarines.

In addition to the key phonograph and storage battery projects, there were two other important products developed at the West Orange laboratory during this period. The X-ray machine was being perfected at West Orange as the century began. It failed as a commercial product and proved how dangerous new technologies can be. The motion picture had become a highly profitable business for the Edison enterprise by 1900. Edison looked forward to developing dramatic new motion picture products in the twentieth century, including his long standing commitment to bring synchronized sound to moving pictures.

These experimental projects brought about a period of intense activity in the West Orange laboratory. In 1899, there were 111 names on the laboratory payroll and this probably represented the maximum number of employees in the laboratory during the nineteenth century.[67] In 1910, there were over 100 workers in the laboratory and by August 1912 just over 200, including 25 experimenters, 90 machinists, and 12 draftsmen.[68] Every experimental room on the site was

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[66] Much experimental work on the storage battery was performed at the Glen Ridge and Silver Lake factories, a few miles from West Orange.

[67] Employee Records, Laboratory Payroll Time Sheets, Cabinet 50783, Drawer 3

[68] Employee Records - Edison Laboratory Time Sheets, Box 83.

occupied and more were being created in new buildings, such as Building 24. This period marks one of the peaks of experimental activity in Edison's laboratory.

The successful move into mass production of phonographs, cylinders, and storage batteries led to the construction of several new factory buildings at West Orange. The increasing load of administering Edison's large business organization led to the construction of an administration building, next to the east end of the laboratory on Lakeside Avenue, and a reorganization of the business organization. Thomas A. Edison, Inc. was formed in 1911 as the first step in bringing all of Edison's various businesses under one corporate head. This company was responsible for running the factories built around the laboratory and for administering experimental work.

Period III: 1915-1931. Although the great fire that ravaged the West Orange complex in December 1914 was a watershed in the history of Edison's business affairs, it did not touch the laboratory nor did it alter a process of change which had started with the creation of the Engineering Department around 1911. What Edison had once called "the best lab ever" was now settling down to the mundane task of supporting the Edison product line. Routine production engineering gradually replaced the great experimental campaigns that characterized the laboratory in the nineteenth century.

This evolution of function brought change to the make up of the laboratory staff. Increasing numbers of professional engineers and administrators were added to the payroll. Edison's secretary William H. Meadowcroft reported in 1916 that the laboratory's work was directed toward support of the Edison product line and "there is comparatively little of mere research work done here...."[69]

The laboratory that once had a world wide reputation for developing completely new technology now acquired the patents and skills of others. Jonas Aylsworth and Daniel Higham, for example, worked as independent inventors under contract to Edison for much of this period. On the other hand the daily work of some experimenters, such as George Werner and Walter Dinwiddie, shows that little had changed in the Edison laboratory from the 1880s. These men played the roles of both engineers and experimenters, applying themselves to the job at hand and moving from basic research to production engineering with ease. They still worked in small teams and were expected to be adaptable, shifting in and out of each project as needed.

Yet a new direction in labor policy had begun at the turn of the century when employees with specific skills and formal education were sought instead of the

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[69] William H. Meadowcroft to A.P.M. Fleming, July 24, 1916, Letter Book 113, p. 302 (LB113302).

generalists of the nineteenth century. The professionalization of the work force was widespread in the American economy at this time. At the West Orange laboratory this movement can be seen in the type of man hired in the twentieth century. The old work culture which glorified personal initiative and operated in an environment of chaos was being slowly replaced. Lines of authority were constantly being redefined and a strict hierarchy was maintained in the West Orange laboratory after 1914.

The laboratory work force was reorganized several times during this period. The process of specialization and bureaucratization can be seen in the emergence of a new kind of employee at West Orange, the accountant and financial analyst. The old era of *muckers*--experimenters who worked with Edison--and all night experiments was over. In its place was a tightly run business operation.

This period marked a slow decline after the boom of World War I. In 1917 government contracts created many new jobs at West Orange and the work force increased significantly. There were around 180-190 men at work in the laboratory during World War I.[70] After the initial loss of workers to the armed forces, there was a rapid increase in the labor force, covering both laboratory and factory employees. During the war there were about 8,000 men in the whole Edison complex compared with about 3,000 at the turn of the century. By the end of the hostilities there may have been as many as 11,000 men employed by Edison at West Orange.[71]

But this was to be only a temporary prosperity. When he returned to West Orange after working for the government during the war, Edison was concerned about the hard times ahead; he correctly anticipated greater competition in his core phonograph and storage battery businesses. The post-war depression hit hard in 1921. Edison responded to this crisis by discharging thousands of employees from factory laborers to John Constable, chief engineer of the laboratory.[72] By 1921, it was estimated that less than 2000 workers remained in the factories at West Orange.[73] Retrenchment continued as the financial

[70] Employee Records, Edison Laboratory Time Sheets, 1918, Box 115.

[71] "The Business Activities of Mark M. Jones," Mark M. Jones Papers, Box 1. Jones was employed by Thomas A. Edison, Inc. from 1916 to 1921, first as Employment Supervisor and then as Director of Personnel.

[72] Miller Reese Hutchison Diary, January 1, 1921. Hutchison also notes that Edison "clipped Charles' wings."

[73] "Business Activities of Mark M. Jones," Mark M. Jones Papers, Box 1.

situation of Thomas A. Edison, Inc. deteriorated: "Merrily swings the ax" noted Charles Edison.[74]

The reduction of the laboratory labor force in the 1920s was dramatic. In 1920 the laboratory employed just over 100 machinists and laborers, 36 men involved in research, 51 men working on phonograph engineering and an office staff of ten.[75] There was a total of 65 men at work in September 1923 and this number had dropped to 35 by July 1925. It dropped even further to 21 in February 1926 and there were only 17 left in June 1927. By June 1929, just 12 men were on the laboratory payroll and throughout 1930 there were only seven. The time cards still ran from 1-181, revealing how the work force had shrunk.[76]

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[74] Charles Edison to TAE, July 12, 1926 (in DF 1926, Thomas A. Edison, Inc.--Organization); see also John D. Venable, *Out of the Shadow: The Story of Charles Edison*, (East Orange, NJ: Charles Edison Fund, 1978), p. 80.

[75] John P. Constable to Charles Edison, October 9, 1920 (in Engineering Department Records, Box 11, Charles Edison folder).

[76] Employee Records, Edison Laboratory Time Sheets, Boxes 118-122.

Building 1

The laboratory in Building 1 was one of the best equipped, if not the best equipped, electrical laboratory in the United States. It was the pride of Edison and the centerpiece of his impressive laboratory. David Trumbull Marshall was sometimes given the task of showing visitors around the facility. He claimed that "the star exhibit was the galvanometer room."[77] This impressive facility suffered a major setback in 1892 when the Newark Electrical Passenger Railway laid its tracks right next to the laboratory, rendering its sensitive testing equipment useless.

In addition to measurement and basic experiments in electricity, this laboratory also played an important part in Edison's campaign to develop a commercial phonograph. In this building Arthur Kennelly tested several types of electric motors under consideration for the phonograph. His staff carried out a thorough investigation of primary and secondary batteries which might be used with the battery powered phonograph then under development at the laboratory.

The decrease in electrical experiments undertaken by the West Orange laboratory caused a corresponding decrease in the staff of the electrical laboratory shortly after the laboratory opened. During the 1890s the number of workers in this building dwindled. New experimenters moved into Building 1 as it became the site of numerous projects that were overflowing from the main laboratory building.

The success of the motion picture product increased the amount of experiments devoted to it and after 1899, Edison began to set up rooms in Building 1 to carry out basic research into photography. In addition to perfecting film projectors and designing machines to develop film, he wanted to develop talking films and a method of making films in color.

Dyer and Martin's account of Edison's career states that by 1910 Building 1 housed mainly photographic and motion picture experiments and that much of the electrical equipment that was still in this building was unused.[78]

After 1914 this building became the center of experiments on the business phonograph.[79] Newman Holland and his staff worked here until they joined the other product engineers on the third floor of Building 5 around 1916. A 1915

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[77] Marshall, *Recollections of Edison*, p. 67.

[78] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 653.

[79] Holland moved here because it was too noisy and crowded in building 5. (See p. 106.) MRH's caption in figure 8, dated February 4, 1915, in Photograph Album 10, catalog 5209: "The 'dictating machine' department moved into galvanometer room 1914."

photograph of Building 1 shows Holland with his boss, Nelson C. Durand, manager of the business phonograph operation, and Edison's son Charles (figure 8). Holland's work was closely supervised by Durand and other managers and every expense had to be justified. Unlike experimenters of old, Holland was not free to try anything he wished.[80]

Building 1 eventually became a general use space in the laboratory complex with no clear function. It contained experimental rooms, offices, and even sleeping quarters. During the period after 1914, it housed Stephen Mambert, vice president and financial executive of Thomas A. Edison Inc., and his staff of clerks and accountants, evidence of the changing times at West Orange.[81]

Arthur Kennelly. Kennelly was in charge of the electrical laboratory in Building 1 from 1887 to 1894. He was largely self-taught, learning about electricity as an employee of an underwater telegraph cable company where he worked for ten years before joining Edison. Like Batchelor and many of the other important members of the laboratory staff, he was an Englishman who left home to make his fortune. He filled in an employment application in 1887 and joined the laboratory that year. He was placed in charge of equipping Building 1.[82]

Kennelly's lack of formal education is certainly not noticeable in the detailed notes he made of his laboratory work. These notebooks provide an exact scientific record of the work carried out in the electrical laboratory.[83] After leaving Edison's employ in 1894, Kennelly went into business for himself and later had a distinguished career as an academic, teaching electrical engineering at Harvard. No "chief electrician" or "electrical assistant to Mr. Edison" replaced Kennelly after he left.

Kennelly's own notebooks and those of Building 1 indicate that he was assisted by Alfred J. Thompson. Other workers in this building from 1888 to 1893 include: Theodore Lehmann, Johannes H. Cuntz, F.P. Bergh, E.C. Boynton, Alex W. Brigham, Arthur E. Colgate, Everett W. Frazier, Arthur Hoopes, Oren S. Hussey, and T.F. Lawrence.[84]

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[80] Millard, *Edison and the Business of Innovation*, Chapter 12.

[81] John P. Constable to Charles Edison, September 19, 1918 (in DF 1918, WOL--General).

[82] C.M. Withington, "Interview with Dr. A.E. Kennelly", Edison Pioneer Records, Box 24.

[83] For examples of Kennelly's records see Notebooks N-89-12-13, N-90-07-22, N-91-09-14, N-92-01-08, N-92-03-30, N-92-05-06, and N-93-01-03 and Letterbook LB-87-09-29.

[84] Names compiled from editorial material prepared by the Thomas A. Edison Papers project in preparation for the microfilming of the Kennelly notebooks.

Alex Werner. Werner was hired in 1900 to work on color films. His terms of employment were to "devote [his] entire time and attention to perfecting a process of manufacturing and reproducing both kinetoscopic and lantern slide pictures in natural colors."[85] He was probably stationed in this building.

Dr. W. C. Greene. Greene was also a photographic expert. He worked in Building 1 from 1910 to 1914. In addition to general photographic experiments he also worked on the kinetophone--Edison's attempt at talking pictures. He worked at the Bronx film studio of the Edison Manufacturing Company and could have been an employee of the Edison Manufacturing Company, Motion Picture Department who was loaned out to the laboratory (see p. 93 for more on Dr. Greene).[86]

Walter W. Dinwiddie. Dinwiddie came to West Orange in 1911 from the Alvan Clark & Son Corporation. He was a member of the American Society of Mechanical Engineers and had worked at the U.S. Naval Observatory in Washington.[87] He was one of a new breed of laboratory employees at West Orange, a formally trained engineer with considerable experience in commercial practice. He started work as an experimenter in 1912 and was paid $42 a week, quite a lot for Edison's laboratory.[88]

Dinwiddie must have made a good impression on Edison for he was put in charge of the Educational Film Project in 1912. This was an ambitious project to make a series of films on scientific and technological subjects to be used in schools and in the home. The advantage of such film subjects was that they could be filmed at West Orange and the laboratory's own equipment could be used in them. This work was carried out in Building 1, on the third floor of Building 5, and some filming was evidently done in Building 4. An employees' magazine, published in 1912, noted that "Mr. Edison is devoting a large part of the Laboratory to the task of carrying out his ideas on the subject of teaching by motion pictures."[89]

As a member of the team experimenting in duplicating records it is likely that Dinwiddie also worked in Building 4 from time to time. Around 1914 he was put in charge of duplication of disc records. As the pilot plant for that project was

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[85] James H. White to Alex Werner, June 15, 1900 (in DF 1900, Motion Pictures, D-00-15).

[86] W.C. Greene to "Pat", March 2, [1910]. Employee Records - Laboratory Payroll Time Sheets, Box 74.

[87] Dinwiddie material in Biographical Collection. (This collection contains biographical material on individuals associated with Edison; filed in alphabetical order.)

[88] TAE to W.W. Dinwiddie, December 13, 1911, Letterbook 88, p. 91 (LB088091).

[89] *Edison Works Monthly*, October 1912, p. 4.

established in the rear of Building 4, Dinwiddie would have been based there up until World War I, when he was transferred to Edison's special experimental project to reduce surface noise on the new Diamond Discs.

Dinwiddie continued to be associated with disc record experiments after the war. He was transferred from disc record production around 1917 and assigned to help Edison with his experiments on surface noise. This was a vital experimental project because the fate of Edison's Diamond Disc hinged on removing the annoying surface noise that increased with playing time; even loyal Edison phonograph customers were switching to other makes because of this problem.[90] Dinwiddie died suddenly in 1920.

Stephen Mambert. Mambert's employment with Thomas A. Edison, Inc. began in 1913 when he joined the company as a cost clerk. His opportunity came a year later when he was made assistant to Charles Edison. He was promoted in 1916 to vice president and financial executive. Conscientious and ambitious, Mambert gained the attention of Edison senior and was soon promoted to the post of efficiency engineer and given the job of overhauling the laboratory organization. The gospel of efficiency in American business was led by Frederick W. Taylor and his associates who attempted to apply scientific principles to increase the productivity of the worker on the shop floor. Mambert's goal was strict financial accounting and he relentlessly pressed each manager for exact financial information about costs, purchasing, payrolls, and accounts payable and receivable.[91]

Mambert was soon given his own department of cost clerks and accountants. The power and influence of Mambert's financial executive grew and by 1916 he ran his own empire from Building 1. He portrayed himself as the means to translate "Mr. Edison's policies relative to Management, Labor and Sales" into action.[92] His usefulness was probably more as a liaison with the financial community than as an efficiency expert. Edison thought that Mambert was the most valuable man he ever employed, revealing that "Mambert's methods and showings have now enabled us to borrow very large sums, give us good standing, and the banks have confidence."[93] Mambert also had his uses as a tool to reduce costs in the

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[90] The Phonograph Corporation of Manhattan to C.H. Wilson, January 4, 1915, Record Manufacturing Division Records, Box 17.

[91] C.H. Wilson to [Division heads?], December 14, 1914 (in DF 1914, Phonograph); Stephen Mambert to Edison Storage Battery Company, January 22, 1916 (in DF 1916, Battery, Storage).

[92] Mambert Report, Financial Executive memo # 3497, March 6, 1916, Financial Executive records.

[93] Robert Conot, *A Streak of Luck*, (New York: Seaview Books, 1979), p. 422; Report of R.H. Allen of the Efficiency Department, April 3, 1919, Records of the Financial Executive.

organization. Edison's instructions to Mambert were to cut the payroll and this he did without mercy.

Mambert left Edison's employ in February 1924, while serving as president of the Edison Portland Cement Company. He resigned without informing his employer, and as William Meadowcroft put it "we don't really know just what to think of him."[94]

The introduction of new products and the growing motion picture business brought new experiments and new employees to Building 1:

Selden "Skeets" Warner. A graduate of the College of the City of New York in chemistry, Warner started work at West Orange in 1911. His first job was to assist in the educational film project in Building 1. In 1916 he had his own laboratory in a front office in the building, carrying out electrical and chemical experiments. During World War I he worked on government contracts which involved both chemical and electrical research.

After the war he worked in Building 1, managing a diverse number of experiments on different projects. He left the laboratory in 1921 (see p. 96 for more on Warner and Building 1). At the end of the war much of Building 1 was used for experiments on automobile batteries. (In addition, it served as home to John Constable's wife and children in 1916.)[95] The following employees worked on the automobile battery project:

Paul D. Payne. Payne probably came to West Orange as a college educated professional engineer. He directed the automobile starting battery project until 1930 (figure 12).[96]

Morton Iverson. Iverson was working on the automobile starting battery project in 1927.

Fred Heinis. Heinis worked on the automobile starting battery project from 1920 to 1928.[97]

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94 T.A. Edison to John J. Watson, December 18, 1925, Biographical collection, and William Meadowcroft to F.W. Bacon, [1924], Biographical collection.

95 Historian's Note 118. This note records a conversation between Edwin Smith of West Orange, New Jersey and Norman R. Speiden on February 14, 1966.

96 Photograph Album 16.

97 Historian's Note 152. This Note records a telephone conversation between Norman R. Speiden and Fred (Ferdinand) P. Heinis on November 9, 1962.

Joseph Gitz. Gitz was employed on the starting battery project from 1924 to 1928. He did tests on storage battery cells and kept records, and carried out chemical analysis of materials used in cells and resistance tests between contact plates and cell poles.[98]

Theodore Edison. Theodore was the youngest son of Edison and Mina. After graduating from MIT with a degree in engineering, he came to work in the laboratory in 1923. He occupied experimental rooms in the front of Building 1, as well as a desk in the library, and did important experiments on electrical recording. He devised a universal reproducer that could play all types of disc records on the market. Theodore also played a major role in bringing an Edison radio set to the market (see p. 96 for more on Building 1 and Theodore Edison).

He worked in a small room to the east of the entrance to the building. It was used for continuous plating experiments.[99]

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[98] Historian's Note 89.

[99] Historian's Note 152; Roderic Peters interview by the Columbia University's Oral History Research Office, nd, pp. 22-24. (Hereafter cited by interviewee, date, Oral History Project, and page number.) See Summary of Sources, p. 5 of this report, for more on the Oral History Project.

Building 2

The work of this laboratory in the 1880s was centered on two projects: insulation for electric wires and the cylinder record for phonographs. The insulation project was part of Edison's electrical research and was transferred from his temporary laboratory at Harrison to West Orange as soon as the new laboratory opened. It encompassed the mixing, heating, and electrical testing of numerous combinations of chemicals.

Experiments on the composition of the wax cylinder for the Edison phonograph began as soon as the West Orange laboratory opened and continued into the twentieth century.

The twentieth century started with two ongoing experimental projects on the laboratory books: the development of waxes for phonograph records, and the investigation of substances that emitted X-rays. Edison claimed to have two German chemists working on the latter project in 1899.[100]

Many new workers joined Building 2 during Period II as experimenters in the storage battery campaign. The storage battery experimental program was primarily a chemical investigation to find the combination of chemicals required in a battery not employing the lead acid technology that other companies used to dominate the market. Edison was looking for an alternative and directed years of experiments by several teams working in this building. They tried cadmium, magnesium, and nickel as lighter and more efficient alternatives for the lead of the storage battery.

The storage battery and disc record projects dominated work in Building 2 before World War I. However, the coming of war in 1914 brought a great challenge to Edison's chemical laboratory because the blockade of Germany cut off supplies of chemicals required in the production of batteries and records. Building 2 was therefore devoted to finding substitutes to these strategic materials, and Edison and his experimenters did so well that Thomas A. Edison Inc. was able to sell the surplus of chemicals at a profit.

This laboratory often gave work to college students during their summer vacations. This brought several young chemistry majors to West Orange, among them an Asian worker named G.C. Lee.[101]

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[100] *St Louis Republican*, July 3, 1899.

[101] University of Illinois to TAE, February 12, 1920, Biographical Collections.

In 1927 Edison began work on his last experimental campaign--a project to find a domestic source of rubber. Specimens from all over the country were collected and brought to West Orange. Edison's assistants in these experiments were George Hart and F.S. Schimerka (figure 38).[102] Edison worked in Building 2 at the small table next to table 10 at the north end of the building. The small table had been put there sometime during the war. This table was Edison's last permanent work space in the chemistry laboratory before he died.[103]

A report of the Edison Botanic Research Corporation of January 1932 stated that the employees involved in the company's experiments were: Fred Ott, Charles Dally, C.A. Prince, his son C.A. Prince, Jr., and A. Banta.[104] These men may have worked on their project in Building 2.

Reginald A. Fessenden. Fessenden was one of Edison's laboratory staff who made a name for himself as an inventor and entrepreneur. Fessenden's name is most closely associated with his pioneering efforts to develop continuous wave radio transmission.[105] He was one of the first people to broadcast the sound of music with radio waves, which he successfully accomplished in 1906.

Fessenden's career at the West Orange laboratory provides a revealing look at work in Edison's laboratory, especially the practice of training men in new fields and the great versatility required of the experimenters in the nineteenth and early twentieth century. After completing his college work he applied for a job with Edison, but was unsuccessful because after several years of higher education he did not know anything practical about electricity, and as Edison said, "I have enough men now who do not know anything about electricity."[106] Fessenden then managed to get a job as an assistant tester of electrical cables for the Edison Machine Works. He rose to the position of inspecting engineer and as an engineer of the Machine Works, Fessenden got the opportunity to go to the main laboratory at West Orange. The Edison Machine Works kept some of its men at the laboratory to work on experiments related to its product line, paying the men's wages. On arriving at West Orange, Fessenden was given several odd jobs around the site, such as wiring up new rooms.

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[102] Notebook N-29-08-30.2.

[103] Paul Kasakove interview, 1971, Oral History Project, p. 18.

[104] Edison Botanic Research Corporation Report to Stockholders January 15, 1932. "D-Box" Collection - Rubber. Personnel employed by corporation are contained in an appended list. (The "D-Box" collection contains correspondence to Edison from prominent individuals.)

[105] Hugh Aitken, *The Continuous Wave: Technology and American Radio, 1900-1932*, (Princeton: Princeton University Press, 1985).

[106] Reginald Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News 6*, (June 1925), p. 218.

He was then assigned as an assistant to the chief researcher in Building 2 and was made part of the experimental team looking for an insulator for electrical cables. When all attempts at producing a satisfactory chemical substance to insulate wires failed, Edison decided to appoint Fessenden to the job. When the latter protested that he was an electrician who knew nothing about chemistry, Edison retorted, "then I want you to be a chemist. I have had a lot of chemists...but none of them can get results." Fessenden soon found himself in Building 2 where he worked on the insulation and ore milling projects. He was discharged on good terms in 1890 when the insulation project was discontinued.[107]

Dr. Wuntz. Wuntz was a German chemist whom Fessenden replaced. Edison fired him in 1889 because "[I] can't make his work pay me."[108]

John Dorr. Dorr was an assistant to Fessenden, who noted that he was "a good analyst." There is a photograph in the *Radio News* articles that shows Fessenden and Dorr in Building 2. Dorr also worked on batteries and borrowed books about batteries from the library. When Fessenden's position was eliminated, Dorr was given some of his responsibilities. He left the laboratory to go to college in 1890.[109]

Dr. Franz Schulze-Berge. Schulze-Berge was a German chemist employed by Edison from December 1887 through June 1891.[110] His experimental notes record his work on silver and gold plating in vacuum--an important element in Edison's project to duplicate cylinder records. Schulze-Berge's duplicating experiments were carried on in rooms 5 and 9 of the second floor of Building 5. A. Theo E. Wangemann identifies him as the librarian for the first floor library, testifying in 1903 that "Dr. Schulze-Berge was the librarian. We had to go to him for all the books we needed."[111] Marshall worked with him in Building 2 and remembered him as "one of the most learned men we had at Orange."[112]

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[107] Ibid., *Radio News* 7 (August 1925), p. 158.

[108] TAE to A.O. Tate, March 21, 1889 (in DF 1889, Edison, T.A.--Employment, D-89-14).

[109] Edison Pioneers Records, Box 21.

[110] Testimony of John F. Randolph, *National Phonograph Company v. American Graphophone Company*, 1903, p. 103.

[111] Testimony of A. Theo E. Wangemann, *National Phonograph Company v. American Graphophone Company*, 1903, p. 63.

[112] Marshall, *Recollections of Edison*, p. 65.

David Trumbull Marshall. A graduate of Rutgers College, Marshall joined the Edison laboratory when it first opened in 1887, after leaving his job at a chemical testing laboratory of the New York, Erie, and Western Railroad. He worked on a table next to Aylsworth's in Building 2 on insulation and inorganic incandescent filaments. He also worked in the machine shop and probably served some time in the lamp experimental room on the second or third floor of Building 5. He left the laboratory in 1890.[113]

Jonas Aylsworth. Aylsworth joined Edison's laboratory in 1887 after studying for one year at Purdue University. He worked in Buildings 2 and 5. In 1891 he moved to an Edison Lamp Company factory in New Jersey and supervised the production of cellulose filaments. He returned to the West Orange laboratory in 1894 and thereafter was closely involved in Edison's search for the perfect recording medium.[114] Aylsworth's forte was the waxes and resins used in recordings. A variety of different materials were tried as recording surfaces: resins, gums, waxes, asphalt, and solid fatty acids and their salts, such as stearic acid.[115] The requirements for record compounds were demanding. The material had to be soft enough to take the impression or indentation of the recording stylus but then made hard enough to hold the analog signal for adequate reproduction. The material had to be able to hold a groove of a few thousandths of an inch deep and maintain it over numerous plays. Aylsworth spent years developing these substances and testing their performance as phonograph cylinders. His work was of the greatest importance to the Edison phonograph business. Marshall described him as a quiet plodder and his lack of supervisory duties at the laboratory might indicate a retiring personality.

During the early part of the twentieth century, Aylsworth was charged with finding a harder compound for the disc records which could stand up to the diamond stylus. Although he worked in Building 2, his main place of work was his house in Orange, where he had a fully equipped laboratory. During this period he was not paid weekly like the rest of the experimenters but had a special contract with Edison that paid him a fixed yearly amount.[116]

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[113] Ibid., pp. 60-75.

[114] L.H. Sperling, "Jonas Aylsworth: Leif Erickson of Interpenetrating Polymer Networks," unpublished manuscript at Edison National Historic Site.

[115] Byron M. Vanderbilt, *Thomas Edison, Chemist*, (Washington, D.C.: American Chemical Society, 1971), pp. 118-22.

[116] Aylsworth was so important to Edison that he was prepared to pay him whatever he wanted. Edison supported expenses of the lab in Aylsworth's house. Frank L. Dyer to J. W. Aylsworth, August 6, 1910 (in DF 1910, WOL--Employees).

Aylsworth experimented with compounds that could be easily molded into shape and would not deform or shrink with heat. He examined the properties of phenolic resins which could be molded by heat and pressure and found that they could be mixed with binding agents and molded into hard, heat-resistant shapes. Aylsworth improved the phenol resins first developed by Leo Baekeland and produced a material called condensite, a purer resin with fewer by-products. (Condensite refers to the condensation of phenol and formaldehyde which produces the resin.)

The actual cylinder or disc record was never a blank of pure resin but a combination of cheaper materials for the base covered with a "varnish" of the hard recording medium. Various combinations of asphalt, wood flour and china clay were tried, and finally a mixture of phenol and wood flour was used for the record base.[117]

The thermo-setting resins were not the only ones under investigation for possible use in records. Numerous other substances were the subject of experiment and testing: stearic acid compounds, asbestos, celluloid, montan wax, ceresin, and beeswax.[118]

M.A. Rosanoff. Rosanoff joined the laboratory in 1903. He started work on finding better combinations for the waxes that Aylsworth had developed in the nineteenth century for cylinder records. Like the "boys" at Menlo Park, the staff worked all night. He recalled seeing Edison and Fred Ott in the laboratory at the experimental tables throughout the night.[119] Rosanoff also had a room elsewhere in the laboratory, probably in Building 5.[120]

In 1903, Edison thought he had found a winning chemical combination and he introduced his new product, the type E nickel-iron battery, onto the market. The battery sold well but soon complaints began to arrive at the laboratory about leaks in the battery and losses of charge. Faced with serious problems in this project, Edison fitted up two rooms in the laboratory and put 12 testers to work there "night and day."[121] These rooms were probably on the third floor of Building 5 (see figures 134-136).

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[117] Vanderbilt, *Thomas Edison, Chemist*, pp. 130-132.

[118] Ibid., pp. 120-121.

[119] M.A. Rosanoff, "Edison in His Laboratory," *Harpers Magazine* 165, (Sept. 1932), p. 407.

[120] Shop Order 1567 (ca.1904), Notebook N-99-06-24.1.

[121] TAE to Sigmund Bergmann, November 29, 1904, in Letterbook 71, p. 169 (LB071169).

Paul S. Laverty. In June of 1909, Edison received a letter asking him to employ a young boy, a common enough occurrence at the West Orange laboratory. The boy was described as unusually talented in "things electrical" and came from a "a clear Christian home." Edison asked for a photograph and eventually Paul S. Laverty moved from Pittsburgh and joined the laboratory staff. He was put to work in the chemical building. He received $7 a week.[122]

Laverty first worked for Thomas Greenley on cellulose films for the motion picture department. He then worked directly for Edison on problems in nickel plating and finally he worked on the project to make condensite for disc records.[123] By May of 1910 he appeared on the laboratory payrolls as an experimenter and earned $9 a week. He fancied himself an up and coming experimenter and used the library in Building 5 to advance his education. He left the laboratory suddenly in November 1910.[124]

Thomas Greenley. Greenley's name appears on laboratory payrolls at least as early as February 1906.[125] Experimental notebook references indicate he was engaged in storage battery work around 1907-1908. Later he worked on viscose film for "a non-inflammable motion picture film" before leaving Edison's employ about 1911.[126]

Alexander Herbert Cave. Cave was an experimenter involved in roasting iron sulphate in 1910.[127]

Dr. Otto Grothe. Grothe was Edison's analytical chemist. He was hired around 1906, fired in 1910, and replaced by Ignatius Goldstein.[128] Notebook references indicate Grothe, like Goldstein, worked on solutions used in electroplating baths.[129]

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[122] J.H. Winters to TAE, June 10 and July 19, 1909 (in DF 1909, WOL--Employees).

[123] Historian's Notes 68, 90, and 95 which contain recollections of Paul S. Laverty.

[124] Ibid.; also J.H. Winters to Harry F. Miller, November 15, 1910 (in DF 1910, WOL--Employees).

[125] Employee Records, Laboratory Payroll Time Sheets, Cabinet 50783, Drawer 5.

[126] Historian's Note 90.

[127] Historian's Note 90.

[128] Employee Records, Laboratory Payroll Time Sheets, Box 73; Historian's Note 90.

[129] See for example notebooks N-07-05-13 and N-07-06-29.

Ignatius Goldstein. Goldstein came to West Orange in 1909 from Warsaw, Poland, to be Edison's chief analytical chemist in charge of testing. He was also heavily involved in experiments involving electroplating nickel and in producing various chemical solutions used in the electroplating process. He devised several methods to produce the thin nickel flake that was at the heart of the new battery.[130]

His duties ranged from basic analysis of the electrolyte taken from batteries to mixing up developers to be used in the photography department. He made up the solutions that were used in electroplating baths and the solutions that cleaned them.[131] In Edison's absence he was put in charge of the chemical building.[132] He left in 1913.

L. Rosenstein. Rosenstein acted as Goldstein's assistant in testing and chemical analysis. Both Goldstein and Rosenstein worked in a room in Building 5 before space was made for them in the chemistry laboratory around 1910.[133] Goldstein described him as "a quiet and steady workman...[who] shows much knowledge in inorganic and organic chemistry also in analytical researches."[134] Rosenstein worked in the laboratory from 1910 to 1911.

H. W. Lancaster. Lancaster was an English experimenter who worked on shellac, phenol, and other chemicals used to make records. He was employed in the laboratory from 1910 to 1912.[135]

Peter Christian Christensen. Christensen was a Dane who experimented with various chemical mixtures to be used in records and also was in charge of the production of lithium for the storage battery. He worked in the chemistry laboratory from 1907 to 1915 and then at the Silver Lake plant from 1915 until November 1918. He was then transferred back to the West Orange laboratory, which he left in May 1919 to pursue his own interests.[136]

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[130] William H. Meadowcroft to TAE, August 18, 1911 (in DF 1911, WOL--Meadowcroft's Reports).

[131] Experiments and analysis orders found in DF 1914, Battery, Storage.

[132] TAE to I. Goldstein, August 1, 1911 (in DF 1911, Battery, Storage--General, 2 of 2).

[133] Historian's Note 90.

[134] I. Goldstein to H. Miller, October 20, 1911 (in DF 1911, WOL--Employees).

[135] Historian's Note 90.

[136] Edison Pioneers Records, Box 21.

Ludwig "Louis" Ott. The son of John Ott, Ludwig worked as an experimenter during this period. His employment in the laboratory lasted from 1902 to 1926.[137] In 1919, there were 12 men at work in Building 2 under the supervision of Ludwig Ott.[138] He continued to direct the experimental work in this building in the 1920s.

Paul B. Kasakove. After joining the laboratory work force in 1920, Kasakove carried out important work in the chemistry of records. He improved the process of electroplating masters. He worked in Building 2 throughout the 1920s.[139]

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137 Edison Pioneers Records, Box 26.

138 "Functions of Present Laboratory Organization," September 24, 1919 (in DF 1919, Thomas A. Edison, Inc.--Organization).

139 Historian's Note 128; Paul B. Kasakove interviews, August 1961 and January 5, 1971, Oral History Project.

Building 3, Pattern Shop

A payroll of February 1890 indicates three patternmakers and three carpenters at work in this building.[140] Laverty noted that Fred Mudd supervised this shop during his tenure (around 1910) and Mudd's name appears on the payrolls for the period 1900 through 1914, although he worked there longer.

In 1919, Mudd had a staff of eight men. By 1920 his department included five patternmakers, one carpenter, and one cabinet maker.[141] Mudd was one of the oldest serving members of the West Orange labor force. His time card number was 8. Only Fred Ott, with card number 3, had a lower number in the 1920s. Mudd worked for Edison until about 1926.

Building 3, Chemical Store Room

Little is known about the furnishings or use of this area during the late nineteenth and early twentieth centuries. In 1917, a note in the accounts receivable stated that no inventory had been made for several years--indicating a lack of usage.[142] In 1925 a decision was made to centralize all purchasing through this "Chemical Stock room." This would have increased the usage of this space considerably.[143]

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[140] Payroll ending February 6, 1890 (in DF 1890, WOL--General, D-90-64).

[141] "Functions of Present Laboratory Organization," in DF 1919, Thomas A. Edison, Inc.--Organization; "Thomas A. Edison Laboratory - Payroll Comparison's [sic]", December 14, 1920, D-Box Collections - Box D10 - West Orange.

[142] "Memorandum Explanation of General Ledger Accounts by Mr. H.F. Miller," in DF 1917, Thomas A. Edison, Inc.--Financial, Explanation of Accounts.

[143] "Central Chemical Stock Room of The Edison Industries," memorandum of Charles Edison, May 26, 1925 (in DF 1925, WOL--Chemical Stock Room).

Building 4

W.K.L. Dickson worked on the ore milling project in Building 4 in the 1890s. In addition, a blacksmith and a blacksmith's helper are noted on the February 1890 payroll and these men could have been at work at the forge at the rear of this building.

In the 1890s another part of the building was set up to produce blank cylinders and duplicating equipment was moved in.[144] This was the Recording Department, or what the employees called the "record plant" or "Wurth's plant," named after Al Wurth, the experimenter in charge of the duplication of records (see p. 74 for more on Al Wurth). The "plant" was an experimental installation of the machines that would eventually duplicate millions of records in Building 24. Wurth continued to work on the duplication problem throughout the period 1900-1914.

With the demise of the ore milling venture by 1900, part of this building was left empty. Dyer and Martin reported that Building 4 was used as a general stock room after Edison gave up on the ore milling project.[145]

In 1918, this building was divided between disc record development and Edison's experimental projects directed at eliminating the surface noise of discs and improving phonograph reproduction. Building 4 was now designated as "experimental".[146] Talking picture experiments were also carried out in Building 4.

Walter H. Miller. Walter Miller began his career with Edison at age 17, entering the laboratory when it opened in 1887 and later becoming an expert on phonograph recording techniques. He took on a variety of jobs and worked late at night with the other men. Once he had proven himself he was given pay raises and more demanding tasks.[147]

Recording experiments probably continued in the music room on the third floor of Building 5 and in the new facilities established in Building 4 at least through

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[144] Harold Anderson interview, nd, Oral History Project, p. 12.

[145] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 655.

[146] "Thomas A. Edison Personal - Floor Areas Laboratory Building," November 25, 1918 (in DF 1918, WOL--General); G.M. Ryder to R.W. Kellow, March 22, 1919, D-Box Collections - Box D10 - West Orange.

[147] Mary Childs Nerney interview with Walter Miller, in Notebook N-28-11-01, pp. 50-52, and in Notebook N-29-09-12, pp. 5-9.

1904-1905 and perhaps longer (see figure 132).[148] Edison was most interested in this project and Miller worked under his close supervision. Although it is evident that they enjoyed a cordial relationship, Miller found it was not easy to satisfy the "old man" with his recordings.[149]

As Edison's first recording expert, Miller was given the task of running the New York recording studio in 1915. He still carried on experimental work at the West Orange laboratory and regularly brought in wax masters from New York to be turned into working masters in Building 4. The correspondence between Edison and Miller gives the impression that Miller was in overall charge of recording, and that he took the brunt of Edison's criticisms of the music recorded.

William "Bill" Hayes. Hayes was an assistant to Miller during the development and tests of the gold moulded duplicated cylinder. He was also involved in the experimental campaign that led to the four minute Amberol cylinders and the Blue Amberol cylinders of 1912.[150]

Hayes first came to work at the West Orange laboratory in 1895. He learned the ropes from Miller and went on long recording trips with him overseas. From 1903 to 1914 he was in London making recordings and finally became recording manager of the English operation. He came back to West Orange when World War I broke out in Europe. By 1923, his expertise as a recording engineer was so valued by Thomas A. Edison, Inc. that he was put under a contract binding him to the company which prohibited him from taking his skills elsewhere.[151]

George Werner. Werner joined the Recording Department in 1903, although he appears to have been employed in the laboratory from the mid-1890s.[152] His experience as an experimenter was typical in that he was moved from job to job

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[148] Jones, Francis Arthur, "Mr. Thomas Alva Edison," *The Strand Magazine*, May 1905, pp.375-384. A note on page 375 states, "Illustrated by photographs specially taken for this article by Byron, New York." Figure 132 is one of the illustrations; a 1904-1905 date agrees with dating established for other photographs used in the article.

[149] Phonograph folders in the Document File for 1910-1914 contain several handwritten notes from Edison to Miller, for example: "All the newest records all have points too weak to be used commercially." TAE to Walter Miller, [December 1912] (in DF 1912, Phonograph--General).

[150] National Park Service, "Historic Structures Report, Part I--Metallurgical Laboratory, Building No. 4, Edison Laboratory National Monument," prepared by Melvin J. Weig, Norman R. Speiden, William T. Ingersoll, and Gordie Whittingham, (February 9, 1962), p. 4.

[151] Contract between William A. Hayes and Thomas A. Edison, Inc., March 5, 1923. Hayes material in Biographical collection.

[152] Information on George Werner in the Edison National Historic Site Card Catalog. (The Card Catalog, similar in format to a library card catalog, is an alphabetical listing by subject of material in the collections.)

and from building to building. Werner learned his trade as a recording engineer under the direction of Walter Miller. Based on his job assignments, Werner probably worked on sound recording in Buildings 4 and 5, participated in the kinetophone project being carried out in Buildings 1 and 5, and spent some time working on the business phonograph on the top floor of Building 5. His pay was assigned to several different experimental shop orders depending on the work he did. In 1914 he was transferred from the phonograph works payroll to the laboratory payroll.[153]

Werner continued as a recording engineer at the laboratory and probably took over more duties as Walter Miller spent more time in the New York studio. In 1920 he was noted on the payroll as an "experimental recorder."[154] When a large recording studio was erected on Columbia Street, close to the laboratory, he went there as its manager.[155] His colleagues were William Hayes and F.C. Burt.

F. C. Burt. Burt started in the recording department in 1904 and served overseas until 1914. He worked with Hayes and Werner in Building 4 and at the Columbia Street studios until 1930.

Disc record and talking picture experiments were also carried out in Building 4. Employees involved in the experiments included:

Walter Dinwiddie. As a member of the team experimenting in duplicating records it is likely that Dinwiddie worked in Building 4 from time to time. (See p. 37 for a more complete description of Dinwiddie's career at the West Orange laboratory.)

Adolph Gall. Gall was an employee of the Motion Picture division who was permanently assigned to the laboratory in 1917. He was given various jobs, encompassing the entire product line of the Edison enterprise; he worked on phonographs, storage batteries, and motion pictures. In 1918 he worked on disc records with the assistance of a Mr. Loomis. In the 1920s he was in charge of the reproducer experiments in this building.[156] He left Edison's employment in 1922.

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153 C.H. Wilson to Leeming, December 12, 1914 (in DF 1914, Phonograph--Manufacture).

154 "Thomas A. Edison Laboratory - Payroll Comparison's [sic]", December 14, 1920, D-Box Collections - Box D10 - West Orange.

155 Edison NHS Card Catalog.

156 "Functions of Present Laboratory Organization," in DF 1919, Thomas A. Edison, Inc.--Organization; "Thomas A. Edison Laboratory - Payroll Comparison's [sic]", December 14, 1920, D-Box Collections - Box D10 - West Orange.

Sam Moore. Moore was Edison's machinist and experimental assistant. (See p. 73 for additional information on Moore's career.)

Thomas Edison, Jr. The eldest son of Edison's first marriage came to the laboratory after World War I. In the 1920s he worked on testing a new line of kitchen appliances, the Edicraft toasters and coffee makers, in Building 4.

Building 5, First Floor

Charles Batchelor. After the West Orange laboratory opened in 1887, Batchelor was in overall charge of the machine shops and ran the laboratory in Edison's absence.[157] He had been at Edison's side since he joined the inventor's work force in 1871. Born in the north of England, Batchelor was sent to install machines in the Clark thread mills in Newark, New Jersey, met Edison, and never returned home. A master of metal working, he could handle any job--from casting parts of a dynamo to fitting the fragile experimental filaments into incandescent bulbs. His neat, well-organized notebooks reveal an orderly mind and a precise hand. According to one of the laboratory staff, Batchelor was the "sometimes needed, conservative element of the combination," an ideal counterbalance to the mercurial Edison who often got so involved in an experimental project that he forgot everything else.[158]

Batchelor was experienced in factory management and played an important part in setting up the first Edison Phonograph Works factory, constructed of brick, adjacent to the laboratory complex on Lakeside Avenue in 1888. His domain was the first floor of Building 5 but it is more than likely that he had experimental tables in other parts of the laboratory and would have spent a great deal of his time in the Phonograph Works.

In 1890 Batchelor went on an extended trip to Europe and the western part of the United States. During the early 1890s he appears to have concerned himself with running one of the ore milling concerns and travelling. It is unlikely that he spent much time at the West Orange laboratory during this period, and he retired in the mid-1890s.

Miller Reese Hutchison. Born and educated in the South, Hutchison had considerable success as an independent inventor before he came to work at West Orange. He had produced a hearing aid, invented the electric klaxon horn[159], and was in the process of developing an automobile self-starter and a tachometer for warships when he first visited the West Orange laboratory. He quickly ingratiated himself into the good favor of Edison and spared no effort in cultivating the great man. They worked together on several experimental projects, staying up all night just as Edison had done in the old days. "Hutch" and the "old man" became inseparable. Hutchison became chief engineer of the laboratory in

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[157] Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7, p. 156.

[158] Ibid.

[159] Obituary of Miller Reese Hutchison (hereafter MRH), *New York Times*, February 18, 1944.

August 1912.[160] Since Donald Bliss also held the position of chief engineer until October 1912, it is possible that there were two chief engineers during this period --one for the entire West Orange operation and one for the laboratory.

Hutchison was more than a successor to the faithful Batchelor who had left the laboratory in the 1890s to look after his failing health and his investments in the electrical industry. Hutchison represented the force of change in the laboratory and was an influential figure in the whole Edison organization. Hutchison believed himself to be a modern man--a modern engineer and a modern businessman. He therefore tried to implement new ideas in scientific management, organizational theory, and engineering efficiency into the tradition-bound work culture of Edison's laboratory. The time clock he installed on the first floor of Building 5 is one example, as are the organizational changes he made in the laboratory structure and the new procedures he initiated in executing shop orders.

By 1914, Hutchison moved onto the second floor of Building 5 in the coveted office (room 11) next to Edison's room 12. As Hutchison's main experimental work was connected with the kinetophone it is likely that he had been housed in Building 1 or in the special studio constructed for this work on the grounds of the storage battery factories.

Despite the excellent work he did on motion pictures and phonographs, Hutchison's value to Edison was in the area of his sales expertise and his connections with various military organizations--the ideal market for the Edison submarine storage battery. In the decade leading up to the beginning of World War I in 1914, many of the world's navies were involved in programs to build new ships and develop new weapons. The submarine was an especially desirable weapon because of its relatively low cost and the threat it posed to capital ships. The fleets of submarines under construction all required batteries and thus this military market had the potential of great volume and high levels of profit. Hutchison had many friends in naval circles and his urbane bearing and outgoing personality made him the ideal salesman for the Edison submarine battery. Bearing this in mind it is likely that he had offices in the new administration building built next to the laboratory on its east side. Several laboratory employees had their offices here. When Hutchison writes "sometimes there are half a dozen men waiting to see me in my office while Mr. Wilson and Durand...," he is probably referring to his office in the administration building.[161]

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[160] Miller Reese Hutchison diary, entries for July 16, 1912, through August 18, 1912, Edison NHS.

[161] MRH to TAE, October 28, 1912 (in DF 1912, WOL--General). Both Wilson and Durand had offices in the main administration building.

Building 5, Library

Thomas Edison. Edison administered his laboratory and his manufacturing empire from the library from 1888 until the late 1920s, although he probably did not spend much time there at the beginning of this period. During the 1890s Edison was away from the West Orange laboratory for long periods, working at his ore mining operation in Ogden, New Jersey. Beginning around 1910 Edison and his wife also spent a month or so almost every winter at his house and laboratory in Ft. Myers, Florida.[162] When he was at West Orange, Edison was in and out of the library daily; depending on which project he was working on, he spent his time in his second floor experiment room, room 12, or in the chemical or metallurgy laboratories. That his presence in the library was strongly felt, though, is evident in this 1911 letter from William Meadowcroft to the absent Edison: "The library has an unusual air of quietness these days. I miss the stream of enquiries for you, and have not yet quite got used to looking up at the door to see you coming in and finding it is some one else....The only familiar sight missing is yourself." [163]

Edison routinely spent the first part of the day in the library "looking over his mail or otherwise busily working on matters requiring his attention."[164] William H. Meadowcroft, Edison's long-time secretary, explained his routine in a 1928 article:

> At some convenient time during the day--frequently the noon hour--Edison disposes of the day's mail in his usual way. He takes up a letter, reads it, and with a lead pencil makes comments upon it as to how it shall be answered or attended to by his secretaries. It is then laid aside and the next one disposed of in a similar manner, until all are passed upon. There is not a moment's hesitation as to a reply. He masters the subject with the first reading, and his disposal of the letter follows instantly. At the bottom of the mail basket are placed letters, papers, etc., for his signature.[165]

As Edison aged, he may have spent more time in the library. In 1922, Meadowcroft's assistant wrote that after an attack of lumbago, Edison "...for the whole day, remained in his seat at the desk, and did what business there was." A

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[162] Historian's Note 138 and notes from Edison Winter Home and Museum, Ft. Myers, Florida.

[163] Meadowcroft to T.A. Edison, August 4, 1911 (in DF 1911, WOL--Reports).

[164] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 642.

[165] William H. Meadowcroft, "So They Wrote to Edison" in *Popular Science Monthly*, December 1928, p. 16, in Edison Pioneers Records, Box 26.

few days later he reported: "[Edison] Mentally is very active, but is conducting all his business from the Library."[166]

Edison also held meetings in the library, and was often photographed at a table in front of the fireplace surrounded by colleagues seated in the distinctive caned swivel chairs.[167] Dyer and Martin describe these meetings:

> It has been the privilege of the writers to be present at some of these conferences, not only as participants, but in some cases as lookers-on while awaiting their turn. On such occasions an interesting opportunity is offered to study Edison in his intense and constructive moods. Apparently oblivious to everything else, he will listen with concentrated mind and close attention, and then pour forth a perfect torrent of ideas and plans, and, if the occasion calls for it, will turn around to the table, seize a writing-pad and make sketch after sketch with lightning-like rapidity, tearing off each sheet as filled and tossing it aside to the floor. It is an ordinary indication that there has been an interesting meeting when the caretaker about fills a waste-basket with these discarded sketches.[168]

By 1912, Edison's chief engineer and close friend, Miller Reese Hutchison, was scheduling meetings for Edison's staff in the library, although his office was located elsewhere.[169] During his years at West Orange, Hutchison often gave exhibitions of Edison equipment for visitors to the laboratory. In 1915, he scheduled a kinetophone and phonograph demonstration for the Chinese Commercial Commissioners but planned for it to be away from Edison's library because "...it will inconvenience you to have all those people in [the] Library for an hour or so. The library should be kept for your sole use."[170] Exhibitions of Edison's inventions in the library were not unusual. As early as 1905, Edison was photographed operating a projector in the library, and in 1914, Hutchison ordered a new Kinetoscope for the library so that "Mr. Edison will be able to show the same to his friends."[171]

At times Edison ate meals in the library, although he did not habitually dine in the room. Edison was known for his erratic eating habits, and he often ignored

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[166] Frank [Ryan] to William H. Meadowcroft, August 4, 1922 and Frank [Ryan] to William Meadowcroft, August 7, 1922; Biographical Collection.

[167] See figures 52, 57, and 60.

[168] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 642.

[169] Miller Reese Hutchison to TAE, October 28, 1912 (in DF 1912, WOL--General).

[170] Hutchison to T.A. Edison, annotation on May 26, 1915 correspondence (in DF 1915, WOL--General); also Hutchison to T.A. Edison, January 16, 1913 (in DF 1913, WOL--General).

[171] Hutchison to Meadowcroft, February 23, 1914 (in DF 1914, Motion Picture).

the packed lunches and dinners Mina Edison sent down from Glenmont, or ate them wherever he happened to be working at the time. He also hosted meals for employees or business associates at long tables set up through the center of the library, or when fewer people were attending, at the director's table placed in front of the fireplace.[172]

The 1914 fire at West Orange brought changes to the laboratory, and the library was pressed into use during rebuilding. Edison used the library as his command post to direct the rebuilding of his organization. An early 1915 photograph shows Edison reviewing charts tracing the progress of the work, while in the foreground sits a cylinder attached to a placard proclaiming "A Thousand A Day of these wax cylinders for dictating machines made in 482 hours after the fire on Dec. 9th, 1914."[173] The laboratory photographer photographed construction daily from the same vantage point, and delivered new prints to Edison's desk every morning so that he could trace each day's progress. [174] For some time after the fire, all of the executives formerly in the Administration Building set up their offices elsewhere within the complex. C.H. Wilson, vice president and general manager of Thomas A. Edison, Inc., moved his office into the library at this time.[175]

After Edison died on October 18, 1931, his body lay in state in the library for two days. Plans for viewing the body were established in advance of Edison's death, during his last illness in September. Mina wanted the body to lie in the library for one day, and suggested that a "simple orchestra" play during the viewing.[176] The orchestra idea was abandoned, but there were plenty of police on hand outside the laboratory, and plainclothesmen on guard in the library and in Building 5. It was originally planned that employees and members of their families be admitted to the library an hour before the public viewing began on the morning of the second day. The crowds were so great, however, that the original plan was discarded and the public was admitted immediately after the library was opened. An estimated 2,000 visitors an hour passed through the library for the two days Edison's body lay there, with an estimated 40,000 mourners passing through on the second day.[177]

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[172] See figures 52, 60, and 67.

[173] See figure 73.

[174] "The Edison Phonograph Monthly," February 15, 1915, p. [?].

[175] Ibid., January 1915, p. 16.

[176] "Notes taken by Mrs. Sloane," from Mina Edison interview, September 18, 1931 (in DF 1931, Edison, T.A.--Death, Undertaker/Cemetery Arrangements).

[177] The *New York Times*, October 19, 1931, p. 25; and the *New York Times*, October 21, 1931, p. 3, col. 3.

Family, friends, Thomas A. Edison, Inc. executives, and long time laboratory workers were admitted to the library directly. John Ott, Edison's associate from before the Menlo Park days, had been ill for a long while himself and died shortly after he heard of Edison's death. Harvey Firestone paid his respects, but Edison's great friend Henry Ford was not able to enter the library. He explained to Charles: "You remember the last time I saw him in the library, how we talked together? Well, I want to keep that as a lasting memory."[178]

Charles Edison. Charles, Edison and Minas' oldest son, went to work for his father in 1913 after studying engineering at the Massachusetts Institute of Technology. Charles became president of Thomas A. Edison, Inc. in 1926 and chairman of the executive board in 1927.[179] Thomas Edison was chairman of the board. It is tempting to speculate that Charles' entry into his father's business precipitated the addition of the two private offices within the library a few years later, but there is no firm evidence to support this theory. Charles eventually worked in one of these offices, however, certainly occupying one by the 1920s. Edison's youngest son, Theodore, came to work at the laboratory later, and he also had a desk in the library (see p. 40 for more on Theodore Edison).

Beginning in 1914, Stephen B. Mambert acted as Charles' assistant (see p. 38 for more on Stephen Mambert). In 1917, Charles' new assistant was George E. Clark; Clark himself also had a secretary, R.W. Kellow, who eventually became an office manager in charge of several of Edison's "personal undertakings, such as Chemical Plants."[180]

It is not known exactly where Mambert and Clark worked, but it is logical to assume that if Charles was in a library office at this time, they would be located either in that office, or nearby in the library. Roderic Peters, who marketed the Edison phonograph in the mid-1920s, remembered that Charles' office and his clerks' desks were in the library. At that time, Isaac (Ike) Walker was Charles' assistant, and Peters sat across from him at a double desk in an alcove. Peters also recalled that a comptroller had the other private office in the library.[181]

Alfred O. Tate. When Edison opened his laboratory in 1887, Alfred O. Tate succeeded Samuel Insull as personal secretary to Edison. Long before Edison moved to West Orange, Insull had established the position of private secretary to

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[178] The *New York Times*, October 21, 1931, p. 3, col. 3.

[179] Matthew Josephson, *Edison: A Biography*, (New York: McGraw-Hill Book Company, Inc., 1959), p. 445; see also Venable, *Out of the Shadow: The Story of Charles Edison*, p. 74.

[180] Stephen B. Mambert to Mullin Wayne, March 28, 1923, Biographical Collection.

[181] Roderic Peters interview, nd, Oral History Project, pp. 22-24.

Edison as a powerful one. He was financially astute and started the tradition of controlled access to Edison via his private secretary. Tate began his career as Insull's stenographer and quickly advanced through the organization. With a small support staff of his own, Tate was an important player in the Edison organization, and was close to Edison himself. His responsibilities included bookkeeping, monitoring all company business, and managing Edison's personal correspondence and finances.[182]

Although we do not know where Tate's office space was, it probably was not in the library with Edison. In his 1935 account of his years working with Edison, Tate refers to the library as Edison's territory, separate from his own. He describes a meeting Edison had with Gilliland and his attorney "in his library" which Tate was not invited to attend.[183] Tate also writes that in the 1890s, "I went to Edison in his library at the laboratory, where he was standing alone near his desk...."[184]

John Randolph. John Randolph followed Tate as Edison's personal secretary in 1893. A long-time Edison employee, he was also treasurer of many Edison companies and as personal secretary had power of attorney to act for Edison. Photographs depict Randolph attending luncheons and other social gatherings in the library but, again, the exact location of his desk or work space is unknown. By this time Edison's personal staff consisted of several secretaries, and the distinction between personal and confidential secretaries is not clear.

After Randolph died in 1908, Harry F. Miller became Edison's primary personal secretary (see p. 84 for more on Harry F. Miller.)

George Meister. George Meister, eventually chief paymaster of all Edison industries, began his career with Edison in 1903 as "Junior Clerk under the personal supervision of Mr. Edison." He later handled Edison's personal correspondence and acted as his confidential messenger to the New York City and Newark financial districts. Meister worked on the third floor of Building 5 at some point; he notes that he "had the pleasure of being engaged by Mr. Edison in Room #16...at $6.00 per week."[185]

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[182] Millard, *Edison and the Business of Innovation*, p. 54.

[183] Alfred O. Tate, *Edison's Open Door*, (New York: E.P. Dutton, 1935), p. 171; Tate may also be referring to the library in Edison's home.

[184] Ibid., p. 278.

[185] Edison Pioneers Records, Box 26.

William H. Meadowcroft. Meadowcroft began his association with Edison in May 1881, when he accepted a position as assistant to Major S.B. Eaton, vice president and general manager of Edison Electric Light Company in New York City. In 1885, Meadowcroft left his position and struck out on an independent venture. In 1887, he returned to Edison industries, becoming assistant to the manager of the Edison Lamp Works in Harrison, New Jersey, and eventually manager of the X-ray department. In the early part of the twentieth century Meadowcroft left the Lamp Works, returning in 1908 to assist Dyer and Martin in the preparation of their biography of Edison. During this time he also wrote *The Boy's Life of Edison.*[186]

Edison asked William H. Meadowcroft to become his assistant and confidential secretary in the autumn of 1910. Meadowcroft's desk was located in alcove 5, or "A," in the southwest corner of the library, and he probably worked in the library over the entire course of his career as Edison's secretary. A 1911 photograph shows Meadowcroft seated at his desk in the alcove and in a 1917 photograph Henry Altengarten and another unidentified man are posed around Meadowcroft seated at a desk in the same location.[187] Altengarten was Meadowcroft's assistant in charge of production reports. His office was moved from the library to the second floor of Building 5 in 1921, and a former employee recalls him also working on the third floor in the 1920s.[188]

By 1922, Meadowcroft's assistant was Frank T. Ryan, and it is likely that Ryan also worked in the library. Ryan handled all of Meadowcroft's business when he took a rare vacation during the summer of 1922 and Meadowcroft's explicit directions to him imply that Ryan was very familiar with his desk and work area.[189]

Meadowcroft was always a presence at the laboratory. On Edison's birthday in 1927, he "turned out for the occasion in a fine long coat and striped trousers," serving as master of ceremonies to visitors and the press in the library as Edison

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[186] "Autobiographical Sketch of William H. Meadowcroft" and Edison Pioneers Obituary, in Edison Pioneer Records, Box 26.

[187] The Coakley interview also states that Meadowcroft's desk was in the corner of the library, and the Roderic Peters and A.E. Johnson/K. Ericke interviews refer to Meadowcroft working in the library. (Both interviews from the Oral History Project.) See figure 79.

[188] Laboratory Labor and Material Ledger, 1918-1931, Work done March 29, 1921, Accounts Records; and A.E. Johnson/K. Ericke interview, March 29, 1971, Oral History Project, p. 31.

[189] Frank T. Ryan to William H. Meadowcroft, August 7, 1922, and notations; Frank T. Ryan to William H. Meadowcroft, August 10, 1922, and notations; and William H. Meadowcroft to Frank T. Ryan, August 5, 1922, Biographical Collection.

gave his annual interview session.[190] Although Meadowcroft was near Edison in age and nearly blind, he continued working in the library at the West Orange laboratory after Edison died in 1931. He served as librarian and historian at the laboratory until his own death on October 15, 1937. Meadowcroft's funeral was held on October 18, 1937, the sixth anniversary of Edison's death.[191]

Other Employees. Tate, Meadowcroft, and Randolph had assistants while working for Edison, and these assistants would have had easy access to the library. Meadowcroft's assistants probably had desks or work tables in the library, in alcoves 4 and 5. Henry Altengarten is one of the few office workers identified in the photographs, but several other unidentified men appear in the background of photographs dated 1914, 1915, 1917, and 1920.[192]

E.C. Barnes, a clean-cut, well-dressed young man, appears in 1914 and 1915 photographs with Edison at his desk using an Edison dictating machine. These images were probably publicity photographs; Barnes patented part of the dictating machine and was not on Edison's secretarial or personal staff. The photographs are ironic: Although Edison first envisioned the phonograph as a business tool, and the Edison dictating machine--known as the Ediphone in later years--was an Edison mainstay, Edison himself seems rarely to have used it, preferring instead to make written comments on correspondence and other documents. Roderic Peters recalled that "...I never remember [Edison] using his Ediphone to dictate. I never remember him using that. I don't think he liked it. He didn't care much for it."[193]

In what appears to be part of the same series, Edison was photographed in 1914 with a female secretary who is using a similar device. The woman featured in the series certainly did not work in the library, though she may have worked elsewhere in the laboratory complex, or on the third floor of Building 5. Although women worked in offices and plants throughout the West Orange complex, according to a former employee, "[Edison] never would have any women working in the library, no women, no women secretaries."[194]

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[190] *Literary Digest*, March 5, 1927.

[191] "Autobiographical Sketch of William H. Meadowcroft" and Edison Pioneers Obituary in Edison Pioneers Records, Box 26.

[192] See figures 69, 76, 79, and 83.

[193] Roderic Peters interview, nd, Oral History Project, p. 42.

[194] A.E. Johnson/K. Ericke interview, Oral History Project, p. 30.

During the early years at West Orange, at least, employees at the laboratory from machinists to shop boys to chemists were permitted to use the library to consult or borrow reference material. An 1888 notebook records books checked out from the library by employees from January of that year through February 1890. Kennelly, Schulze-Berge, Cousens, and Fessenden were frequent borrowers.[195] In May 1890 Edison purchased books from his usual dealer, D. Van Nostrand Company, specifically for his employees. These included *Facts Worth Knowing*, *Engineer's Pocketbook*, and Humber's *Handy Book on Strains*.[196]

Access to the library for research purposes seems to have continued into the twentieth century. Paul Laverty started working for Edison in 1909 at the age of 16. In a 1963 interview he recalled that Edison allowed him free run of the library, and that he often stayed there late into the night. When Edison left, according to Laverty, he would say "good night" and leave Laverty alone in the library.[197] Another employee, however, remembered that while Edison spent a lot of time in the chemical laboratory and the library: "As a matter of fact we young fellows, when we'd come up the yard--it was kind of off limits, you weren't supposed to be wandering around the library, and we'd peek in the door of the chemical lab...But normally the factory workers didn't spend too much time up there in the library."[198]

Recollections of a scientist working at the laboratory during World War I indicate that the library was still open to employees for research at that time. Dr. Karl Compton, a scientist from Princeton, was detailed to the laboratory as a volunteer at Edison's request in 1917. Edison suggested he meet with another volunteer scientist working on the same problem and compare methods. The scientists agreed completely on the method they were using:

> but disagreed radically as to conclusions....On looking over his work, however, [Compton] found that he had based all calculations on a formula for alcohol, $C_{12}H_{22}O_{11}$, which is sugar. In other words, he had been actually finding out what fuels would be better than sugar for driving the Navy's torpedoes. When I asked him where in the world he had got that formula for alcohol he said, 'you see, I am a mathematician and not a chemist so I went to the library', and with that he showed me an ancient book on chemistry, in which $C_{12}H_{22}O_{11}$ was actually given as the formula for alcohol.[199]

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[195] Notebook N-88-01-30.

[196] Voucher 530, 1890.

[197] Laverty to Speiden, September 17, 1963, in Historian's Note 68.

[198] Edward Daly interview, nd, Oral History Project, p. 12.

[199] *Science*, vol. 75, 1933, p. 70.

Although the library may have been accessible in 1917, this account suggests that the reference material may not have been kept current by this time.

The Press. On May 11, 1888, Edison opened the library to the press for one of the first tours of the West Orange laboratory. The *New York Times* described the event:

> Edison's new laboratory and perfected phonograph at Orange, NJ were thrown open to representatives of the press yesterday. The plant is purely for experimental purposes, and is one of the largest in the world...There is a combination office and library in it....[200]

When representatives of the press were allowed inside the laboratory buildings, they entered through the Gate House and were directed immediately into the library. In 1901, another reporter writes: "Once inside the visitor is conducted into a spacious and lofty library, where he waits. Here, after a time, comes to him the genius of the place...."[201] It is likely that reporters were ushered around the laboratory by an assistant, rather than being shown around by Edison himself: "Whichever of his assistants may have been deputed as guide, you will surely find him cultivated, courteous, and acknowledged expert in one or more branches of scientific research, and proudly interested in the establishment of which he forms a part."[202]

Edison's assistants dealt with tour arrangements and details for the press, while Edison gave interviews on all subjects, often from his desk in the library.[203] According to Dyer and Martin, Edison welcomed reporters and "the easy, inveterate good-nature of Edison toward reporters is proverbial in the craft." Reporters had access to Edison for interviews, but large groups probably did not actually enter Building 5 except on special occasions, such as award ceremonies or Edison's birthday.[204]

Visitors. When Edison moved to the West Orange laboratory in 1887 he was already a famous man. A constant stream of visitors passed through the

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[200] The *New York Times*, May 12, 1888, p. 8, col. 3.

[201] The *New York Times*, January 20, 1901, p. 18, col. 1.

[202] *Cosmopolitan*, April 1889, p. 600; Horace Townsend, author of the 1889 *Cosmopolitan* article, wrote directly to Edison's secretary, Alfred Tate, requesting help obtaining photographs to illustrate his article "Can you not by hook or crook get these for me? I will remember thee in my prayers if you do so." (H.Townsend to A. Tate, February 20, 1889 (in DF 1889, Edison, T.A.--Articles, D-89-07).

[203] *Literary Digest*, March 5, 1927; *American Magazine*, vol. 86, 1918, p. 35.

[204] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 659.

laboratory, and especially important visitors--Edison's friends or others he found interesting--stopped in the library for a conversation or sometimes a photo session. Dyer and Martin describe some of the various groups and individuals who visited Edison at West Orange:

> It is the common experience of any visitor to the laboratory that there are usually several persons ahead of him, no matter what the hour of the day, and some whose business has been sufficiently vital to get them inside the porter's gate, or even into the big library and lounging-room. Celebrities of all kinds and distinguished foreigners are numerous--princes, noblemen, ambassadors, artists, litterateurs, scientists, financiers, women. A very large part of the visiting is done by scientific bodies and societies; and then the whole place will be turned over to hundreds of eager, well-dressed men and women, anxious to see everything and to be photographed in the big courtyard around the central hero. Nor are these groups and delegations limited to this country, for even large parties of English, Dutch, Italian, or Japanese visitors come from time to time, and are greeted with the same ready hospitality....[205]

Edison himself gave Tolstoy's son a tour of the laboratory, and in 1926 the Crown Prince of Sweden paid a visit to Edison in the library. Henry Ford and Harvey Firestone were close to Edison in his later years, and frequently met with Edison at Glenmont or in the library at the laboratory.[206]

Building 5, Heavy Machine Shop

The old work culture of the Edison laboratory had brought machinist and experimenter together in the process of innovation and valued each equally. Both had clocked in on the same clocks and been paid on the same payrolls. An analysis of laboratory employees in Period I (1887-1900) found that craft skills were well rewarded in the laboratory and often machinists could make more than experimenters.[207]

Many payroll records of the laboratory from this time period survive. Edison's bookkeepers kept careful notes of the individual time cards of the employees and distributed labor costs over the various experimental projects. A payroll for the week of September 5, 1889, shows 17 machinists at work in the first floor machine shop. The payroll from the next week recorded only 12 men.

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[205] Ibid., pp. 658-59.

[206] Roderic Peters interview, p. 11 and Edward Daly interview, p. 28, both from Oral History Project; Josephson, *Edison: A Biography*, p. 478; *New York Times*, March 24, 1911.

[207] Millard, *Edison and the Business of Innovation*, p. 337, footnote 69.

The rates of pay ranged from 10 cents to 60 cents an hour and the men worked from 49 to 79 hours per week.[208]

A payroll for the week ending February 6, 1890, shows 21 machinists at work, including Fred Ott. John Ott, who was salaried, was the chief superintendent along with two others at that rank.[209]

A list of laboratory employees who worked on the motion picture experiments from February 1889 to February 1890 shows a high rate of turnover in the laboratory, for many of the names are not to be found on the February 1890 payroll and several machinists who worked on this project in 1889 are not to be found in 1890.[210]

Many unskilled workers were employed at the West Orange laboratory. These men were often to be found in the machine shops or carrying out construction or cleaning tasks in various parts of the site. One particular payroll dated 1890 showed nine laborers. One newly-arrived immigrant who took a job as a laborer in the West Orange laboratory was Fred Devonald, who later became the storekeeper.[211] He remained at that post until 1903.

Every surviving payroll for this period shows the employment of boys. Sometimes they are called apprentices but normally they were noted on the payroll as boys. The term "boy" probably referred to any young man in his teen years.

At West Orange these youths carried out light work, ran messages, and had the opportunity to learn the trade of the West Orange laboratory. They worked in all parts of the laboratory: some did clerical work in the library, some assisted experimenters and some helped out in the machine shop. Walter Miller is an example of an experimenter who began his Edison career as a boy. In 1888, one of the clerical staff noted that "our present staff of juveniles are excessively stupid."[212]

The February 1890 payroll lists 23 experimenters, including Walter Miller but excluding the Otts. Dickson and Kennelly were the highest paid, indicating their

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[208] In DF 1889, WOL--Machine Shop Accounts, D-89-69.

[209] In DF 1890, WOL--General, D-90-64.

[210] "Complainant's Exhibit Work on Kinetophone Experiment from February 1, 1889, to February 1, 1890," *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith.*

[211] Historian's Note 101.

[212] Thomas Maguire to Alfred O. Tate, November 19, 1888 (in DF 1888, Edison, T.A.--Secretary, D-88-20).

supervisory status. In 1888, Edison told Batchelor to raise the wages of experimenters James Gladstone, Arthur Payne, Cuntz, Deems, Fred Ott, and Jonas Aylsworth because "these are good men."[213]

The records of the machine shop employees during Period II (1901-1914) show that Edison still hired machinists, laborers, and boys and still maintained a hierarchical pay structure. The names on the payrolls indicate that Edison maintained his practice of hiring machinists from northern and western Europe, especially Germans. He also hired many Scandinavians as machinists and experimenters.

During the period 1915 to 1931 the distinctions between experimenter and machinist grew more pronounced, with the former joining the ranks of the administrative staff and the latter's prestige declining. By the time of the first World War there appear to have been two time clocks in use in the main laboratory building: clock A, and clock B ("all executives and office men of the laboratory") and two different payrolls.[214]

A change in the laboratory organization in 1918 established a general foreman in charge of both machine shops. He acted as an assistant to the chief engineer, who also held the title of division manager of the laboratory.[215] The machinists still called their boss the superintendent, although his powers appeared to have been diminished by this change.

Charles N. Wurth. Wurth joined the laboratory staff in 1888. In the 1890 labor records Charles Wurth is noted as a superintendent, along with John Ott. Assuming that Ott was on the second floor, it follows that Wurth was on duty on the first floor and supervised the heavy machine shop. In 1891 Wurth was described as an experimenter on the payroll records.[216] His employment lasted until at least 1910.[217]

Charles Schiffl. The transfer of Charles Schiffl to the laboratory from the Phonograph Works in December 1909 was a significant event in the history of the

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[213] TAE to Charles Batchelor, undated (in DF 1888, WOL--General, D-88-56).

[214] R.W. Kellow to George E. Clark, December 29, 1917 (in DF 1917, WOL--Employees).

[215] John P. Constable to Charles Edison and others, April 11, 1918, Engineering Department Records, Box 5, Laboratory binder.

[216] "Distribution of Labor No. 6" (1890-1891); "Distribution of Labor No. 7" (1891-1893), and "Distribution of Labor No. 8" (1893-1896). These volumes are in the Account Books Records at Edison NHS.

[217] Edison NHS Card Catalog.

West Orange laboratory.[218] Schiffl was a tool maker, draftsman, and foreman. He was to become the nucleus of a new laboratory department, the Engineering Department, that was to take over production engineering at West Orange. At first he worked in Building 5, probably close to the heavy machine shop, supervising the construction of prototypes. Later he was to move to the second floor and work on design and development of new products.

Donald M. Bliss. Bliss was the first to hold the title cf chief engineer at West Orange. He was hired to work on electric motors and regulators as he had considerable experience in designing electrical machinery. He came to West Orange in 1910 and was appointed chief engineer in 1911.[219] As he worked with the electric motor department in the Edison Phonograph Works it is possible that he had his work space on the first floor, perhaps in the machine shop. On the other hand, his duties would have involved close coordination with the precision machinists on the second floor and this may have established his office on the second floor, adjacent to the machine shop. This office, on the north side of the central hallway, was later used as the office of the chief engineer.

Part of Bliss's job was production engineering on the disc and storage battery projects, and this meant overseeing work carried out in the machine shops of Building 5. He was involved in the design and production of cylinder phonographs, primary batteries, and motion pictures in addition to special jobs such as designing a small electric motor for a prospective Edison lawn mower and building a complete electric delivery wagon.[220]

He was clearly under a lot of pressure from Edison who drove him hard and had little patience with him--Bliss was not a hustler. In October 1912, he was fired. Some years later Edison explained that Bliss's work was not satisfactory "due perhaps to the conditions here, which are rather exacting."[221]

R. A. Bachman. During the period 1901-1914, the laboratory payroll records describe Bachman as "M.M" which probably stands for master machinist. Although he did not hold the official title of superintendent of the machine shop (this belonged to John Ott), he supervised the workers in the shop on the main

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[218] Nelson C. Durand to Frank L. Dyer, December 17, 1909, "The Ediphone Division of TAE, Inc, Records," Box 1.

[219] His contract stipulated the generous sum of $3,500 per annum for five years with a commission (in DF 1910, Phonograph--Manufacture).

[220] See Edison Manufacturing Company folders in the Document File for examples of patents assigned by Bliss to the Company.

[221] TAE to Francis M. Applegate, October 26, 1916, Letterbook 114, p. 606 (LB114606).

floor and signed their time cards. Laverty remembered him as superintendent of the heavy machine shop.[222] It is possible that he acted as superintendent of both shops after John Ott relinquished the post in 1910 and before Charles Luhr assumed it in 1913. In 1919 Bachman supervised 51 men at work in the machine shop.[223]

Charles Luhr. Luhr was superintendent of the machine shop from 1913 until 1917. (See p. 72 for more on Charles Luhr.) W. Benney took charge of the shops around 1920.[224]

Building 5, Stock Room

Thomas Ebdell. Thomas Ebdell ran the storeroom in February 1890 according to the payroll for that month. A list of employees found in a 1890 laboratory notebook, but evidently entered much earlier than that, lists Ebdell as a member of the staff. This shows that he was one of the core laboratory employees who were brought over from Harrison to West Orange in the fall of 1887.[225]

Fred Devonald. Fred Devonald took over this job some time in the 1890s and stayed until 1903.[226] After joining the laboratory in the early 1890s Devonald slowly worked his way up to the position of storekeeper. He is seen in an 1894 photograph of the Black Maria holding a pet fighting cock.

Otto Beyer. Laverty notes that "Otto" was in charge of this room in 1910. He described it as a "tool stock room where a mechanic would go to get a tool bit or a drill also it was stocked with many large bottles of chemicals, small bottles of same were in the Chemical Room."[227] Beyer is consistently on the payrolls as the storekeeper after 1903.

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[222] Employee Records, Laboratory Payroll Time Sheets, Box 74; Historian's Note 90.

[223] "Functions of Present Laboratory Organization," September 24, 1919 (in DF 1919, Thomas A. Edison, Inc.--Organization).

[224] A.E. Johnson/K. Ericke interview, 1971, Oral History Project, p. 25.

[225] Notebook N-90-01-04.3. The list is in Edison's own handwriting and is a rough tally of the expenses of running the lab for one week. This payroll probably dates from November or December 1887.

[226] "Distribution of Labor No. 6" (1890-1891); "Distribution of Labor No. 7" (1891-1893), and "Distribution of Labor No. 8" (1893-1896).

[227] Historian's Note 90.

No inventory of the stock room was made after the 1914 fire and none had been made by 1917. There is no evidence that the role of this department changed. In 1920 the stock room was supervised by Frank McDermott.[228] One of his assistants was James Burns who worked in the stock room from 1925 to 1931.[229]

Building 5, Second Floor

A photograph (figure 116) taken by W.K.L. Dickson prior to 1894 shows the wall and at least one door of the rooms lining the south side of the precision machine shop.[230] A careful examination of the floor and ceiling of the machine shop indicates that the line of offices stretched from room 5, by the elevator, along the length of the shop. These rooms served as experimental rooms, each fitted up for a specific project or task.

By 1914, most of the experimental offices along the side of the precision machine shop adjacent to Lakeside Avenue had been removed and their staff disbanded and moved elsewhere. One room, presumably room 5, and the elevator enclosure were all that remained.

In 1918, the machine shop occupied all of the floor space from the stairs to the east end; it roughly matched the floor space of the heavy machine shop below it. In 1916, Edison, Hutchison, and Charles Luhr worked in their offices along the courtyard side of the second floor, but there were no experimental rooms left by 1918, only rooms for cabinet design and the jewel department.[231] In 1920 the jewel department undertook the development of a new method of producing diamond points with the laboratory also making 25 spindle units for diamond rounding machines.[232]

In 1920, experimental rooms on the second floor were used by Dr. Gibbs, the phonograph product engineer, for "developing a lecture on 'sound and the

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[228] "Thomas A. Edison Laboratory - Payroll Comparison's [sic]", December 14, 1920, D-Box Collections - Box D10 - West Orange.

[229] Edison Pioneers Records, Box 20.

[230] Figure 116 appears in Album 12, catalog 560. W.K.L. Dickson's name appears in both the lower left and lower right corners of the image. An inscription inside the album cover reads, "Presented to A.O. Tate by his friend Thomas A. Edison, Orange, N.J., December 5, 1893.

[231] Floor Plan, second floor, building 5, November 26, 1916; "Thomas A. Edison Personal - Floor Areas Laboratory Building," November 25, 1918 (in DF 1918, WOL--General).

[232] Minutes of a Meeting of the Board of Directors of Edison Phonograph Works, March 9, 1921, Minute Book in the microfilmed collections of the Charles Edison Fund, reel 4 of 6.

phonograph' and making demonstration apparatus." Also working in this area were Mr. Scott, who was in charge of building a "revised dipping machine," and Mr. Taylor, who was investigating "trembling and bad regulation" in the assembly of Amberolas. A draftsman was also working on the second floor on disc record machinery.[233]

Thomas Edison. Edison had places reserved for his experiments in every building on the site. He could be found at the back of Building 2, next to the end table (table 10) where he was photographed several times. He also had a space on the third floor of Building 5. His office in the library often served as sleeping quarters. Yet his favorite place was room 12, an experimental room on the second floor of Building 5.

During Period II (1901-1914) much of Edison's time was spent on storage battery and phonograph experiments. Room 12 was probably the site of "years of empirical experiments" during which Edison made up thousands of diaphragms and reproducers. In 1914, Edison was examining the new line of disc playing phonographs before the prototypes were taken to the Works.[234] He probably inspected them on the third floor, where much of the testing was being carried out.

John Ott. John Ott was placed in charge of the second floor precision shop when the laboratory opened and it is likely that his office was room 10, which directly overlooked the machine shop. He kept all the records of shop orders for work done in the shop and this required close supervision of the work being done in the shop.

John Ott had been associated with Edison since 1870 when he was hired at Edison's machine shop in Newark.[235] He was an expert machinist who could turn Edison's rough sketches into working models. Such was Ott's skill that he was given the most delicate machining jobs in the laboratory, becoming Edison's "confidential experimental instrument and model maker." Their friendly, life-long relationship embodied the unity of master and craftsman in the shop. Edison worked in close cooperation with his machinists, overseeing the work and

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[233] "Report of Work Done in the Laboratory," John P. Constable to TAE, October 23, 1920, Engineering Department Records, Box 11, T.A. Edison folder. Gibbs had one assistant. Also "Thomas A. Edison Laboratory--Payroll Comparison's [sic]", December 14, 1920, D-Box Collections - Box D10 - West Orange.

[234] Memorandum of C.H. Wilson, December 12, 1914 (in DF 1914, Phonograph--Manufacture). Edison was also examining the product of development work on the cylinder machine, including a new type of Amberola. With the disc line moving ahead, Edison was asked what the lab should concentrate on next. His answer: "The 2nd thing to start full blast is the new disc clockwork mfg as fast as tools are ready. The 3rd is big phono 4th Amberola 10 new clock work." Marginalia by TAE, R.A. Bachman to Stephen Mambert, December 31, 1914 (in DF 1914, Phonograph--Manufacture).

[235] Edison Papers, vol. 2, p. 560.

changing it as he saw it take shape. It was in the process of altering an experimental model as it was being assembled that the germ of an invention sometimes emerged. In the inventor's own words: "Well, sometimes I would get an idea and I would jot it down in the book; sometimes I would get the idea while the machine was being made, and I would change it and then jot it down in the book."[236]

John Ott suffered a crippling bout of paralysis in his lower body in 1895, the result of an earlier accident.[237] It is unlikely that he carried out supervisory duties after this point although he did remain in his room next to the machine shop and retained the title of superintendent of the machine shop until 1910. He continued to play an important part in Edison's experimental activities. In 1909, John Ott's assignments included designing a graphiting machine and making drawings of copper-plating apparatus and a "good recording machine."[238]

Charles Luhr. Luhr joined the Edison enterprise in 1889 and worked in the Phonograph Works. In 1903, he became a foreman for the Edison Manufacturing Company and in 1911 moved to the laboratory where he was given charge of experimental and precision work on the second floor. In 1913 he was placed in charge of all work carried on in the laboratory directly under Mr. Edison. Luhr held this post until 1917 when he was made manager of the Edison Phonograph Works.[239]

Fred Ott. Fred Ott was John's brother and one of Edison's close friends. He was one of Edison's most trusted machinists and his precision lathe would not be too far from the "old man," perhaps in his own room adjacent to Edison's, or (as Fessenden remembered) in Edison's room. In describing the second floor, Fessenden wrote "The next room was where Edison did most of his work, and where Fred Ott had his precision lathe."[240] Ott was humorously called the "mechanician in chief" at the laboratory and remained a close associate of Edison

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[236] "Deposition of TAE," *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith*, p. 119.

[237] The accident was said to have occurred in Sigmund Bergmann's shop in New York City. Several vertebrae in his back were damaged. After the paralysis he was brought to the West Orange laboratory in a wheel chair. "Unknown Soldiers in Edison's Service," *The Daily Courier*, October 21, 1929.

[238] Frank L. Dyer to [?] Weber, December 15, 1909 (in DF 1909, Phonograph--General).

[239] Edison Pioneers Records, Box 25.

[240] Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925) p. 157.

until Edison's death. A newspaper report of September 17, 1931, described him as "working side by side everyday" with Edison.[241]

Laverty reported that Fred Ott had a room on the second floor, and this is corroborated by Dyer and Martin, who say that Ott could be seen "in one of the many experimental rooms lining the sides of the second floor."[242] As one contemporary wrote, "I don't know what he would do without Freddie, who is kept on the jump from morning to night."[243]

Charles Dally. Charles Dally joined Edison's employ with his brother Clarence--the first man to die from exposure to radiation. The Dally brothers worked with Edison on the X-ray project from the late 1890s until sometime in the first decade of the twentieth century. A photograph shows Charles Dally with the X-ray machine in an experimental room around 1904 (figure 128). The appearance of the walls and ceiling of this room indicates that this room might have been on the second floor on the south side of the precision machine shop. Moreover Paul Laverty said that Dally had a room on the second floor around 1910. He also noted that Dally came down to Building 2 and worked at H.W. Lancaster's bench.[244] Here he was involved in making the 'varnish' (recording media) to coat the surface of record blanks.[245] He moved around the laboratory as his duties dictated and by 1912 had an office on the third floor.[246]

Other important experimenters who might have had rooms on the second floor include the following:

Sam Moore. As a result of John Ott's illness, Sam Moore became Edison's personal machinist and assistant. He accompanied "the old man" wherever he carried out his experiments. A photograph of a group of experimenters, "the insomnia squad," taken in Building 4 in 1912 shows Moore sitting next to Edison

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[241] A memorandum in Edison's handwriting describes Ott as "Mechnician in Chief"; unidentified newspaper article dated September 17, 1931. Both in Edison Pioneers Records, Box 27.

[242] Historian's Note 90; see also Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions,* p. 648.

[243] William H. Meadowcroft to A. Thompson, March 23, 1927, Biographical Collection.

[244] Historian's Note 90.

[245] C.H. Wilson to [?] Hird, August 18, 1911 (in DF 1911, Phonograph--Manufacture).

[246] MRH to TAE, October 29, 1912 (in DF 1912, WOL--General).

(figure 46). As Edison's main place of work was room 12 it follows that Moore would have had a room nearby.[247]

Moore worked in Building 4 on disc record development from 1912 to around 1917 and on long playing records in 1924-1926.[248]

Daniel Higham. An independent inventor, Higham was brought to West Orange in 1909 to apply his special knowledge of loud speaking phonographs to the kinetophone project.[249]

He worked in the kinetophone studio, a large tent in the laboratory complex, and he probably worked in Buildings 1 and 5. He developed the large phonograph used in the kinetophone sets.[250]

Al Wurth. The son of Charles N. Wurth, 17-year-old Albert first worked for Edison for six months in 1894, helping his father Charles to prepare records and make duplicates from molds. After a three year hiatus, Albert returned to stay in 1897. In 1903, he succeeded his father as head of the department making molds to manufacture duplicate records for the National Phonograph Company. In 1909, when the disc record project began at Glen Ridge, Albert guided John Ott in the preparation of drawings for copper-plating apparatus. He continued working for Edison until 1921.[251]

John Joseph Force. Force was the glass blower during Period I (1887-1900). His room is likely to have been on the second floor. Fessenden places him on the third floor, which might have been a mistake.[252]

W.K.L. Dickson. William Kennedy Laurie Dickson's association with Edison has been the source of some controversy and a great deal of misinformation. The

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[247] Reporting to TAE on work in progress at the laboratory, Meadowcroft mentions that he saw Moore and Acker "going about with discs in their hands." This was in Building 5 as Meadowcroft was writing from Edison's library. William H. Meadowcroft to TAE, August 4, 1911 (in DF 1911, WOL--Meadowcroft's Reports).

[248] Harold Anderson interview, 1973, Oral History project, p. 29; see also NPS, "HSR, Part I, Metallurgical Laboratory, Building 4," p. 5.

[249] See DF 1909, Motion Picture--Highamphone and Higham, Daniel for the terms of Higham's contract.

[250] MRH to TAE, March 14, 1912 (in DF 1912, Phonograph--General).

[251] Frank L. Dyer to [?] Weber, December 15, 1909 (in DF 1909, Phonograph--General); Testimony of Albert Wurth, *National Phonograph Co. v. American Graphophone Co.*, pp. 32-33; Edison National Site Card Catalog.

[252] Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925), p. 157.

eminent motion picture historian, Gordon Hendricks, makes the case for Dickson as the inventor of motion pictures. Dickson, Edison, and the early film historian, Terry Ramsaye, have each distorted the record of Dickson's work with Edison. A more balanced view is found in the work of Charles Musser.[253]

Dickson was definitely working for Edison at the Harrison Lamp Works in the period after the Pearl Street Station was erected in New York City.[254] He moved from Harrison to the West Orange laboratory in 1887 with the rest of Edison's skeleton crew. Dickson worked in Building 4 on the ore milling project in the 1890s.

As an amateur photographer of some skill Dickson soon got himself appointed as photographer of the laboratory--a busy job considering the publicity Edison generated about himself and his laboratory. Dickson claims that Edison had talked with him about moving pictures while they were working together at Harrison. At West Orange in the mid-1890s he was given the task of synchronizing the sound of the phonograph with a moving image.

As was the practice in the laboratory, Dickson was given his own room, his personal helper--a laborer called Charles Brown--and an account number to which he could bill supplies and other labor. Dickson moved into room 5 on the second floor, next to the elevator.[255] He was assisted by several machinists who were later to carry out experiments on motion pictures including Eugene Lauste and Charles Kayser.[256] Dickson left the West Orange laboratory in April 1895.

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[253] See Gordon Hendricks, *The Edison Motion Picture Myth* (Berkeley: University of California Press, 1961). Antonia and W.K.L. Dickson, "Edison's Invention of the Kineto-phonograph," *Century Magazine*, 48 (June 1894) is Dickson's published version. The "official" history, approved by Edison himself, is by Terry Ramseye, *A Million and One Nights: A History of the Motion Picture* (New York: Simon and Schuster, 1926). See also Charles Musser, *Before the Nickelodeon* (Berkeley: Univ. of California, 1991).

[254] Pay vouchers show that Dickson was with Edison at this time, see Vouchers 224 (July 1887), 432 (October 1887), and 480 (November 1887).

[255] "Deposition of TAE," *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith*, p. 100.

[256] "Complainant's Exhibit Work on Kinetophone Experiment from February 1, 1889, to February 1, 1890," *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith*, pp. 360-61.

Charles A. Brown. Brown was a laborer who became part of the historic experiments that led to the development of a motion picture camera. He was employed at various places in the laboratory including the lamp test room on the third floor and the ore milling room in Building 4 before joining Dickson in room 5.[257]

Eugene Lauste. An experimenter from France, Lauste left the West Orange laboratory in the 1890s and took his valuable skills with him. Lauste worked for various other motion picture companies before setting himself up as an independent inventor. He successfully developed a system of talking pictures in the first decade of the twentieth century, but lack of money and the coming of war in 1914 prevented him from perfecting this technology as a commercial system.[258]

Draftsmen. These employees did the important work of making precise measured drawings of Edison's inventions for manufacturing and patent applications. The February 1890 payroll indicates two draftsmen at the West Orange laboratory, and they were probably on the second floor, close to Edison.

A draftsman would often double as an experimenter--there being no hard and fast job definitions in the Edison laboratory. This was the case with E.G. Thomas, who worked from 1888-1890.[259]

Laverty reported that the drafting room on the second floor was under the direction of John Ott.[260] In March 1910, there were nine draftsmen on the payroll under the supervision of Charles Schiffl.[261]

The old drafting room was restructured as the Construction Engineering department which handled all the changes in the laboratory's physical equipment and plant. This operation was under the supervision of a Mr. Wolf, who had two clerks and nine assistants in this room. One of the latter was Joseph Gustadt,

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257 "Deposition of C.A. Brown," *Thomas A. Edison v. American Mutoscope Company and Benjamin F. Keith*, pp. 140-58.

258 David Robinson, *Chaplin: His Life and Art* (New York: McGraw Hill, 1985), pp. 387-88, reproduces a letter written by Lauste in which he recounts his career and his experiments.

259 Edison Pioneers Records, Box 28.

260 Historian's Note 90; see also Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 649.

261 Employee Records, Laboratory Payroll Time Sheets, Box 74, (March 1910).

who later took over this department.[262] Despite this organizational plan there is evidence that this department also did some drafting for experimental projects.

In 1919, Charles Nicolai was manager of the Construction Service division and was probably based in this room. He began as a machinist and was described by Hutchison as a "master machinist."[263]

Building 5, Third Floor

There were several experimental rooms on this floor running along the south side dating from the 1880s. According to Fessenden, some time before 1900 James Gladstone (an English experimenter working on batteries for the phonograph), and the chemist Jonas Aylsworth, among others, were working on the third floor.

During the period 1901-1914 more space on the north side of this floor was converted into experimental rooms. Many of the experiments conducted on this floor were concerned with the phonograph. Dyer and Martin described the third floor in 1910:

> On each side of the hallway above mentioned, rooms are partitioned off and used for experimental work of various kinds, mostly phonographic, although on this floor are also located the storage-battery testing-room, a chemical and physical room and Edison's private office, where all his personal correspondence and business affairs are conducted by his personal secretary, Mr. H.F. Miller. A visitor to this upper floor of the laboratory building cannot but be impressed with a consciousness of the incessant efforts that are being made to improve the reproducing qualities of the phonograph as he hears from all sides the sounds of vocal and instrumental music constantly varying in volume and timbre, due to changes in the experimental devices under trial.[264]

This space was completely reorganized in 1916. Dinwiddie's room for educational films (at the east end) was converted into offices for the engineering department. These offices included the Chief Engineer's office, the Engineering Test Service department, and the Drafting Service department. Next to this complex of offices, on the south side of Building 5 were the offices of the product engineers.

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[262] "Functions of Present Laboratory Organization," in DF 1919, Thomas A. Edison, Inc.--Organization.

[263] Photograph Album 10, catalog 5209.

[264] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 651.

Charles Deshler. Deshler was in charge of the lamp testing operation on this floor. He had at least three assistants: Arthur Payne, John Marshall,[265] and Joseph Harris.[266]

A. Theo E. Wangemann. Wangemann was a German experimenter who helped build a recording studio on the third floor and was in charge of making records. He joined the staff before 1889. He was head of the experimental phonograph department of the laboratory.[267] He spent part of 1889 in Germany demonstrating the new Edison phonograph. He was one of several formally-trained German experimenters at the West Orange laboratory and like them was called "Professor" by the rest of the staff. He was aided in his recording work by the young Walter Miller, who picked up the tricks of the trade from him.[268] Wangemann was struck and killed by a train in June 1906.

Albert O. Petit. Petit had assisted Bell and Tainter in their Volta laboratories and was lured away to the West Orange laboratory. He joined the staff in 1888 and became an important figure in the development of cylinder and disc records and in the construction of machines to duplicate recordings, with several patents awarded in these areas. Petit was based in Building 2 but had an office on the third floor, no doubt to be close to the phonograph testing room.[269] While working on the disc record project he carried out test pressing of coated blanks in this room.[270]

Albert or Brian Philpot. An expert on making records from celluloid, Philpot was hired away from the Indestructible Record Company and brought to West Orange before 1910.[271]

Charles Hibbard. Hibbard was one of the first engineers hired at West Orange to work on developing one product exclusively. In 1906 he joined the laboratory and moved into an office on the third floor. His task was to improve the business phonograph and to explore new types of dictating machines. He was not assigned an unskilled helper, as was common practice at the laboratory. Instead, he was

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[265] Marshall, *Recollections of Edison*, pp. 92-94, 97.

[266] Edison Pioneers Records, Box 23.

[267] Wangemann material in Biographical Collection.

[268] Mary Childs Nerney interview with Walter Miller, in Notebook N-28-11-01, pp. 50-52.

[269] Historian's Note 90.

[270] C.H. Wilson to Hird, August 18, 1911 (in DF 1911, Phonograph--Manufacture).

[271] Frank L. Dyer to Samuel Insull, March 23, 1911, Record Manufacturing Division Records, Box 17.

furnished with a draftsman and reported directly to the superintendent of the Phonograph Works and the manager of the Business Phonograph department.[272]

Newman Holland. Holland was hired as a replacement for Hibbard in 1910. He had 15 years experience in the design of electrical apparatus, including five years at Western Electric, where he had worked in the original design section and rose to head the experimental laboratory in Chicago.[273] Holland's work covered all aspects of the dictating machine: improved reproducers and control devices, completely new machines aimed at special uses (including a spring driven portable machine), and the development of some of Edison's pet projects, such as the telescribe.

Holland found it difficult to work on the third floor, where he was given space next to the music room. The noise and lack of space compelled him to move into Building 1 to work around 1912.[274] He returned to Building 5 around 1916. He had an assistant, and sometimes used an additional helper.

The position of product engineer was the logical outcome of the product specific work that the laboratory had done since the formation of Thomas A. Edison, Inc. in 1911. Each engineer was attached to a specific product and was directed to improve it and perfect its manufacture. The emphasis on manufacturing and marketing was reflected in the job description which was classified under experiments, development, manufacture, and sales. Although a member of the laboratory staff under the supervision of the chief engineer, he was expected to remain in close contact with the manufacturing and sales departments who often initiated his work. His experimental work had to be "one jump ahead of the Sales Department."[275]

W. Telfair. Telfair was Holland's assistant, who concentrated on the production aspects of the new designs and dealt with the Phonograph Works. He went on to become product engineer for the cylinder record around 1918.

John Constable. John Constable replaced Miller Reese Hutchison as chief engineer in 1918. Although Hutchison probably used an office on the second floor, when Constable became chief engineer, his office was located on the third floor.

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[272] Frank L. Dyer to Nelson C. Durand, March 26, 1907, National Phonograph Company Records, Commercial Department.

[273] Newman Holland to Nelson C. Durand, February 10, 1910 (in DF 1910, WOL--Employees).

[274] MRH to TAE, October 29, 1912 (in DF 1912, WOL--General).

[275] John P. Constable to "The Product Engineers [of which there were eight]," [Copies were also sent to Charles Edison and other executives.] Engineering Department Records, Box 5, Laboratory binder.

Constable worked on designing phonographs and working out the steps of their mass production. He did not have the same close relationship with Edison enjoyed by Hutchison. Hutchison thought that the job of chief engineer had evolved from engineering and experimental work to primarily clerical and administrative tasks, complaining that it "seems to resolve itself into issuing engineering notices on screws, nuts, bolts, gears, etc."[276]

During his tenure as chief engineer, Constable fought an unsuccessful battle against the steady erosion of his power and his independence of action.[277] He was dismissed at the end of 1920.

W. H. Harvey. A testing department had been created around 1914 to carry out neutral tests, which were supposed to be the unbiased evaluation of a piece of work by someone who had no connection to it. This department grew into the Engineering Test Service department.[278]

W.H. Harvey was the first director of the new Engineering Service department. The Engineering Test Service department functioned as a testing facility for amusement and business phonographs, records, and diamond points. He had an assistant and a staff of nine people. F.S. Povah had replaced him by 1918. This department had a heavy work load which probably justified this large staff through the mid-1920s.

A. M. Kennedy. Kennedy graduated from the Alabama Polytechnic with a degree in electrical engineering. At the time he was hired by Edison he was chief engineer for the American Talking Picture Company of New York. His expertise was soon applied at the West Orange laboratory where he was quickly placed in control of kinetophone filming: "I certainly wasted a lot of the old man's money making rotten pictures at first."[279] Kennedy developed improvements to kinetophones, film projectors, and film cans. He experimented with film lighting. In 1917 he went with Edison to Long island to carry out anti-submarine experiments and left his employ soon after.[280]

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[276] MRH to TAE, November 5, 1913 (in DF 1913, WOL--General).

[277] See his history of the Engineering Department, undated and unauthorized, in DF 1919, Thomas A. Edison, Inc.

[278] Memo in DF 1918, WOL--Experimental Work; Monthly Record of Reports, Engineering test Service department, in DF 1918, WOL--Experimental Work.

[279] Recollections, A.M. Kennedy Papers, University of Alabama at Tuscaloosa Special Collections.

[280] Ibid.; see Laboratory notes.

Walter Holland. Holland began his Edison career in November 1902 at age 18, working in the testing laboratory of the Edison Storage Battery Company in Glen Ridge, New Jersey. On the recommendation of Aylsworth, Holland was transferred to the West Orange laboratory, in charge of the battery research and testing operations in 1904. Holland held this position until 1911 when he was appointed chief electrician of the Edison Storage Battery Company and moved to the new factory building.[281] The 1910 payrolls show that Holland was assisted by two helpers, one noted as a boy.[282]

The small cell test department replaced the lamp testing room. It was probably staffed by boys or young men, judging by the photographs and Edison's practice of using this kind of cheap labor for repetitive testing. In 1904, he reported 12 testers in November and 18 "men and boys" in December in the test department.[283] Once the battery problems had been solved this department settled down to routine testing.

There were also various other experimental rooms created on the third floor. In 1914 Edison sent a memo to his assistant Sam Moore and another experimenter called Nehr, instructing them to "decide together what part of [the] 3rd floor you want" and set up their experiments there. In the same memo he said he did not want any more partitions, a sentiment reflected in a Hutchison memo when he noted that Edison was against the idea of private rooms.[284] But private experimental rooms and partitions remained at the laboratory.

The experimenters Greenley and Lancaster had a room on the third floor in addition to their benches in Building 2. They worked in great secret in Building 5 on cobalt batteries.[285]

Alexander N. Pierman. Alexander N. Pierman's first Edison employment began in 1889 in the Edison Phonograph Works, a job which lasted until 1895. Following an absence of a few years, he returned to work in the laboratory itself in 1901 and engaged in experimental work until 1914.[286] From 1910 to 1914

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[281] Edison NHS Card Catalog.

[282] Employee Records, Laboratory Payroll Time Sheets, Box 73.

[283] TAE to Sigmund Bergmann, November 29, 1904, Letterbook 71, pp. 169-70 (LB071169); TAE to Sigmund Bergmann, December 28, 1904, Letterbook 71, pp. 220-21 (LB071220).

[284] TAE to Moore and Nehr, [1914] (in DF 1914, WOL--Fire).

[285] W. A. Campbell to Walter E. Kreusi, June 1, 1949, Edison Pioneers Records, Box 21.

[286] Edison Pioneers Records, Box 27.

Pierman's work was billed in the accounts as musical experiments. He carried out experiments on phonograph records and also worked in Building 2. He developed a method of electroplating masters with silver and copper and also produced an "air" reproducer which used compressed air to increase the volume of phonograph playback.[287] His work on recording the sound of the piano must certainly have taken place on the third floor of Building 5.[288]

By 1920, four experimenters were at work on the third floor: Mr. Harris, Mr. Samuels, Mr. Cummings, and Mr. Huenlich. Harris worked on phonograph governor development, and Samuels on electrical instrument repair and standardization. Cummings unpacked, tested and examined eight disc phonographs from the Silver Lake plant each week and reported his findings to factory inspectors. He was supervised by Harris, as was Huenlich, who inspected Ediphones.[289]

Bill Lyman. Lyman ran a small studio and dark room during the period after 1900. The department was kept busy making prints of machines and products for advertising purposes and meeting the insatiable public appetite for images of Thomas Edison. His printing operation may have moved to Building 1 in 1914, when Edison approved his taking over Dr. Greene's former room in the "Galvanometer Room."[290]

Joseph Whelan. Whelan began working for Edison in 1902 and became the laboratory photographer around 1915.[291] He worked at the laboratory until the 1930s.[292] (See p. 167 for more on Joseph Whelan.)

Through the early part of the twentieth century, the photographic studio was kept busy making photographs of the Edison plant and products; it also handled the

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[287] P. Weber to [?] Gilmore, April 3, 1902, Record Manufacturing Division Records, Box 15; Memorandum of Frank L. Dyer, January 6, 1909, Record Manufacturing Division Records, Box 16.

[288] William H. Meadowcroft to Edison, March 29, 1912 (in DF 1912, Phonograph--General, 4 of 5).

[289] "Report of Work Done in the Laboratory," John P. Constable to TAE, October 23, 1920, Engineering Department Records, Box 11, T. A. Edison folder.

[290] MRH to TAE, January 12, 1914 (in DF 1914, WOL--Photograph Department).

[291] Norman R. Speiden interview, June 6, 1973, Oral History Project, pp. 30-31; see also NPS, "HSR, Part I, Metallurgical Laboratory, Building No. 4," p. 4.

[292] Norman R. Speiden, "Plan of Action in the Project to Care for the Laboratory Group," June 28, 1939, Records of Historical Research Department, Thomas A. Edison, Inc. (hereafter cited as Historical Research Dept.).

continued demand from the general public for images of Thomas Edison. In 1918 this department consisted of Louis Lueder and a boy.[293]

Clarence Hayes. Clarence Hayes may have been the only individual of native American descent to hold a position of prominence in the Edison laboratory: his mother was a pure-blooded Mohawk and his father half Scottish and half French. Hayes first worked for Edison about 1912 when he was engaged, along with others, to sing through an enormous repertoire of sheet music for Edison's edification. He was then given the tasks of indexing music and then of reviewing recordings. By the end of 1918 Hayes estimated he had listened to 4,000 trial records of new artists as well as 4,000 regular releases.[294]

Hayes was in charge of the music room. The old recording studio established by Wangemann and others was replaced by other experimental rooms in Building 4 and a commercial studio in New York City. There was still a need at the laboratory to review recordings, arrange music and listen to potential recording artists. This was the function of the music room.

Hayes acted as a liaison between the experimenters developing new recording equipment, the recording engineers in the studio and the artistic community. He was also a sort of talent scout for new artists. He prepared the lists of the new Edison recordings, which were the official records used in compiling record catalogues. The Recording Committee, who judged the quality and commercial appeal of new Edison recordings, probably met in the music room.

Hayes had a staff of two or three clerical assistants, usually young women (figure 143). A 1920 payroll indicates two women worked as musicians in the laboratory. There was also a female clerk in the music room.[295] Hayes left Edison's employ sometime in the 1920s.

The phonograph test room was established close to, or within, the music room to test machines and records. It was staffed by young men who did fairly difficult work. Meadowcroft wrote to Edison that "the boy upstairs" found no wear on the diamond tip of a stylus after repeated plays.[296] Edison told Fred Ott that "the

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[293] "Functions of Present Laboratory Organization," September 24, 1919 (in DF 1919, Thomas A. Edison, Inc.--Organization).

[294] *Edison Diamond Points*, December 1918, p. 12.

[295] "Thomas A. Edison Laboratory - Payroll Comparison's [sic]," December 14, 1920, D-Box Collections - Box D10 - West Orange.

[296] William H. Meadowcroft to TAE, September 1, 1911 (in DF 1911, WOL--Meadowcroft's Reports).

little boy testing records" could be kept busy testing new recordings and doing odd jobs.[297]

There are hints in the laboratory correspondence that point to Edison's involvement in this testing and his subsequent use of a room on the third floor. In 1912, a newspaper article reported him on the third floor of the laboratory, in a small room "roughly boarded off" from a big room (presumably the music room) where he was testing records.[298] There are also several photographs showing him listening to disc phonographs, presumably in or near the music room.[299]

The activities of the test and music rooms filled the third floor of Building 5 with the sounds of music. Dyer and Martin commented that a visitor to this area "hears from all sides the sounds of vocal and instrumental music constantly varying in volume and timbre."[300] The third floor also housed several offices for business administration of the laboratory and for those attending to Edison's private correspondence.

R. W. Kellow. One of Edison's personal secretaries, Kellow had an office on this floor. Kellow began his career at the laboratory as secretary to Charles Edison's assistant, George E. Clark, around 1917. He eventually became an office manager in charge of several of Edison's "personal undertakings, such as Chemical Plants."[301]

Harry F. Miller. Miller acted as treasurer of Edison's business enterprise. He joined the laboratory as an assistant to Edison's secretary John Randolph.[302] He began as an "office boy, clerk, etc...." assisting Randolph from 1888 through 1896.[303] After Randolph died in 1908, Miller became Edison's primary personal secretary.

According to the 1910 version of Dyer and Martin's biography of Edison, Miller was Edison's personal secretary, operating from an office on the third floor, "where

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297 TAE to Fred Ott, August 1, 1911 (in DF 1911, Battery, Storage, 2 of 2).

298 *Milwaukee Sentinel*, September 8, 1912 (in DF 1912, Phonograph).

299 Figure 139; Album 10, catalog 5209.

300 Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 651.

301 Stephen B. Mambert to Mullin Wayne, March 28, 1923, Biographical Collection.

302 Edison Pioneers Records, Box 26.

303 Edison Pioneers questionnaire, Edison Pioneers Records, Box 26.

all [Edison's] personal correspondence and business affairs are conducted...."[304] In a questionnaire circulated by the Edison Pioneers, Miller states that he served as Edison's secretary from 1908 to 1917.[305]

Women. The laboratory payroll records indicate that women were employed at the laboratory in the first decade of its operation. They were employed as stenographers, such as Miss Mandeville (1893), and musicians, such as Katie Lonagen. The musicians worked on the third floor in the recording studio or music room. The location of the stenographers is unknown; there were offices requiring their services on all three floors by 1900.

Several photographs show women at work in the music room in 1917. In the payroll for 1912, a Louise Carlin appears in August but disappears soon after. No job title is given.[306] In September that year, a Miss Emily Sieder wrote to Hutchison complaining about the lack of toilet facilities for women in the laboratory. She worked as a stenographer, perhaps in the music room or for Harry Miller. She also noted that there were "lady visitors" to the laboratory, who probably went to the music room to either listen to or play music.[307]

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[304] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 651. In 1914 Miller was still working on the third floor, see "Laboratory Fire Department Rules," in DF 1914, WOL--Fire.

[305] Edison Pioneers questionnaire, Edison Pioneers Records, Box 26.

[306] Employee Records, Edison Laboratory Time Sheets, Box 83.

[307] Emily Sieder to MRH, September 19, 1912 (in DF 1912, WOL--Personnel). Hutchison figured it would cost $100 to build a ladies toilet and wrote to Edison: "The alternative is to get a male stenographer in her place and exclude lady visitors, or put in a toilet. Which?" Edison's reply asked Hutchison where a ladies' toilet could be built. MRH to TAE and TAE annotation, September 17, 1912 (in DF 1912, WOL--Personnel).

Building 6

The payroll for February 1890 lists two engineers and two firemen employed at the West Orange laboratory.[308] Around 1910, the power house was occupied by Jeff Jacobs, the engineer. Laverty reported that "old Jeff...had two men under him as firemen taking care of the boilers, etc. Jeff had charge of the plumbing and steam fitting."[309]

William Drees. An employee of Edison General Electric, Drees worked in the dynamo room wiring equipment and winding armatures.[310]

EVIDENCE OF ROOM USE AND FURNISHINGS

Period Summaries

Period I: 1887-1900. The ore milling project and the onset of a serious economic depression are the two influential forces in the history of the laboratory during this period. The early to mid-1890s were a time of cutbacks in experiments and construction after the excesses of the late 1880s. Many experimental projects were terminated at the end of the 1880s because the Edison enterprise was suffering financial problems.[311] Income from contract research declined at the beginning of the 1890s as the depression forced reductions in the research budgets of Edison's customers. The huge outlays on the ore milling project served to increase the laboratory's financial difficulties. Experimental work on the phonograph was cut back and only the cylinder reproduction project was maintained through the 1890s. In 1896 when the depression seemed to be lifting, more attention was given to developing a commercial phonograph.

By the end of the nineteenth century Edison began to realize that his ore milling project was not going to be the great success he had hoped for. Experimental work was reduced in the last years of the century and production of ore stopped in 1900. The end of the disastrous ore milling project forms a watershed in the history of the laboratory. By 1900 Edison had returned to the West Orange laboratory for good after spending much of the previous decade in various mines

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[308] Payroll for the week ending February 6, 1890 (in DF 1890, WOL--General, D-90-64).

[309] Historian's Note 90.

[310] Edison Pioneers Records, Box 21.

[311] "Laboratory of T.A. Edison, Journal No. 5," (January 1888-June 1890), p. 147. This volume is in the Account Books Records at Edison NHS.

and the ore milling plant he had built in the mountains of New Jersey. In 1901 Edison began to close his ore milling plants and look for new products to revitalize his finances in the twentieth century.

Period II: 1901-1914. This period marked the resurgence of the Edison laboratory after the economic downturn of the 1890s. The phonograph business finally began to meet Edison's expectations and the yearly income of over a million dollars that came from the phonograph supported a massive program of expansion at the West Orange site.

Edison went on a building spree that added many new buildings to the plant site: an administration building, a new building to make records (Building 24), enlargements to the Phonograph Works, and a completely new set of storage battery factories across the road from the laboratory.

While the exterior fabric of the six main laboratory buildings was not significantly changed, there was a continual program of alterations within these buildings. The rise to power of Miller Reese Hutchison led to several structural changes intended to improve the efficiency of the laboratory.

The site was also changed to accommodate two major new product lines: the diamond disc and the storage battery. These two experimental projects were the most arduous and the most expensive ever mounted at this or any other Edison laboratory. Both ran into millions of dollars of experimental expenses. A great deal of new equipment was imported or made up in the laboratory in the development programs.

Period III: 1915-1931. The coming of World War I brought new challenges and significant changes to the Edison enterprise. New products were manufactured, new contract research initiated, and many new employees came to the site. Like every other major manufacturing concern in the United States, Thomas A. Edison Inc. put its production and experimental facilities at the disposal of the government.

Edison was away from the site for much of the duration of America's involvement in the war. He was participating in the desperate search to find a solution to the U-boat problem. This was an experimental project of some irony, for Edison had done his best to advance the submarine threat by producing his special alkaline submarine batteries in the years before the war. The development of the modern submarine owed everything to electrical propulsion and its storage batteries.[312] Now Edison sought a way to find and destroy submarines.

While Edison was away his laboratory concentrated on devising manufacturing programs for the numerous war goods that Thomas A. Edison, Inc. had agreed to manufacture: gas masks, bomb sights, and electrical equipment. Although Secretary of the Navy Daniels had talked about applying Edison's "magnificent facilities" at West Orange to the war effort, the work done in the laboratory was more a case of arranging the manufacturing of a specified part than experimenting to come up with a new or better product.[313] This was routine engineering work.

After the war was over, a short-lived economic boom began; the West Orange laboratory applied itself to improving the large Edison product line and to reducing manufacturing costs. The only new experimental project of any importance was the attempt to convert Edison's alkaline battery to an automobile starter battery--a project doomed to failure because his battery did not have the power required to turn the engine over. Many Edison batteries were sold for use in electric delivery trucks, although not as many as Edison would have liked; his dream of powering millions of electric automobiles was never realized.

The automobile was still one of Edison's great loves and his laboratory was full of them. He maintained his own collection in the garage between Buildings 1 and 2, test rigs in a converted Building 6, and various machines in the courtyard.

Although the 1920s were boom years for much of American industry, they were years of depression and retrenchment at West Orange. The core phonograph business was in a great deal of trouble and Edison missed the boat on both the new popular dance music and new methods of electrical recording and amplification. While the project to improve the acoustic phonograph in the 1880s had taken up the bulk of the experimental facilities of the West Orange laboratory, electrical recording experiments were carried out in Building 1 by the product engineers of the business phonograph. No attempt was made to transfer

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[312] Edison was extremely enthusiastic about the potential of storage batteries for submarine usage and Edison's alkaline storage battery was an ideal power source for submarines. The disastrous explosion of the US Navy's submarine E2 may have prevented the wide adoption of Edison storage batteries for submarine use. See TAE to Franklin D. Roosevelt [Acting Secretary of the Navy], September 10, 1915 (in DF 1915, World War I).

[313] Josephus Daniels [Secretary of the Navy] to TAE, July 7, 1915, Naval Consulting Board Records, Box 1.

this knowledge to the amusement phonograph because Edison was firmly opposed to electrical recording.

The project to find a domestic source of rubber gained a great deal of publicity but was not a commercial endeavor. Its basic function was to keep an elderly inventor happy and occupied during the last years of his life.

Edison's active managerial role decreased as the 1920s progressed. In 1926 Edison's son, Charles, became president of Thomas A. Edison, Incorporated. Three years later he agreed to sell his West Orange laboratory to Thomas A. Edison, Inc. for the "book value" of $165,000 for the land, premises and contents. This transaction took place on May 1, 1930. The laboratory was described as "operated by Mr. Edison for experimental and development work."[314]

Building 1, Period I: 1887-1900

Electrical equipment was brought to this building from Edison's temporary laboratory at the Edison Lamp Company in Harrison, New Jersey. The impressive list of measuring equipment brought to the laboratory in December 1887 is testament to the importance of electrical experiments to Edison and his business empire at this time. Numerous types of galvanometers were installed in this building: universal, tangent, single coil, double coil, sine tangent, single ring, dansonial, gaugain, Siemens sine and a couple of "deadbeat" galvanometers.[315] The latter was a galvanometer of unique design developed at the Edison laboratory.[316]

Other measuring equipment installed in Building 1 included ammeters, voltmeters, manometers, thermometers, photometers, dynometers, and tachometers. Experimental equipment included a radiophone, phosphoroscope, tachograph, and photophome.[317]

A photograph taken by W.K.L. Dickson between 1888 and 1892 provides us with a look inside this building (figure 6). The six brick piers on the west side are covered with electrical equipment, including galvanometers. Several batteries are placed near and on the piers and several sit on a workbench placed in the middle of the line of piers. There is a workbench and two large storage cabinets on the

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[314] Minutes of the Board of Directors, Thomas A. Edison Inc., May 1, 1930, vol. 8, p. 97.

[315] Notebook N-87-12-19. At least two deadbeat galvanometers are mentioned in the notebook lists.

[316] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, pp. 181-82.

[317] Notebook N-87-11-9.

east side, the bench and smaller cabinet next to the two concrete floor slabs, and the larger cabinet abutting the south wall.

The front part of this building, near the main entrance, cannot be seen clearly in this picture. Although the front door is visible, it is not possible to gauge the dimensions of the two offices that Fessenden claims were on either side of the aisle. Fessenden's sketch map of the laboratory as it appeared around 1888, drawn from memory many years later, clearly shows the division of the front of this building into two halves, possibly experimental rooms or office space.[318]

This building was called the "Galvanometer Room" by Edison and his men. Although much of the equipment on the piers is related to electrical measurement, the work of this laboratory extended beyond measurement and testing. The notebooks of Arthur Kennelly and the shop orders executed by his department indicate a great deal of construction: motors, dynamos, alternators, transformers, meters, switches, and experimental apparatus were built for Edison.[319] This laboratory provided some of the most significant advances in electrical supply technology in the 1880s and 1890s.

By the same measure, the sheer amount of electrical testing contracted by Edison forced him to carry out some of this work outside of the galvanometer room. A special rack and control panel was devised to evaluate the performance of incandescent bulbs; it was probably laid out in Building 1. This equipment was later installed on the third floor of Building 5 in what was called the lamp testing room.

Building 1, Period II: 1901-1914

Dyer and Martin describe Building 1 as it appeared in 1910:

> In order to provide rigid resting-places for the numerous and elaborate instruments [Edison] had purchased...the building was equipped along three-quarters of its length with solid pillars, or tables, of brick set deep in the earth. These were built up to a height of about two and a half feet, and each was surmounted with a single heavy slab of black marble. A cement floor was laid, and every precaution was taken to render the building free from all magnetic influences, so that it would be suitable for electrical work of the utmost accuracy and precision. Hence, iron and steel were entirely eliminated in its construction, copper being used for fixtures for steam and water piping, and indeed, for all other purposes where metal was employed...Unfortunately, however, for the continued success of Edison's elaborate

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318 Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925), p. 156.

319 Notebook N-87-11-24.

plans, he had not been many years established in the laboratory before a trolley road through West Orange was projected and built, the line passing in front of the plant and within seventy-five feet of the galvanometer-room, thus making it practically impossible to use it for the delicate purposes for which it was originally intended.

For some time past it has been used for photography and some special experiments on motion pictures, as well as for demonstrations connected with physical research; but some reminders of its old-time glory still remain in evidence. In lofty and capacious glass-enclosed cabinets, in company with numerous models of Edison's inventions, repose many of the costly and elaborate instruments rendered useless by the ubiquitous trolley. Instruments are all about, on walls, tables, and shelves; the photometer is covered up; induction coils of various capacities, with other electrical paraphernalia, lie around, almost as if the experimenter were absent for a few days but would soon return and resume his work.[320]

With the decline of electrical experiments at the laboratory, most of the expensive measuring equipment was no longer in use and much of this building was converted to storage. Offices for experimenters were established in the front part of the building, which was divided from the main room. The staff of this laboratory carried out their experiments on the pier tables on the west side of the building (figure 7).

The open space in the middle of the building was left open until some time after 1906 when offices were created along the east side of the main room. As these were experimental rooms, they could have been quickly erected from wood panels. Around 1912, Newman Holland and his assistant moved into this building to continue their development of the dictating machine.[321] Figure 8, taken in February 1915, shows that a room was also partitioned off on the west side of the building, containing two of the pier tables (see schematic plan 1). By 1915, the experimenters were installed in this partitioned room and their equipment can be seen on the pier tables (see figure 8).

This room did not last long: a photograph taken in September 1915 (figure 9) shows the same two pier tables without the partitions. This image shows Newman Holland at work on his pier table and the line of offices on the east side of the building.[322]

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[320] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 652-53.

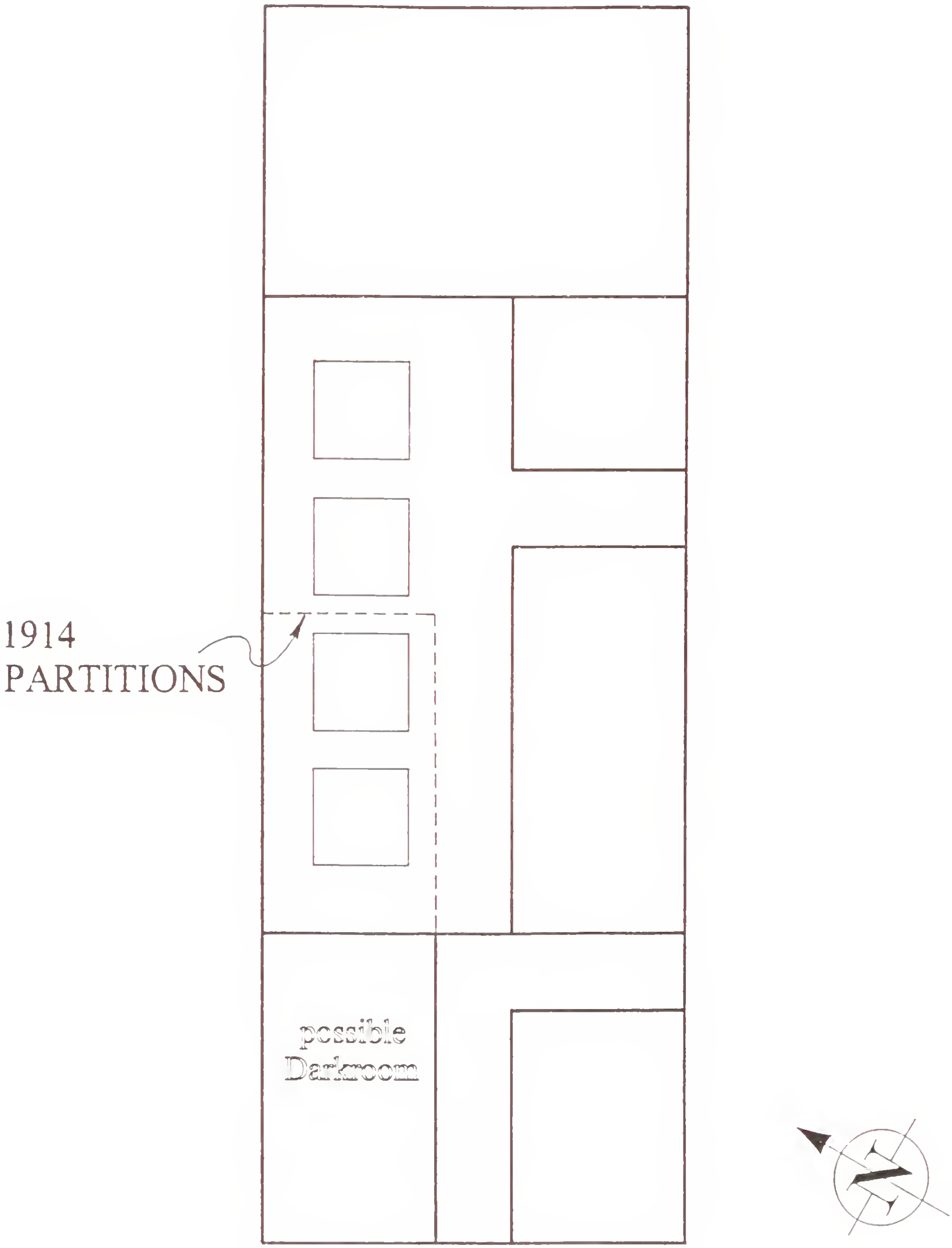
[321] MRH to TAE, October 29, 1912 (in DF 1912, WOL--General).

[322] National Park Service, "Historic Structures Report, Physics Laboratory, Building 1," nd, no title page, first page starts with historical data section, pp. 6-7, appendix 2, drawing no. 2.

Schematic Plan 1

BUILDING 1, 1914-1915

(not to scale)



In 1911 a darkroom was installed in Building 1; it may have contained facilities to make prints of motion pictures.[323] This darkroom was either in the front room on the west side or in one of the experimental rooms along the east side of the main room. Close to it was a room occupied by Dr. Greene for photographic experiments from 1910 to 1914 (see p. 37 for more on W.C. Greene). After 1914 it was still referred to as "Greene's room," and these offices were collectively known as the photographic department. This department was enlarged in 1914 to handle the overflow of photographic work from the rooms on the third floor of Building 5.[324]

The beginning of the Edison educational films project, under the direction of Walter Dinwiddie, brought more changes to Building 1 as more space was devoted to photographic work and filming. In 1912 an "electrical repair room," which was probably in this building, was dismantled to make way for educational films.[325] It could have been the space at the south end of the main room in which Selden Warner worked.

A foundry was erected "in the rear" of this building to produce copper for disc master plating.[326] The foundry is pictured in figure 10 for which no reliable date has been established. Based on 1912 photographic evidence, the foundry was likely constructed after 1912 and sometime in the late 1910s or early 1920s.[327]

In 1912 a fireproof building to hold film stock was erected outside the east wall of the building. It was described by Hutchison as a "fireproof vault for school film" and was made of poured concrete. It is now known as Vault 8.[328]

Building 1, Period III: 1915-1931

During this period Building 1 was again a general experimental and office area that handled the overflow from other experimental facilities. The interior of the

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[323] Shop Order 3612 (1911), Notebook N-09-01-29.

[324] MRH to TAE, January 12, 1914 (in DF 1914, WOL--Photographic Department).

[325] Donald M. Bliss to W.E. Greene, May 10, 1912 (in DF 1912, Motion Pictures--Kinetograph).

[326] Historian's Note 128, which contains recollections of Paul B. Kasakove, "Electroplating Process for Disc Record Moulds."

[327] Information obtained from Edison NHS Cultural Landscape Report (draft, August 1993).

[328] Photograph Album 10, catalog 5209, p. 112 (this album originally belonged to Miller Reese Hutchison); see also National Park Service, "Historic Structures Report-Part I, Small Storage Vault, Building No. 8," prepared by Melvin J. Weig, Arthur Spiegler, and Norman Souder, 1965, pp. 3-4.

main room in the middle of the building was dominated by the line of pier tables on the west, and offices and experimental rooms on the east side. The boundaries of this space were the two offices at the front of the building and a partition erected across the north end to create offices in the rear. The partition was faced with large display cabinets with glass doors. These extended from the floor to the tops of the windows and the space above them appears to have been used as storage.[329] This partition cut off two pier tables from the main room and housed an enclosed office on the east side (see schematic plan 2).

The open space and pier tables on the west side of the building were devoted to electrical and acoustic experiments related to the business phonograph. This would have been what the staff called "Holland's lab," where Newman Holland developed new types of dictating machines. As this product stayed viable while the amusement phonograph went into a decline, it justified a continuing experimental program. Although Holland spent much of his time in an office on the third floor of Building 5, it appears that he still experimented here during this period.

A photograph taken in 1915 shows Holland at work in Building 1 (figure 9). The piers have wooden cabinets and pigeon holes placed on them. The counter on the west wall is also crowded with equipment.

By 1916, Stephen Mambert held the position of financial executive of Thomas A. Edison, Inc., and his offices were located in Building 1. He left Edison's employment in 1924, but it is not known whether he continued to work in Building 1 until that time (see p. 38 for more on Stephen Mambert's career).

While Edison was certainly not enthusiastic about the new technology of radio and electric amplification, many of his laboratory staff were and they acquired and experimented on several of the new devices that appeared after World War I.[330] As the business phonograph was the only part of the Edison product line to incorporate electrical amplification, the likely place to carry on these experiments was Building 1. In 1930 all radio equipment and experiments were transferred to a new building in the Phonograph Works.[331]

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329 Photograph no. 14.720/1, neg. no. 5587, taken between 1917 and 1919, not reproduced in this report.

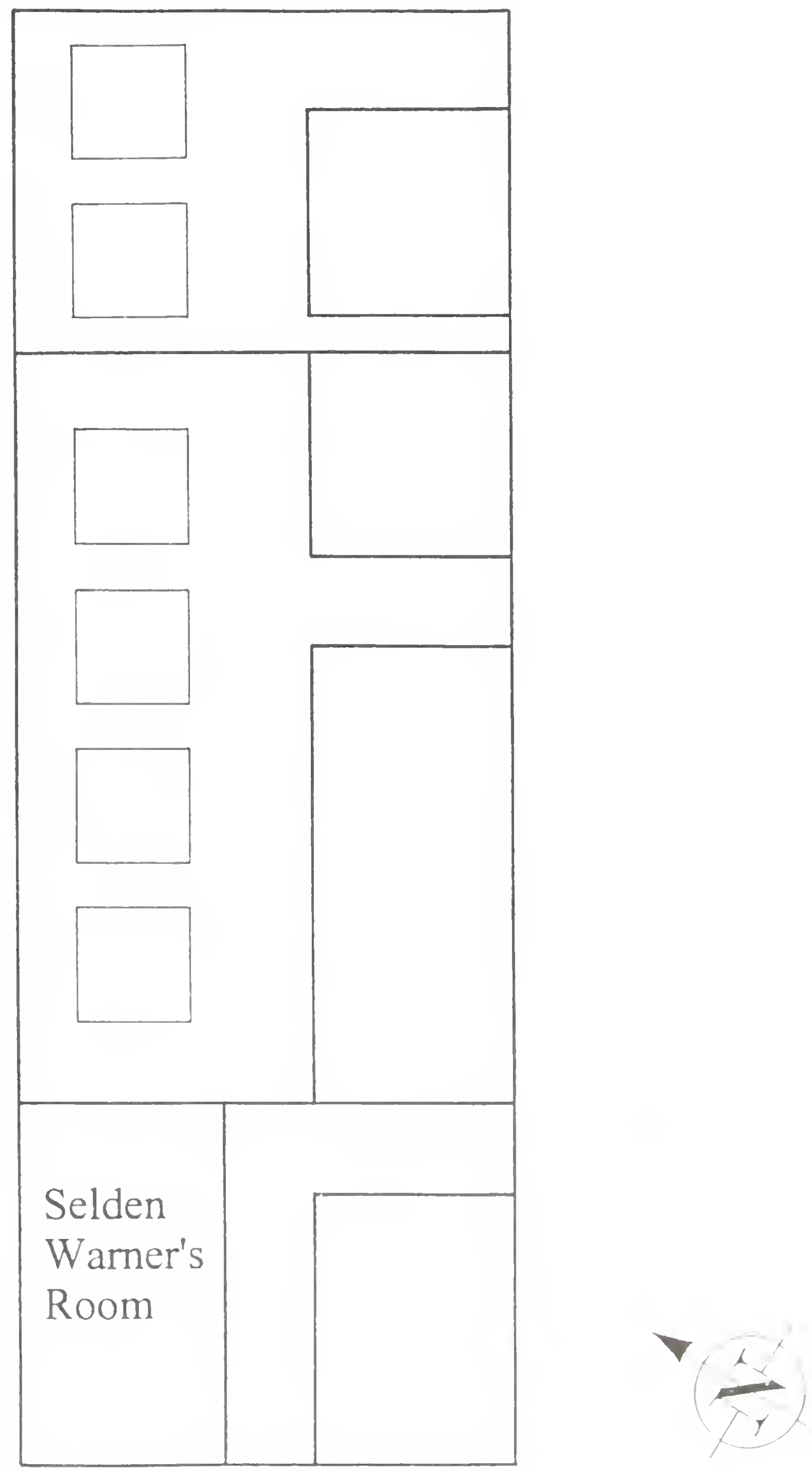
330 Letter of J.P. Constable, May 13, 1919 (in DF 1919, WOL--General).

331 Minutes of the Board of Directors, Thomas A. Edison, Inc., April 14, 1930, vol. 8, p. 89.

Schematic Plan 2

BUILDING 1, 1917

(not to scale)



The two small rooms at either side of the main entrance were also changed to suit new experimental projects. They were not similar in shape for the west side office was larger and extended up to the partition. During the war they were equipped to carry out experiments on hydrogen testing apparatus (to measure the gas in the interior of submarines) and on depth sounding equipment. This was carried out by Selden Warner in the small laboratory in the room on the west side of the building.[332] This room had once housed photographic equipment and remnants can be seen in the photographs (figure 11). Spieden called it a "chemical room and photographic dark room." It contained a sink at the north end and a counter top and shelves running along the east side.

After the war, Selden Warner continued to work in this room. He left Edison's employ in 1921 (see p. 39 for more on Selden Warner). This room was eventually taken over by Theodore Edison and was called "Theodore's room." A photograph taken in 1939 shows little structural change and the addition of numerous bottles of chemicals and a balance (figure 13). In the 1930s this room was designated as a chemical laboratory.[333]

The end of World War I work brought changes to this building as government research contracts were terminated. A 1918 plan indicates a total remodelling of Building 1. The plan divides Building 1 into a main room and a disc record celluloid room, about one-third the size of the main room.[334] No experimental rooms are described. The use of the term celluloid is puzzling because this material was not used in the production of Edison discs, only for Blue Amberol records which were cylinders. Perhaps this room was used for temporary production of Blue Amberol records after the war and there was a mistake in its description on this document. On the other hand the term celluloid might have been loosely used to cover all types of recording material. In that case this room could have been employed in the production of discs. A final possibility is that Edison took celluloid more seriously as a recording medium than has previously been believed.

In 1919 this building was used to develop electrical systems for use in Ford Model T automobiles. This included converting the alkaline storage battery to

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332 NPS, "HSR, Edison NHS, Building 1," pp. 7-8. Warner also worked on sound ranging equipment and assisted with the miner's safety cap lamp.

333 "Classification of Buildings-Historical Dept," July 21, 1939, Historical Research Dept., containing reports and correspondence relating to the History of the Edison Laboratory from 1935 to 1949. The reports and correspondence were generated from 1935 through 1949. This listing included all buildings being converted to historical/museum use. Interior spaces were divided into sections and subsections.

334 "Thomas A. Edison Personal--Floor Areas Laboratory Building," November 25, 1918, in DF 1918, WOL-General.

automobile use and developing an electrical generator and starter. This project led to the dismantling of the line of experimental rooms on the east side of the building. The brick pier tables were probably taken out in 1923/24 during these experiments.[335] The large open space was filled with experimental tables, machine tools (mainly drill presses and hydraulic presses), and battery testing apparatus. The latter occupied long wooden tables which ran along the center of the room (figure 14).[336] (See schematic plan 3.) The two rooms in the rear of this building were also used in this project. The room on the west side was used for battery testing and remained equipped for this function during the 1930s.[337]

The sorry state of Edison's phonograph business during the late 1920s finally forced him to enter the era of electrical recording and reproduction. Theodore Edison was in charge of developing the Western Electric technology and applying it to Edison phonographs. By the end of the decade Thomas A. Edison, Inc. was manufacturing a line of the new "electric" talking machines with several radio-phonograph combinations. This development work was led by Theodore Edison and probably took place in Building 1 in his laboratory in the front office (see p. 40 for more on Theodore Edison).

Throughout this period Building 1 remained a store room for many electrical measuring instruments and other valuable apparatus related to the early days of the West Orange laboratory. A large cabinet with double glass doors and numerous shelves was probably used for this purpose. Many instruments stored in Building 1 were later stored on the third floor of Building 5 prior to their removal to the Henry Ford Museum in Dearborn, Michigan.[338]

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[335] NPS, "HSR, Edison NHS, Building 1," p. 9.

[336] Photographs 12.440/71 through 12.440/76, neg. nos. 8067-8072 (not reproduced in this report), taken September 1939. Photo no. 12.440/75, neg. no. 8071, is reproduced in this report as figure 14.

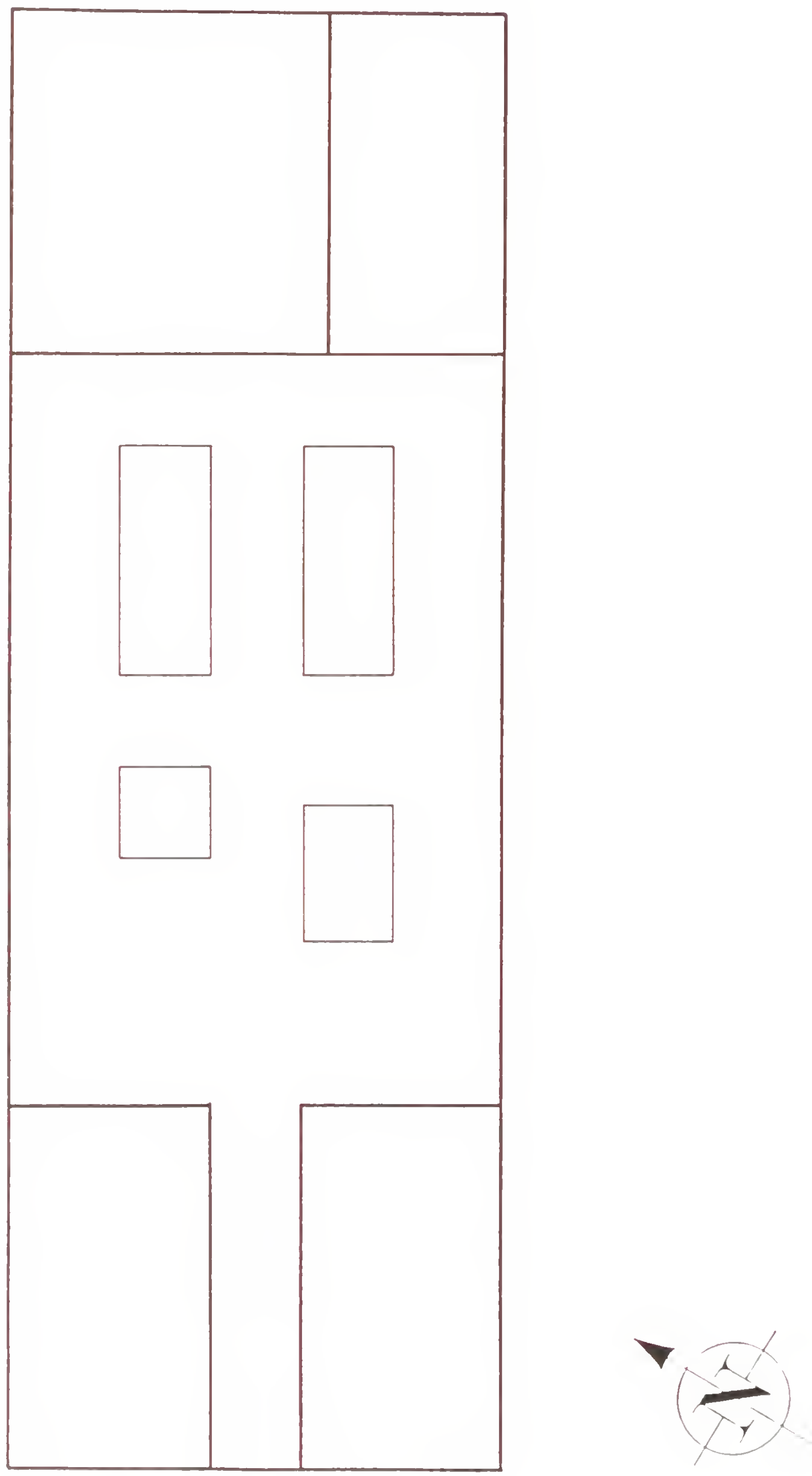
[337] "Classification of Buildings," June 13, 1939, Historical Department Records.

[338] NPS, "HSR, Edison NHS, Building 1," p. 8.

Schematic Plan 3

BUILDING 1, c. 1929

(not to scale)



Building 2, Period I: 1887-1900

Although the drawings produced by the architect Taft indicate that Building 2 was divided into two spaces, the plan produced by Fessenden shows it divided into three equal parts.[339] Note that this map was drawn long after Fessenden's departure from the laboratory, and the evidence it provides should be used cautiously. Figure 16, a photograph by W.K.L. Dickson, clearly shows the wooden dividing wall between the main part of this building and the back room (at the north end). The rear room might have been a private experimental room for Edison--something he was determined to have in his new laboratory--or it might have been reserved for measuring equipment. The Dickson photograph does not show any balances in that room, but it does show a vacuum pump which was probably associated with experiments on incandescent bulbs or the development of electroplating techniques--in a vacuum--for records.

The interior of Building 2 was much different from the building we now associate with chemical experiments. Two large racks of chemicals, which must have been over six feet high, are joined together to form a chemical store at the north end of the main room (figure 16). The walls in both rooms are bare brick and there is no indication of any wall cabinets for chemicals. During this period the walls between the front and back room, now called the balance room, were sheathed with wood panels (figure 17).[340]

The work of this laboratory in the 1880s was centered on two projects: insulation for electric wires and the cylinder record for phonographs. The insulation project was part of Edison's electrical research and was transferred from his temporary laboratory at Harrison to West Orange as soon as the new laboratory opened. It encompassed the mixing, heating, and electrical testing of numerous combinations of chemicals. It would have required facilities to heat up numerous batches of heavy tars and resins and electrical apparatus to measure conductivity. The requirement of fireproofing meant that each batch had to be tested for heat resistance and this dangerous exercise would best be attempted under an extractor hood. Despite the efforts of many experimenters, it was difficult to meet the requirements of a cheap, non-conducting, waterproof and fireproof insulation.[341]

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[339] Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925), p. 156.

[340] NPS, "HSR-Part I, Chemical Laboratory, Building 2, Edison NHS," pp. 5-6.

[341] See correspondence among TAE, Samuel Insull, and Alfred O. Tate, May through July 1888 in DF 1888, Electric Light--Edison Machine Works, D-88-35.

Experiments on the composition of the wax cylinder for the Edison phonograph began as soon as the West Orange laboratory opened and continued into the twentieth century. The first commercial solution was based on stearic acid and its salt, sodium stearate, a common fatty acid used in the manufacture of soap and candles. The mixture was heated to about 480°F and then filtered through fine muslin. On cooling, it congealed into a thick molten wax into which metal forms were dipped to make cylinders.[342]

The smallest crack or bubble in the wax compound--small enough to be invisible to the eye--caused a crackle that could be distinctly heard as the record played. The wax was also sensitive to heat: high temperatures caused softening and low temperatures made the cylinder brittle and liable to crack. Much of the work on the wax cylinder was therefore directed at testing wax compounds under different conditions.

Experiments making duplicate recordings were a very important part of Edison's phonograph business. As early as 1888 Edison had begun an experimental project to duplicate recordings by making molds of cylinders, and soon stated that his business plan for this new product was based on mass producing prerecorded cylinders: "What I want is the manufacturing of duplicates...."[343] An experimental notebook kept by Albert and Charles Wurth reveals that much of the development work for this project was carried out on the second and third floors of Building 5.[344] (Also see sections on Franz Schulze-Berge, A. Theo E. Wangemann, and Albert Wurth.)

Building 2, Period II: 1901-1914

A 1904 photograph (figure 17) taken from the door to the balance room shows a brick room, probably erected in 1890 or earlier, about 19 feet long built along the east wall of the chemical laboratory. The north and south walls of the room extended from a partition built down the middle aisle to the east wall. An additional partition was built from the west wall of the building to the wall of this brick room, cutting off the balance room and the space in front of it from the main room (see schematic plan 4). The partition and brick walls facing the balance room had large glass door cabinets placed in front of them, and the shelves inside held chemicals and glassware. Entrance to this rear room could only have been

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[342] Aylsworth's lab notes in Notebook N-88-08-23.

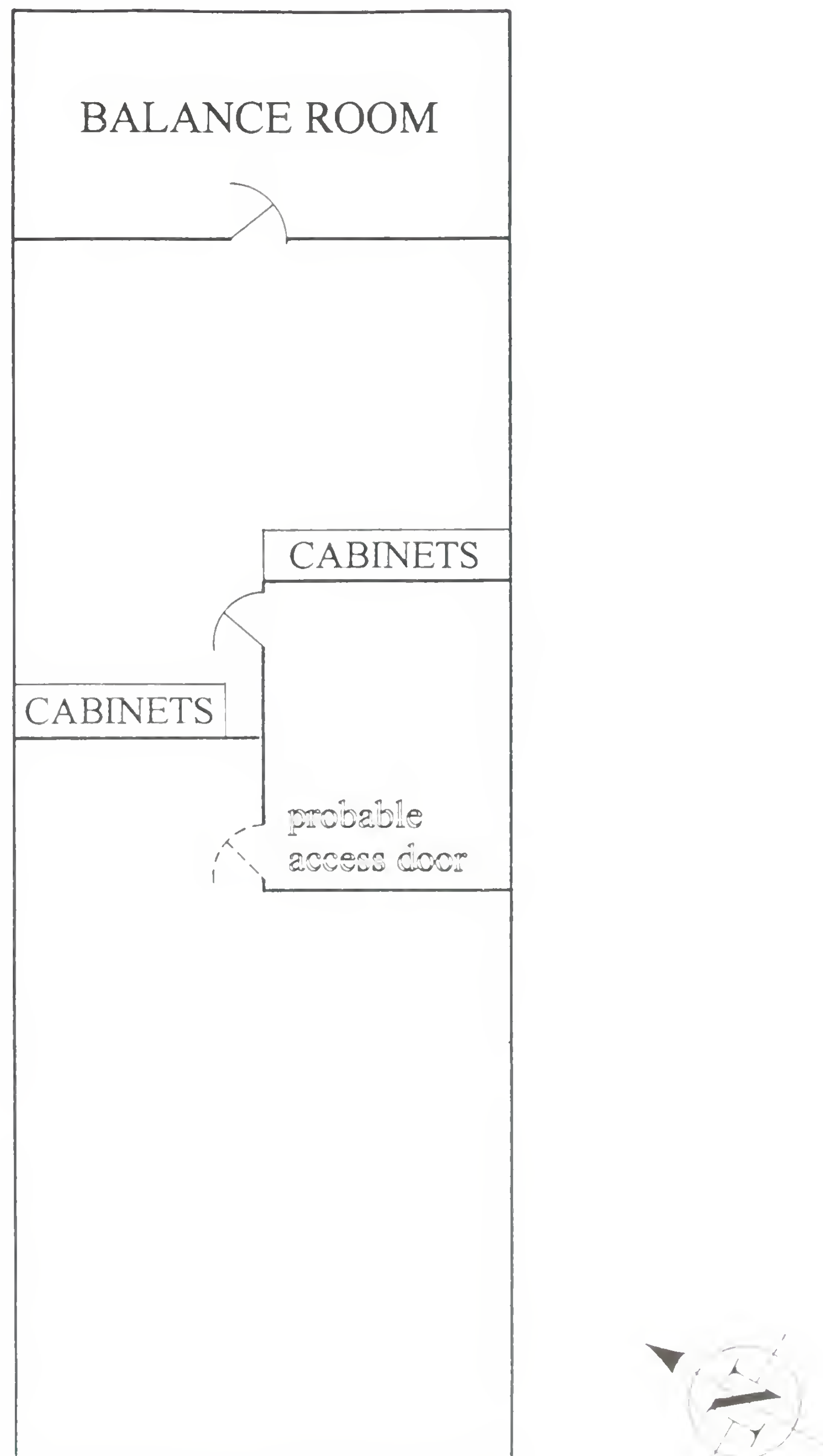
[343] TAE to S.B. Eaton, December 11, 1890, Letterbook 46, p. 97 (LB046097).

[344] Notebook N-91-11-24.

Schematic Plan 4

BUILDING 2, c. 1890 (?) - 1906

(not to scale)



through a door in the brick room. Photographs show two experimental tables and one table fitted with drawers within the room (figures 18 and 19).[345]

There are no photographs of the interior of the brick room and no evidence about its use. It was gone by 1906.[346] The use of brick as a building material, where cheap pine panelling was used everywhere else in the laboratory, is significant, perhaps prompted by risk of fire from experiments undertaken in this room.

The large cabinet with glass doors which was placed in front of the partition was moved into the balance room where it now stands. The balance room contained microscopes to evaluate crystals developed in experiments on recording media and to examine the surface of disc and cylinder masters.

A series of wall cabinets are visible in photographs taken during this period. These were used to store chemicals and were arranged under a system that grouped similar types of chemicals together. Six cabinets on the east side of the chemistry laboratory held chemicals, and three on the west side held glassware.

Two large machines were brought into the laboratory as part of the disc record project. The first was a condensing distilling machine used to make up the phenol resins used to make the disc blanks. It was a pressure container in which a vacuum could be created. A vacuum pump was placed nearby. The container was sheathed in a steam jacket to heat the mixture and steam pipes were attached. At the bottom of the container was a valve to draw off the hot liquid and a manhole cover attached by large bolts was at the top. The various elements of the mixture were pumped in and then condensed under pressure and at high heat. This created the thick resin, called condensite, which when cooled, could be made into blanks.

This machine would have been made up by the laboratory staff from plans drawn up by experimenters--probably Edison, Sam Moore, and Fred Ott--and copied from existing distilling machines and heated mixers. The condensite project was carried out in great secrecy, for just a few miles away from West Orange, Leo Baekeland was carrying out experiments with the same phenol resins. Baekeland was in the lead in developing these early plastics and had a strong patent position. In 1910 and 1911 Edison negotiated with Baekeland to license his patents while simultaneously attempting to circumvent these patents and set up his own production operation. Secrecy was therefore essential. No publicity was given to this project or to this machine. The mixtures concocted by Aylsworth

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[345] NPS, "HSR, Physics Laboratory, Building 1," p. 5; see also figure 18. There are three more photographs of this area in Photograph Album 7.

[346] See figure 26.

were also kept secret at this time, for fear that they might give Baekeland an idea of what the West Orange laboratory was up to.[347] (See p. 44 for more on Jonas Aylsworth.)

A Robertson disc press was set up opposite the condensite mixer to press master records unto blanks and make copies (figure 34).[348] The press was hydraulically operated and could accommodate one disc at a time. A new master could be easily slid into the top part of the press. This machine could also press out a variety of other forms made from condensite.

The practice of Edison's laboratory was to set up and test equipment before it was installed in the factories. This would give a rough date of 1910 or 1911 as the time of the installation of the press, because production of disc records in the factories did not begin until 1913.

The working disc masters that were used in this press were also produced in Building 2. Again, the purpose of the laboratory was to establish the procedures and make up the equipment and then thoroughly test the device before handing it over to the production staff. The electroplating equipment used to make masters and submasters was installed in Building 2 by 1910.[349]

The product of this plating process was a negative, a matrix, of the master. This was used to make a submaster which in turn was used to produce a working master. This working master could be used to stamp out hundreds of copies of the original master disc.[350] The standard operating procedure at the Edison Phonograph Works was to make working masters to actually press discs and save the original submasters and matrices as archival copies.

Although the most important project carried out in the phonograph business was the new disc product, it should not be forgotten that Edison dearly loved the cylinder format and continued experimental work on it throughout this period. Building 2 would therefore still have evidence of work on the cylinder and the equipment to make copies of prerecorded masters and test them. There were also

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[347] Frank L. Dyer to Smith, March 23, 1910, in Record Manufacturing Division Records, Box 16.

[348] John Robertson and Company to Edison Phonograph Works, Purchasing Department, December 11, 1914 (in DF 1914, WOL--Fire).

[349] Historian's Note 90.

[350] Historian's Note 128.

devices to coat both cylinders and discs with varnish or lacquers, such as air brushes and a revolving barrel with air and steam pipes attached.[351]

The storage battery project also brought large machines into Building 2 for development and testing. It is more than likely that the large drums used in the electroplating of nickel were first set up in this laboratory. A large model nickel-flake separator was installed in 1911.[352] Around 1908, apparatus to distill water was erected on the west side of the building by the front door.[353]

Building 2, Period III: 1915-1931

The interior fabric of this building remained unchanged during this period but there were many changes in the furnishings. The disc press and phenol production machines were removed sometime in the 1920s. The large arc lamps hanging over the center aisle were removed and replaced with twin rows of incandescent lamps in glass shades (figure 37).[354]

Photographs taken in Building 2 indicate that a small table was placed at the north end of table 10 between 1915 and 1917 (figure 35). It stood near table 10, and a chair and a wastepaper bin stood beside it. This was Edison's personal table and the one which remains in the laboratory today (figure 39).

During this period, new equipment may have been brought in to extract rubber substitutes from plants--the last major experimental campaign undertaken in the chemical laboratory. Specimens of plants from all over the United States were sent to the West Orange laboratory.

It is not known where the job of crushing and testing these specimens was carried out. It was said that the room used for these experiments was called "the hay fever room" by the laboratory staff, such was the number of plants in it.[355] Mills and crushers were used to break down the specimens. Edison's instructions to his assistants in the rubber experiments mention several types of mills and describe

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[351] William H. Meadowcroft to TAE, August and September, 1911 (in DF 1911, WOL--Meadowcroft's Reports).

[352] Ibid.

[353] Shop Order 2011, Notebook N-99-06-24.1, "New Water Still for Chemical Room/May 21, 08"

[354] See also photograph no. 10.383/7, neg. no. 5511A, not reproduced in this report.

[355] Conot, *Streak of Luck*, p. 434.

special equipment to be constructed for this project. The process of heating and drying large amounts of rubber extract may have required special equipment.[356]

Special extractor apparatus was constructed to squeeze and distill organic chemicals from specimens. This equipment contained a considerable amount of glass work and tubing. Pictures of the apparatus (which were not taken in the West Orange laboratory) show the complicated Soxhlet extractors packed onto the tops of experimental tables. The records of the Edison Botanic Research Corporation indicate that $3,207 was spent on experimental apparatus at the West Orange laboratory between May 1928 and December 1931. Some of this was probably used in analysis of specimens by the bromination process (using benzol solvent) and in experiments vulcanizing the crude rubber obtained from the goldenrod plants.[357]

The images of Building 2 in the 1920s do not show special equipment that might have been used in rubber analysis or vulcanization. No photographs have been found which show the Soxhlet extractors and distilling plant now occupying the experimental tables of Building 2. Instead, the surviving photographs show a spacious and immaculately clean laboratory with hardly any equipment on the tables. A series of pictures taken in June 1928 show almost no apparatus on the tables and no experiments in progress (figure 37). A few flasks and beakers have been placed in the middle of the tables. Only one employee occupies the room. The balance room is clean and tidy with a row of microscopes on the table by the east wall. Fresh cut flowers on the experimental tables are evidence that Edison was not at work in this space.[358] This pristine laboratory may reflect diminished experimental activity and not simply a clean-up for a special event. An examination of the laboratory records revealed no important event in June 1928, when the photographs were taken.

We have several accounts of Edison at work in this laboratory in the 1920s and a couple of photographs taken in 1930 to prove that he was experimenting here.[359] It appears likely that he remained at the end of the laboratory where his little desk stood and moved his chair into the aisle to supervise tests carried out by George Hart. In figure 38, the fact that Edison's chair is completely blocking the

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[356] Thomas Edison, handwritten notes, Edison Botanic Research Corporation Records, Box 24, Folder 18.

[357] "Edison Botanic Research Corporation Report to Stockholders," January 15, 1932. "D-Box" Collection--Rubber. Personnel employed by corporation are contained in an appended list.

[358] See figure 37; also photographs 10.383/7, neg. no. 5511A; 10.383/3, neg. no. 5511B; and 10.137/15, neg. no. 5511C, not reproduced in this report.

[359] Paul Kasakove interview, Norman Speiden interview, and Harold Anderson interview, Oral History Project.

aisle and that the door of the balance room is closed suggests either that the laboratory was doing no other work and only Edison and a few assistants worked there, or that this photograph was staged for publicity. (The door to the balance room may be closed simply to block out light in order to take the photograph.)

While the photograph depicting Edison in the laboratory could certainly have been staged, the conclusion that little work was going on in the laboratory at this time is supported by the labor records. In the late 1920s no more than 20 men worked in the laboratory and only two of them could have worked as chemists.[360] Much of the experimental work for the rubber project was carried out in Edison's chemical laboratory at his Fort Myers home.

[360] "Laboratory of T.A. Edison Time Sheets," Employee Records, Boxes 120-122.

Building 3, Chemical Storage: Periods I, II, and III

No images of the chemical storage room have come to light. There are no plans of this space and no accounts of its contents in the document files or in memoirs of employees. There is no proof that it was used exclusively for storing chemicals.

A comparison of the chemical orders from the nineteenth century with a 1941 inventory revealed little disparity.[361] As other parts of the laboratory were used for the storage of chemicals it could well be that this space was also used for the storage of materials other than chemicals.

Building 3, Pattern Shop, Period I: 1887-1900

The initial selection of tools and machinery, and photographs of the shop's interior suggest that this space was intended to be used as a general woodworking shop with the capacity for precise patternmaking, rather than as a pattern shop alone.

The following machines for this shop were ordered from Joseph A. Fay of Cincinnati in 1887:

> a carving, paneling, & edge molding machine [shaper], with iron top and assorted cutters; an improved door sand papering machine, with exhaust fan and table; a hand feed drum sand papering machine; a surface ornamenting machine, with ten assorted cutters and countershaft; a double circular saw table; a hand and power feed surfacer [planer], with countershaft; an unstrained scroll saw; a Cochran hand planer [jointer]; and a universal single spindle horizontal borer.[362]

Edison specified that the shop was to be equipped with sets of patternmakers' and carpenters' tools ("Make these very complete & best on market"), two benches with vises, a grindstone, several clamps, and a steam glue pot. In January 1888, Fay shipped a patternmakers' lathe with double face plates, floor stand rest, iron shears, movable carriage and tool rest.[363]

A photograph of the south end of the pattern shop (figure 42), taken by W.K.L. Dickson, ca.1890, clearly shows the door sander, patternmakers' lathe, and 24-inch planer in the foreground and the horizontal boring machine, scroll saw, and double

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[361] National Park Service, "Historic Structures Report-Part I, Chemical Stock Room and Pattern Shop, Building No. 3, Edison National Historic Site," prepared by Melvin J. Weig, Norman R. Speiden, William T. Ingersoll, and Gordie Whittington, October 11, 1962, p. 6.

[362] Voucher 784, November 18,1887.

[363] TAE to Charles Batchelor, undated (in DF 1887, WOL--General, D-87-55); Voucher 236, January 12, 1888.

blade table saw behind. A bipolar motor and rheostat panel are located in the southwest corner of the shop. There is a sink in the southeast corner. Lumber racks, for the vertical storage of long stock, cover about a third of the south wall. The belt in the extreme right foreground of the photo probably carried power from the lineshaft in the basement to the countershaft for a second lathe. Six incandescent lamps with conical reflectors are visible, suspended by their wires from the collar ties. There is no way of telling what stood at the north end of the shop or if, for example, the bandsaw was already in place.

Building 3, Pattern Shop, Period II: 1901-1914

No photographs or inventories of the pattern shop survive from Period II. Photographs of the shop taken around 1890 and in 1917, show that it was substantially rearranged (figures 42 and 43). There is no evidence to indicate when these changes took place, or whether they happened gradually or all at once. Given the age of the new additions, it is reasonable to conclude that the changes occurred sometime between 1900 and 1915.

The door sander, horizontal boring machine, double bladed table saw, and planer disappeared and the scroll saw was banished to the basement. Two new table saws were installed, one set up for ripping, the other for cross-cutting. A drill press was installed in the middle of the floor. The patternmakers' lathe was turned around and moved against the east wall (figure 42).

Building 3, Pattern Shop, Period III: 1915-1931

A photograph of the pattern shop (figure 43) taken January 1917 and a 1920 inventory by the New York Appraisal Company reflect the general arrangement of machines and benches that exists today. The drill press, miter trimmer, ripsaw, jointer, cross-cut saw, small lathe, and bandsaw formed an irregular row down the center of the shop floor. The patternmakers' bench lined the west wall, with a work station, tool rack, and vise in front of each window. Work space on the bench was supplemented by three rolling tables, each topped by a cast-iron surface plate. Racks in front of the windows held some of each man's most commonly used personal tools: chisels, dividers, squares, patternmakers' scales, screwdrivers, bit-braces and bits. Gluepots and planes stood on the bench and clamps hung from racks overhead.

Marking stencils hung from nails on the east end wall and stencil brushes stood in cans on the bench below. A cabinet, barely visible in the northeast corner of the 1917 photo, still contains leather fillets for easing the interior corners of patterns and cast zinc letters and numerals that were tacked to patterns to identify the castings they produced. An embossing machine, used to make raised letters and numerals on metal tags was mounted on a small stand in the middle of the room. Benches along the east wall were set up for less precise cabinet work and general carpentry with conventional face vises rather than universal patternmakers' vises.

Lighting in this shop came from windows and was supplemented by a random assortment of single and double bulb fixtures hanging by their own braided conductors. Most were bare bulb fixtures but there was at least one example each of conical sheet metal, enameled spun steel, and milk glass reflectors.

Beams located just below the heads of the windows supported a mezzanine, used for lumber storage, over the north end of the shop. A rack, suspended from the mezzanine over the east aisle, held choice wide boards that could be passed through a casement window in the north end wall.

Building 4, Period I: 1887-1900

The ca.1890 photograph by W.K.L. Dickson of the interior of this building shows a shambles of work tables, stamp mills, crushers and rolls (figure 45). The problem with this photograph is that it shows a wooden floor and walls while we know that the specifications for this building were for brick floors and walls. It is therefore possible that this photograph does not depict the interior of Building 4. On the other hand we know that Edison asked for many changes during the construction of the laboratory. He may well have changed the original specifications for the floor of this building. A wooden floor is much cheaper than a herringbone brick floor and this might have been the motivation to change.

There are several woodcuts of Edison's ore milling machines published in Dickson's memoirs and in issues of *The Iron Age*.[364] These machines appear to be in Building 4, judging by the windows. In figure 44, published in the December 1888 issue of *The Iron Age*, the floor of the building is wood. Although these sources contain images of blower separators and crushing rolls, and Dickson's laboratory notebooks contain drawings of individual equipment, there is no overall description of the machinery and its layout in Building 4.

Dickson also reported that Building 4 contained Edison's collection of ores and minerals in barrels, kegs, and boxes while other samples were stored in supplementary sheds.[365] A collection of ores and minerals in smaller containers was also kept in the library of Building 5.

Building 4, Period II: 1901-1914

The interior of this building was probably changed at the end of the nineteenth century when record experiments replaced ore milling experiments as the major function of this building. The small rooms in the back of Building 4 were turned into a recording studio and an experimental area for recording and duplication. This was a "recording laboratory" and the development of the Gold Moulded Cylinder and the Edison Amberol longer playing cylinders took place here.[366] Several musicians and singers were recorded in this building and C.W. Noyes' book, *The C.W.N. Handbook*, contains rare photographs of Edison recording

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[364] "The Edison Magnetic Separator," *The Iron Age* 41 (December 6, 1888), p. 847, and Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, pp. 323-24.

[365] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, p. 323.

[366] NPS, "HSR, Metallurgical Laboratory, Building No. 4," p. 4; see TAE to W. Miller, [?] 1911 (in DF 1911, WOL).

technicians at work here.[367] The rest of the building was taken up with equipment to manufacture and duplicate cylinder records.

The 1962 "Historic Structures Report" stated that experiments on the Edison disc record began here in 1910. However, a 1909 memorandum from Frank L. Dyer clearly indicates that the initial work was done at the Glen Ridge factory.[368] A photograph from 1912 shows a group of employees who worked on this project (figure 46).[369] From around 1910 to 1912 filming for the Edison Educational Film project was also carried out in this building.

Building 4, Period III: 1915-1931

The 1918 analysis of floor space divides this building into two equal halves: "Disc Record Experimental" and Edison experimenters. The first space was devoted to perfecting the production of Diamond Discs. The mechanical press set up here around 1914 was probably still in operation as the effort to refine mass production of discs, and to lower the cost, was carried on until the time of World War I. A lean-to erected next to the building by 1916 was used to mix bulk chemicals for records.[370]

In 1924 a large disc press was installed in the front part of Building 4. This could be the "powder blank" machine which was still there in 1940.[371]

Edison's experiments during this period covered everything from testing audions (vacuum tubes) to devising new types of storage batteries. Much of his work was concerned with the Diamond Disc record, especially the campaign to reduce surface noise in playback. He was also heavily involved in designing automatic

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[367] C.W. Noyes, *The C.W.N. Handbook* (Cincinnati: Ilsen, 1901). The Noyes book is held at the library of the New Jersey State Archives, Trenton, NJ; see also NPS, "HSR, Metallurgical Laboratory, Building No. 4," p. 4.

[368] Frank L. Dyer to Weber, December 15, 1909 (in DF 1909, Phonograph--General).

[369] NPS, "HSR, Metallurgical Laboratory, Building No. 4," p. 4. The individuals in the photographs were identified by Norman R. Speiden, but it is not known on what he based his information. An article by Oliver Simmons in *Munsey's Magazine* for September 1916, pp. 623-628, identifies the group itself as the "insomnia squad" and their project as the diamond disc record.

[370] Ibid., p. 8.

[371] Ibid., p. 5; also K.G. Berggren to Norman R. Speiden, January 23, 1940, Historical Research Dept.

machinery to press disc records.[372] It is likely that the two latter activities took place in Building 4.

An important innovation that was hurriedly introduced to bolster the Edison phonograph business was the long playing record. This was developed in Building 4 and finally introduced in 1926.[373] The experiments on long playing records would have used the pressing equipment and recording facilities set up in Building 4.

The development of the Edicraft line of kitchen appliances was an effort to regain some of the consumer market that the Edison phonograph had lost in the late 1920s. The development and testing work was carried out in this building while the design and production engineering was done elsewhere. Thomas Edison Jr. worked in a room in the rear of the building in one of a group of offices established in the 1920s. Several other experimenters worked here, as did Mrs. J. Coakley who acted as a domestic science consultant on the Edicraft project.[374]

Photographs of these experimental rooms dated 1939 show rooms for battery and other electrical testing, offices with drafting tables, vacuum pump rooms, and a small machine shop.[375]

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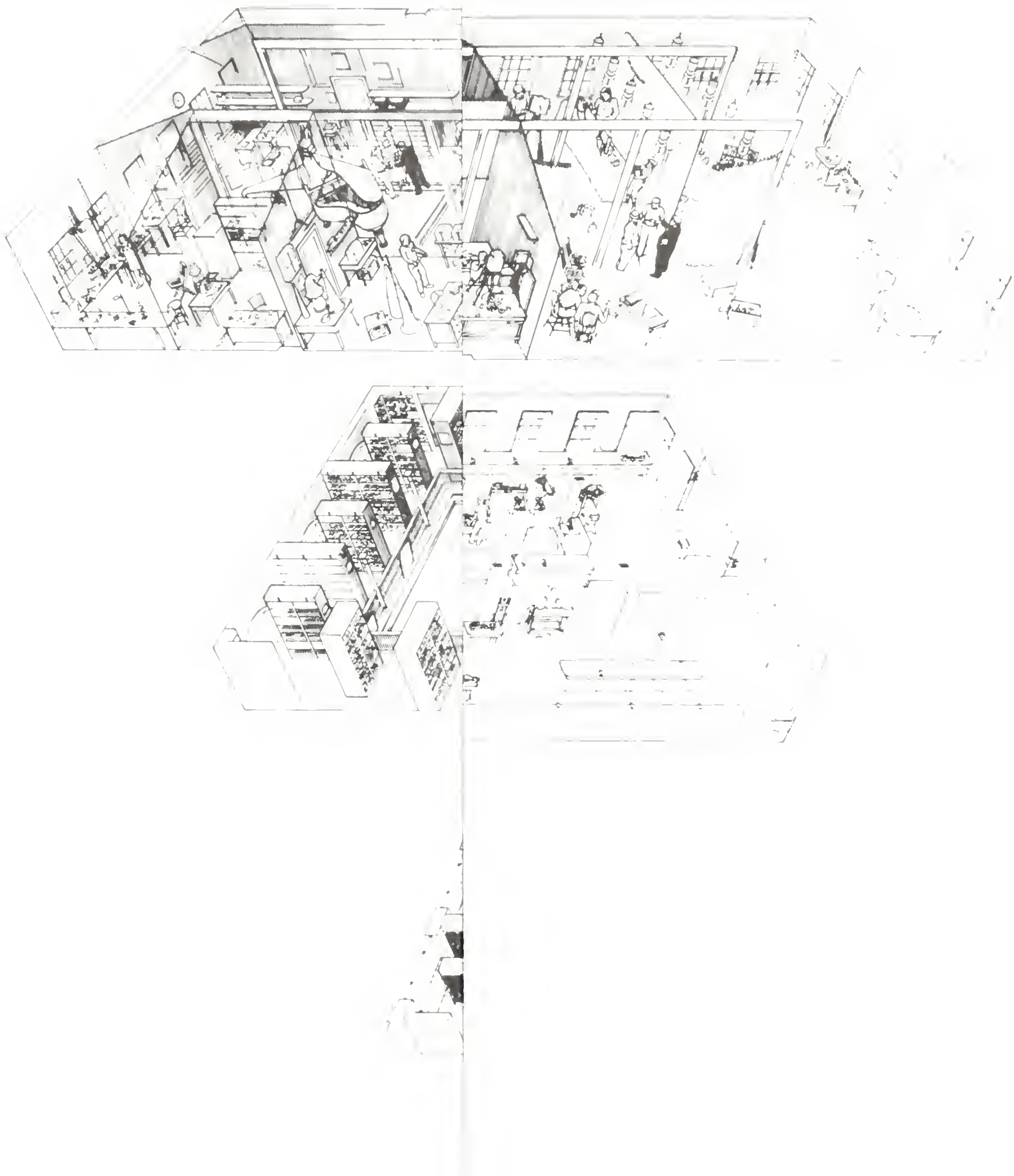
[372] "List of Active Matters," memorandum by TAE, March 17, 1921, D-Box Collection, Box 23, "Edison Files."

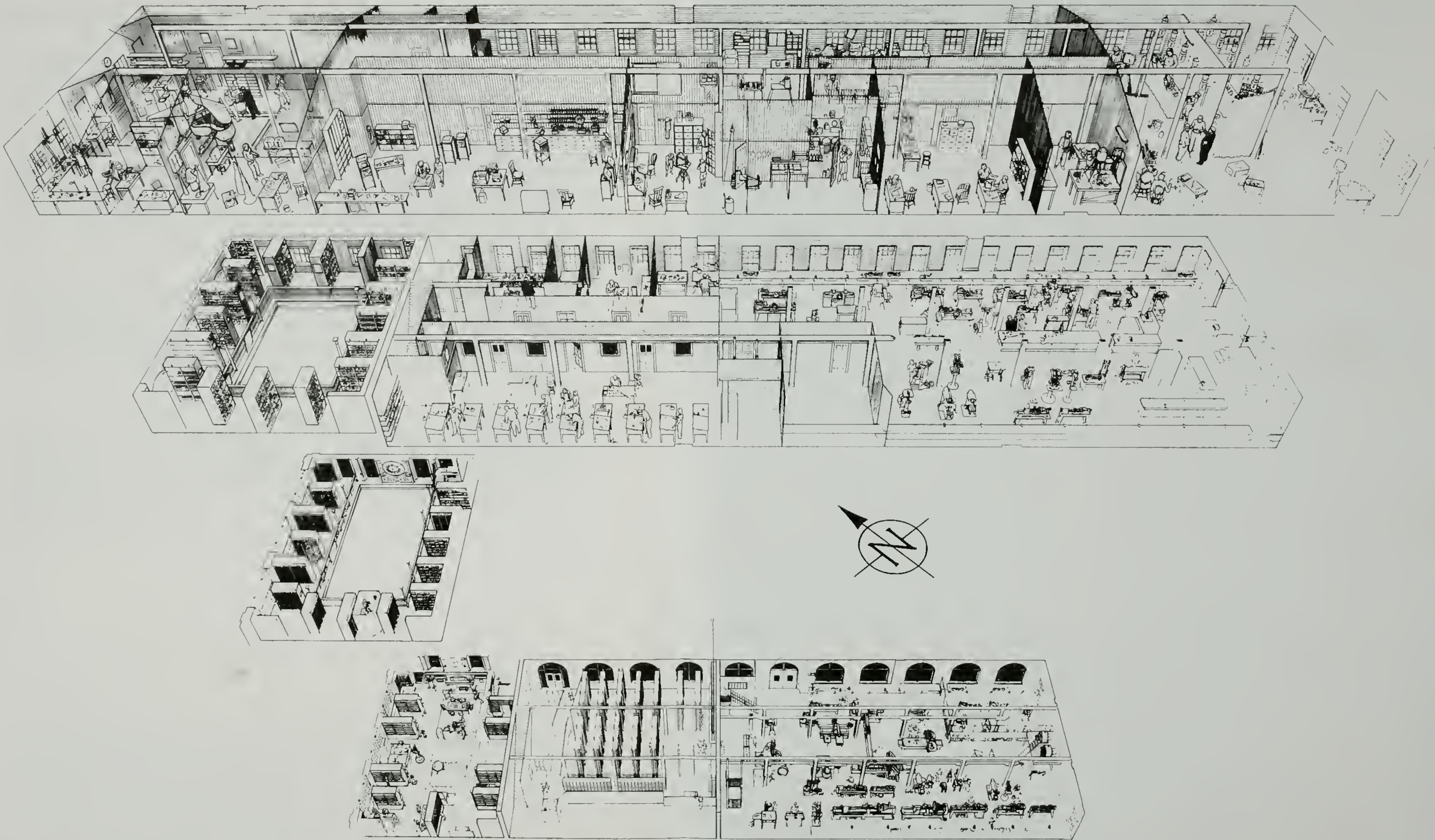
[373] NPS, "HSR, Metallurgical Laboratory, Building No. 4," p. 5.

[374] Ibid.

[375] See photographs 12.440/102 through 12.440/106, neg. nos. 8098 through 8102, in Photograph Album 43, catalog 751 (not reproduced for this report).



BUILDING 5



BUILDING 5

Building 5, Hallway, Period I: 1887-1900 and Period II: 1901-1914

The main entrance to Building 5 led to the doorway of the library. In 1903 or 1904 M.A. Rosanoff found Edison "in a small reception room" which could have been in the library or in the hallway outside the library doors.[376]

In 1912 photographs one can see through the passageway (behind the main door to Building 5) all the way to the window that looked out onto Lakeside Avenue (figure 47). Photographs taken in 1915 show that a vestibule has been erected in this passageway with a door leading to the doorway of the library. The vestibule appears to be made out of wood panels and does not reach to the ceiling (figure 48). (See schematic plan 5.) People entering the building and going to the storeroom and machine shop travelled to the left of the vestibule.

The purpose of this structural change was probably to provide a waiting room for visitors to Edison in the library and to separate these visitors from laboratory staff making their way to the machine shops and storeroom. On a floor plan of 1916 this space is designated as a "waiting room." During this period the other major entrance to Building 5 was on Lakeside Avenue. A door was positioned in the frame of the large arched window that stood across the hallway from the entrance to the stock room.[377]

In 1912 the new chief engineer, Miller Reese Hutchison, quickly made his mark on Building 5. He was proud of the time clock he installed by the main entrance and there are several photographs of Edison clocking in.[378] Yet this was not the first time clock in this building, nor was it the first time that experimenters and executives had to clock in. A 1904 Byron photograph shows a time clock outside the stock room (figure 92).

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[376] M.A. Rosanoff, "Edison in His Laboratory," *Harper's Monthly Magazine* 165 (Sept. 1932), p. 402.

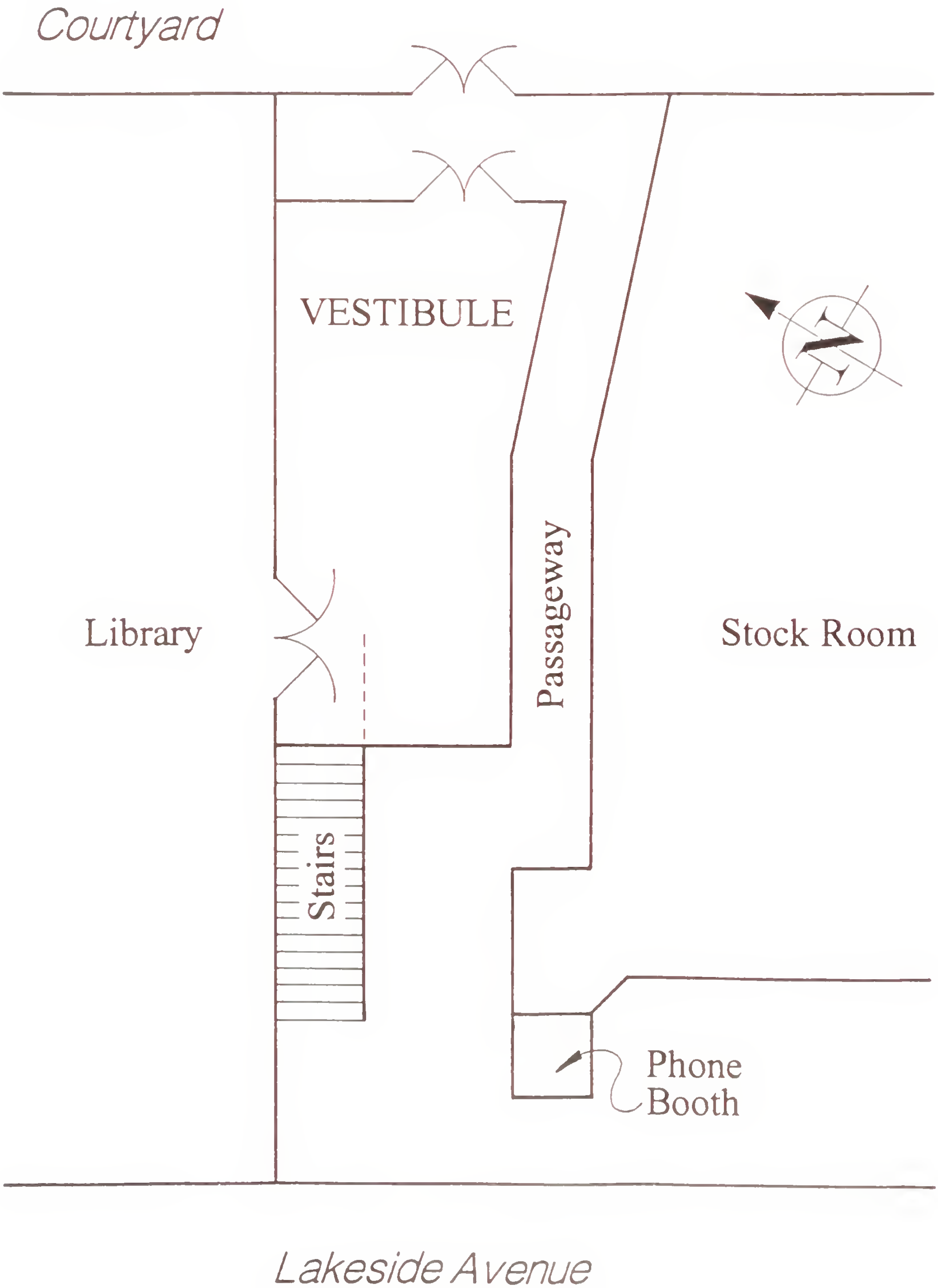
[377] This was one of two doors on Lakeside Avenue; the other was a freight door in the first floor machine shop. See figure 120.

[378] Photograph Album 10, catalog 5209, p. 103.

Schematic Plan 5

VESTIBULE, BUILDING 5, c. 1915

(not to scale)



Building 5, Hallway, Period III: 1915-1931

Major changes were made to the first floor entrance area during this period. A 1925 photograph shows the vestibule outside the library door was removed to open up this entrance area.[379] In 1927 two portable vestibules were set up in this area: one by the library entrance and one by the machine shop entrance.[380]

At some point after 1916, the stairs leading down from the second floor were enlarged and turned 90 degrees at a landing above the first four steps. A wider corridor was therefore created from the main entrance of the building. The storeroom wall was moved back a few feet where it extended out to encompass a telephone booth and the booth was removed to make a broad corridor that led to the first floor machine shop.

The other major change on this floor was the creation of three offices on the northwest side of the stock room. These took up about half the area of the stock room. In 1926 one of these offices was enlarged and alterations made to the stock room.[381]

Building 5, Library, Period I: 1887-1900

When Edison moved into the library in late 1887 or early 1888, it was "a rather sparely furnished place."[382] In his 1887 notes on furnishing the laboratory, Edison allocated only a small sum for "Fitting up office." For $560, he planned to acquire desks, stationary, a safe, chairs, a mirror and fittings for the wash place.[383] He also intended to purchase a large Ansonia pendulum clock.[384] According to an account published in the *Evening Sun*: "There was a desk there and three or four tables, a half a dozen chairs, a clock face without hands or works, and one or two old rugs on the floor. In the big fireplace were two little

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379 Photograph no. 10.111/1, not reproduced for this report.

380 Laboratory labor and Material Ledger Pages [unbound], 1918-1931, February 1, 1927, Accounts Books Records.

381 Ibid., May 29, 1926.

382 The *Evening Sun*, February 11, 1889.

383 Edison note, undated, 1887 (in DF 1887, WOL--General, D-87-55).

384 Ledger Book E 4294, November 24, 1887, p. 16, West Orange laboratory records, Box 38.

brass andirons."[385] Some of the furnishings in the library may have come from Edison's New York office; in November, a carload of desk goods and a book case were shipped to the new laboratory, along with a generator, flywheel, and other machinery.[386]

Office supplies were ordered early in December 1887, and by the end of the month a terrestrial globe was delivered from James W. Queen and Company. An 1889 drawing of the library shows the globe placed next to the fireplace; a ca.1895 photograph shows the globe on the east side of the room against a column.[387] Over the years, the globe was often moved around to accommodate other pieces of furniture or statuary, but it has always remained in the room.

From the beginning, Edison stocked the library with quantities of books and periodicals. He probably brought books with him from his previous shops and offices--certainly he brought his notebooks and ledgers--but how many works, and which ones, we do not know. The ample shelves in the library were not filled, though, at first. The *New York Times* stated the cases "contain 16,000 volumes of choice scientific works, but the capacity is 35,000 books...," while J.B. McClure's *Edison and His Inventions* claimed the library "will hold about 100,000 volumes. Though not quite filled, it will soon be, at the rate of stocking now going on."[388]

As discussed above, books in the library were available for Edison's staff to use in or away from the library. During 1889, 367 books were checked out.[389] In February 1888, A.E. Kennelly borrowed several volumes for use in the galvanometer room, and other volumes, such as dictionaries, were checked out not to an individual, but to an experimenting room. Edison's attorneys also borrowed technical works and volumes of patents for use in their offices in New York.[390] A log of books coming into the library was started in 1888 and maintained until March 1892. This list records the title, publication date, author, and source of each book or periodical, and indicates whether the book was returned to the publisher. A total of 791 volumes was added to the library in the years covered by the log book.

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[385] The *Evening Sun*, February 11, 1889. The *New York Times* described "two or three small tables, as many odd chairs, a triplet of well-worn rugs, and a dismantled clock, which...constituted the only furnishing of the big room outside the book shelves," *New York Times*, February 12, 1889; p. 5, col. 2.

[386] Voucher 736, December 31, 1887.

[387] *Cosmopolitan*, April 1889, p. 601; see figure 50.

[388] *New York Times*, May 12, 1888, p. 8, col. 3; McClure, *Edison and His Inventions*, pp. 24-25.

[389] Notebook N-88-01-30, p. 59.

[390] Ibid., pp. 1-7.

Edison purchased a complete set of electrical patents, as well as sets of *The Century Dictionary*, *Encyclopedia Britannica*, and *Appleton's Annual Cyclopaedia*, among others. He subscribed to dozens of scientific journals, and periodically had them bound. By 1910, the shelves in the first and second tier held thousands of these journals. Edison collected:

> the popular magazines, together with those of a technical nature relating to electricity, chemistry, engineering, mechanics, building, cement, building materials, drugs, water and gas, power, automobiles, railroads, aeronautics, philosophy, hygiene, physics, telegraphy, mining, metallurgy, metals, music, and others; also theatrical weeklies, as well as the proceedings and transactions of various learned and technical societies.[391]

William Meadowcroft said that Edison subscribed to more than 60 magazines. When they arrived at the library during the week, they were sent up to his home for him to review on Sunday. Early in the next week the magazines were returned to the laboratory with Edison's markings and notes.[392] Books from the library were also transferred to the house for Edison's use.[393]

In October 1888, Edison was offered the George F. Kunz mineral collection, which he purchased early in 1890 for $8,000.[394] Later that year Andrew Hartman was hired to mount the minerals in specially adapted shelves on the first tier of the library.[395] The collection remained in the library at least through 1910, when Dyer and Martin described "...a series of glass-fronted cabinets contain[ing] extensive collections of curious and beautiful mineralogical and geological specimens, among which is the notable Tiffany-Kunz collection of minerals...." [396] Theodore Edison stated in 1970 that he believed the collection had gone to the Ford Museum, but its current disposition is unknown.[397] The inventory of the original collection is reproduced as Appendix A.

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391 Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 641.

392 The *New York Times*, November 8, 1931, sect. II, p. 1, col. 4.

393 Notebook N-88-01-30, p. 63.

394 George L. English and Co. to TAE, October 1, 1888, and George F. Kunz to TAE, October 3, 1888 (in DF 1888, Edison, T.A.--General, D-88-05); also George L. English and Co. to TAE, March 26, 1890 (in DF 1890, WOL--General, D-90-64).

395 Voucher 373, April 1890; George L. English Co. to TAE, December 21, 1889 (in DF 1889, WOL--Suppliers, D-89-70).

396 Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 641.

397 Theodore Edison interview, May 7, 1970, Oral History Project, p. 170.

In addition to the mineral collection, Edison also stored his collection of anatomical models in cases on the first tier. These models were shipped to him late in 1887, and appear on the shelves in an early undated photograph. The collection included models of the heart, eye, ear, skin, teeth, brain, head, lungs, respiratory organs, and larynx.[398] Edison attempted to supplement this collection, but received this reply from a vendor: "Now I am sorry to say that I cannot give you the petrified eye-ball which I wrote you about....I put it away about a year ago, so carefully, that now when I look for it, I cannot find it..."[399] The models also remained in the cases through the early part of the twentieth century, but have now disappeared.[400]

In 1889, Edison's employees took the matter of furnishing the library into their own hands. In September 1888, a large group of Edison's employees headed by Tate, and directed by a committee composed of Arthur Kennelly, John Ott, W.K.L. Dickson, and A. Theo E. Wangemann, began organizing to prepare a surprise for Edison on his 42nd birthday.[401] The *New York Evening Sun* described the results:

> This morning when all unsuspectingly he walked into the [library] he found it completely transformed. It was completely and handsomely furnished. There were seven beautifully carved solid oak tables placed where they were most needed. There were eighteen oak and leather armchairs, with TAE in a monogram carved on the backs of each one.
>
> There were twelve oak and leather revolving office chairs with the same monogram carved on each. There was placed near the Wizard's desk a big soft leather reclining chair, which could be turned into a most comfortable bed with a simple turn of the wrist, and in front of the big fireplace were too [sic] great easy leather and oak armchairs, so full of springs and fashioned so cunningly that one felt lazy and luxurious just to look at them.
>
> In the big fireplace itself was an enormous gas-log, whose flames leaped merrily up the wide chimney and sent a genial heat out into the room. The gas-log in turn rested on a pair of great wrought iron andirons which were burnt and twisted in the latest aesthetic style.
>
> High on the wall over the burning logs was the old clock face, which had never had any hands to show the time o'day. But the hands were there this morning and were pointing at the right time to a second, for behind the dial was an electric clock regulated at Washington, DC. On the polished floor, which on Saturday had looked

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398 See figure 51; Voucher 778, 1887.

399 F.J. Kaldenberg to Thomas A. Edison, January 5, 1888 (in DF 1888, WOL--Suppliers, D-88-56).

400 Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 641.

401 Voucher 1069, 1888.

> so bare with its scanty coverings of three old rugs, were thirteen thick, soft Smyrna rugs.[402]

This description agrees with the accounting records Tate and his committee kept, with the exception of the description of the chairs. The employees actually purchased two leather armchairs, a reclining leather chair, eighteen oak and cane side chairs, twelve oak and cane revolving arm chairs, and another revolving arm chair for Edison's desk. They also purchased fire tools and a stand, although the library fireplace contained a gas log and was not a working fireplace.[403]

Records indicate the amount each worker paid into the gift subscription fund. Donations ranged from Charles Batchelor's $250 to 50 cents from Edison workers of more modest means. In all, 87 present and former employees contributed to the purchase of the library furnishings. The total amount raised was $782.75, and the total cost of the furnishings was over $677.75.[404]

Contemporary accounts describe at length a silver phonograph Edison's workers made for him, and accounts show that the committee spent $75 on a "mahogany case roll glass top," presumably to house the phonograph.[405] The *Evening Sun* enthused:

> ...the most beautiful of all the beautiful things in the library, and the object which probably first caught the great inventor's eye, was a perfect gold and silver working phonograph, the finest and most exquisitely finished talking machine ever made.
>
> It stood in front of a window opposite the wide doorway and rested on a finely polished mahogany table, arranged with many drawers to hold several hundred phonograms.[406]

This phonograph is still in the collection at the Edison laboratory and with some exceptions the other gift furnishings remain in the library. The leather reclining chair, the iron andirons and the oriental rugs are no longer at the site. The oriental rugs were used at least until 1918, but it is not known when the reclining chair and andirons were removed.[407]

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402 The *Evening Sun*, February 11, 1889.

403 Invoices, 1889 (in DF 1889, Edison, T.A.--Accounts, D-89-06).

404 One of the invoices is missing from the records, so an exact total is not available.

405 Invoices, 1889 (in DF 1889, Edison, T.A.--Accounts, D-89-06).

406 The *Evening Sun*, February 11, 1889.

407 See figure 81.

The employees also presented Edison with a silver cigar case and an engraved card with the inscription: "The surrounding outfit of laboratory conveniences are presented on his forty-second birthday to Mr. Thomas A. Edison by all the present and a few of the past workers in his laboratory, Orange, Feb. 11." After Edison had taken some time alone in the library to absorb the change, he sent for a caterer and served lunch to everyone in the laboratory. [408]

During the more than 40 years Edison used the library, the furnishings increased and changed gradually. Sculpture, awards, and framed prints and photographs were acquired over the years, and alcoves were used as needed for office desks and work tables. Early in 1890 Edison received at West Orange a statue he had purchased while visiting the Paris Exposition in 1889. The marble sculpture by A. Bordiga represents the triumph of electric light over other methods of illumination; its subject is a winged boy holding a working incandescent light bulb over the ruins of a gas lamp. According to an 1890 article in *The Electrical World* the statue was "placed in the centre of the library where it faces the doorway and is there the first thing seen by the visitor as he enters."[409]

Statuary, prints, and photographs were rearranged to accommodate new acquisitions or to emphasize new interests. In 1891, a model of Edison's electric locomotive stood on the mantel, and a ca.1895 photograph shows it was joined by a bust of Alexander Humboldt, the German naturalist. A stuffed eagle, with wings spread and electrified eyes, first appears on the mantel in this photograph, as does a smaller stuffed bird, sitting on Edison's desk.[410] Although the eagle perched in many locations around the library, it eventually rested on the first tier next to the projector booth, sometime around 1912. A statue of Eugene Sandow, nineteenth-century strong man, was presented to Edison after the celebrity came to the laboratory to be filmed in the early motion picture studio.[411] It was on the mantel in 1896 and remained there, along with the Humboldt bust, throughout Edison's years in the library.

Some furnishings in the library were purely decorative and reflected changes in style and taste. Plants were a common decorative feature throughout most of the library's use, though in Edison's later years they do not seem to have been used as frequently. An April 1889 illustration in *Munsey's Magazine* shows a huge arrangement of potted plants surrounding an immense palm tree in the center of the room. While this flamboyant arrangement probably owes much to artistic

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[408] The *New York Times*, February 12, 1889, p. 5, col. 2.

[409] *The Electrical World*, February 1, 1890.

[410] See figure 50.

[411] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 643.

license, photographic evidence also indicates that potted plants were placed on desks and tables in the room.[412] When the 1889 birthday gift was presented, a newspaper account stated "the air was heavy with the perfume of flowers, which were in every nook and corner of the room, and great palms and tropical plants stood here and there and added to the beauty of the room."[413] Edison's desk was sometimes photographed with a potted plant placed on the top shelf, and Dyer and Martin relate: "In the middle distance, between the entrance door and [the] statue, has long stood a magnificent palm, but at the present writing it has been set aside...."[414]

Original carpeting in the library consisted of "a triplet of well-worn rugs," according to a description published in the *New York Times*. The library was furnished with a collection of oriental carpets as part of Edison's birthday gift, but the invoice for these carpets has not survived. The *Evening Sun*'s report of the gift, however, mentions "thirteen thick, soft Smyrna rugs."[415] Small oriental-style rugs are pictured in all historic photographs taken after 1889, though it is possible that a larger rug was purchased for the center of the room in the early twentieth century.

Window shades were probably used in the library in the late 1880s; they were definitely installed by 1895. The first shades were purchased in June 1888, and another group of more expensive shades were purchased in 1890, but the purchase vouchers do not indicate where in the laboratory these shades were installed.[416] The shades were dark, probably green in color. All of the windows were shaded with the possible exception of the first floor windows flanking the fireplace.

Dickson's ca.1895 photograph is the earliest image to show overhead lighting fixtures in the library. The photograph shows both a cone-shaped fixture designed to hold five light bulbs and a white bell-shaped fixture with one large bulb; these were suspended from the roof in the center of the library. The fixtures appear in another early undated image, but the bulbs have been removed from the bell-shaped fixtures.[417] A single bulb without a shade or fixture hangs in an alcove in yet another undated photograph of the library. Edison's youthful appearance in

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[412] Figures 49, 50, 84, and 85.

[413] The *Evening Sun*, February 11, 1889.

[414] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 643.

[415] The *Evening Sun*, February 11, 1889.

[416] Voucher 672, 1888; Voucher 329, 1890.

[417] See figures 50 and 51; Voucher 319, 1888 may document this purchase.

this photograph, however, helps to fix this image to the early years at West Orange (figure 53).

During the construction of the laboratory at West Orange, Edison ordered a stained glass window as a memorial to his mother, Nancy Edison. The window was sent to the architect, Taft, for approval and the bill for $300.00 was paid, but the window was apparently never installed in the library, or anywhere else in the West Orange laboratory.[418] It is not mentioned in Dyer and Martin's description of the library, nor is it ever described in contemporary periodicals or newspapers.

Building 5, Library, Period II: 1901-1914

Certain additions to the library reflected current projects which interested Edison, or new products introduced by his companies. Dyer and Martin's 1910 description of the library includes a reference to the cement house model which had been given place of honor in the library; a 1909 article in Munsey's Magazine also mentions the house.[419] Photographs show the model house in the center of the library through 1912; during this time Edison was also photographed with a cement phonograph cabinet in the library which remained in the library through the beginning of 1915. In a 1914 memorandum in which he discusses the library, Miller Reese Hutchison asks "don't you think it would be a good scheme for us to have the cement cabinet scrubbed up, so it will look cleaner than it is now?"[420] The library also boasted a model of a dynamo on a marble pedestal and an Edison electric fan presented by employees, as well as framed displays of electric circuitry, and paintings and photographs of some of the Edison works.

In 1911, Edison was given a cubic foot of copper on a pedestal by the leading producers and consumers of copper in America to thank him for stimulating the copper industry with his inventions. This was installed against the bookcase to the left of alcove 7.

The oriental-style carpets used in the library probably did not change significantly during Period II. A brush mat is visible in alcove 2 inside the library door in a ca.1912 image. The earliest use of this kind of mat was probably in 1903 or earlier, when brush mats were ordered for the laboratory.[421]

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[418] Voucher 746, 1887.

[419] Allan L. Benson, "Thomas A. Edison, Benefactor of Mankind," in *Munsey's Magazine*, 1909, pp. 419-25; see also Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 643.

[420] Hutchison to Meadowcroft, February 23, 1914 (in DF 1914, Motion Picture).

[421] J.S. Barron to TA Edison, November 27, 1903 (in DF 1903, WOL--Equipment and Supplies).

Patterned plush curtains were used for a short time in the early 1900s to separate alcoves from the central area of the library, but this is the only time that curtains appear to have been used in the room.[422] Roller shades were used in the windows at this time (see figure 56). Photographs taken in 1912 show a single very wide shade on the windows at the south end of the room, facing onto Lakeside Avenue. By 1915, these south windows were fitted with individual shades.[423]

The alcoves contained desks and work tables, but desks and tables were also used in the center of the library for office work. Edison's desk, located today in the center of the library, was a large roll-top with overhanging pigeon holes and document slots. In the early 1900s, at least one other rolltop desk was photographed in the library. Edison was frequently photographed seated at a desk, but in some earlier photographs the desk he appears to be using is much smaller than the one known as "Edison's desk."[424] An illustration of the library in the April 1889 issue of *Cosmopolitan Magazine* depicts a desk identical to that known today as Edison's desk except for an alteration to the cubicle arrangement. Affixed to the back of the desk near the top center is Edison's carved monogram, similar to those on the furniture purchased as a birthday gift in 1889. As Edison was often photographed in the library, it is not unlikely that another desk was sometimes used to facilitate the photographer's work.

A 1905 image of alcove 4 shows a saucer-shaped overhead fixture with a white or light-colored interior, fitted with two bulbs. A switch hangs from a cord from the center of this fixture (figure 59). These fixtures were installed in all the alcoves by 1911, and were probably installed at the time the fixture in alcove 4 was put in. The four existing six-globed chandeliers in the center of the room also appear for the first time in the 1911 image (figure 62). Their installation date is unknown.

A glass positive transparency of the Hammer lamp collection in a wooden frame was installed in the ground floor window west of the fireplace by 1911 and remained there through 1912. It is not known exactly when it was removed, but it was gone before the 1920's.[425]

Edison's cot, currently tucked away in an alcove on the east wall, features prominently in Edison lore. Edison's naps were well known; he had the ability to

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[422] See figures 53 and 56.

[423] See figures 60, 64, and 65.

[424] See figure 58.

[425] See figures 62, 68, and 87.

fall asleep anywhere for short periods, then awake feeling completely refreshed. The first cot purchased for the laboratory was a canvas model, delivered in the summer of 1888.[426] A 1905 photograph of Edison's cot shows that it was located at that time in alcove 4 next to the window. This early cot was wooden, made up with ticking-striped pillows and mattress, and an Indian-style blanket. Later, Edison switched to a metal cot, and before the offices were installed around 1916 the bed was moved to alcove 3.[427] At some point he obtained a screen for privacy, but it is only pictured in photographs taken after Edison's death.

The December 9, 1914, fire at the Edison works in West Orange made front page news in the surrounding area and received comprehensive coverage by newspapers around the country. The fire began at about 5:30 in the evening and was not extinguished until early the next morning. Beginning in the film inspection department building on the block behind Building 5, the fire spread quickly to the supposedly fireproof concrete buildings surrounding the original six brick buildings of the laboratory. Amazingly, while the surrounding block of Edison's buildings burned, Building 5 and the smaller laboratory buildings remained unharmed.

Edison calmly watched part of his empire burn, and promised to "start all over again tomorrow."[428] Meanwhile, according to numerous newspaper accounts, his wife Mina urged employees to save the contents of his library, and possibly his second floor experimental room too. It was reported that after saving some of his papers herself, Mina directed employees to remove books, papers, experiments, and art works to Glenmont. When asked why she had gone to such effort to save these items, she replied:

> ...I tried to think of something that might make the loss that appeared inevitable a little lighter for him, and decided on the spur of the moment that if, after the fire, I could surround him with the very things he had grown accustomed to seeing in the office he did his work in for years, he would be able to continue his work and finding things so much like they were before on every side, forget the great loss that would then be out of sight.

When Edison wanted to rush down to the laboratory the next day as soon as he awoke, Mina delayed him. She telephoned Meadowcroft and between the two of them they arranged for all of the books and other materials to be replaced exactly

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[426] Voucher 803, July 18, 1888.

[427] See figures 59 and 71.

[428] The *New York Times*, December 10, 1914.

as they had been before the fire. When Edison next entered the library, it appeared as if nothing had changed.[429]

Building 5, Library, Period III: 1915-1931

As framed prints and photographs were acquired for the library, existing pictures were redistributed on the walls, railings and columns to make room for the new acquisitions. By 1930, there were over 65 framed prints and photographs in the library. These included images of Edison at his home in Fort Myers; cartoons; pictures of various illuminations and factories; portraits of Edison with Ford, Firestone and others, as well as portraits of presidents, scientists, and other famous men.[430]

For his 75th birthday in 1922, Edison received a Lorado Taft bronze statue of Orpheus holding aloft a disc record from the midwest Edison phonograph *jobbers*, or sales representatives. It arrived at the laboratory in June of 1923 and was placed "in the south end of the library, which seems to be the most suitable place for it. In this location it can be seen to the best advantage, and here it will remain a perpetual reminder of our friends and their fine tribute to Mr. Edison."[431]

A large area rug with a stylized border replaced the oriental carpet by 1930, and was used at least through 1969 when it was in place for Charles Edison's funeral. This large carpet was placed under Edison's desk, in the center of the room. A smaller carpet has since replaced the 1930 carpet and covers only half of the room. The remainder of the room is covered by utility carpet, because it is in the visitor circulation path.[432]

Certain furnishings in the library are closely associated with Edison himself. Legend has it that Mrs. Edison provided a spittoon for him which he refused to use, but he must have kept it because a white enamelled spittoon appears next to his desk in most photographs.[433]

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[429] The *New York Times*, December 11, 1914, p. 9, col. 1.

[430] "Miscellaneous Exhibits in the Library," 1930 inventory, pp. 2-8 (in DF 1930, WOL--Library, Pictures and Other Exhibits).

[431] Laurence H. Lucker to Charles Edison (?), June 13, 1923 (in DF 1923, WOL--Orpheus Statue).

[432] See figures 88 and 89.

[433] Roderic Peters interview, Oral History Project, p. 16; see figures 61 and 63.

After the excitement of the fire and the task of rebuilding the West Orange plant, Edison focussed his attention on the challenges posed by American involvement in World War I. By the time the war ended, Edison was in his early seventies. Increasingly during his later years, Edison was watched over by his family, his employees, and others around him. When the Crown Prince of Sweden visited, Mina approached Edison at his desk "...put her arm around his shoulders, and said 'The Prince is here. You'll have to get up.'"[434] Before the 1914 fire, the Edison Laboratory Fire Department assigned members to locate Edison on the first, second, and third floors of Building 5 and to warn him in case of fire. Another member was designated to find Edison at night: "The man who finds him warns him and stays by him until he is out of the building."[435]

According to several accounts, by the 1920s the library was becoming very cluttered. It was certainly a hot place to work in the summer; Edison mandated "for ventilation not more than 3 windows need be open at any one time--I will stand for 3 only."[436] Later, the *New York Times* commented on the "Souvenirs of the past, inventions of the early days, lamps, bulbs, pieces of machinery... everywhere in the room."[437]

When Edison died in 1931, his public viewing was held in the library. Flowers were brought in to decorate the room, and guards were stationed by the coffin throughout the two days of public viewing. A comforting note to Mina Edison summed up the arrangements: "The library can be beautifully decorated, guards will be on either side and Mr. Edison will, for a little while, be in his 'work shop' which he has loved so much."[438] Although cameras were prohibited to the masses of people lined up to pay their respects to Edison, at least one photograph of the coffin in the library was taken. This photograph shows the closed coffin before the fireplace, surrounded by flowering plants and palm trees. A garland is draped over the clock and is twined around the first tier balcony railing. A large arrangement of flowers and palms is placed behind the desk in the center of the room, and more flowers and palms fill the alcoves. A railed platform is erected at

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434 The *New York Times*, June 4, 1926.

435 "Laboratory Fire Department," memorandum of MRH, October 143, 1914 (in DF 1914, WOL--Fire).

436 T.A. Edison to Meadowcroft, annotation to May 22, 1916 memorandum (in DF 1916, WOL).

437 The *New York Times*, October 19, 1931, p. 24.

438 John [Miller?] to Mina Edison, September 17, 1931 (in DF 1931, Edison--Death, Undertaker/Cemetery Arrangements).

the south end of the library, presumably to control the crowds of people moving through the room.[439]

Building 5, Stock Room, Period I: 1887-1900

Fessenden's rough plan of the laboratory indicates a very large store room on the first floor of Building 5, bounded by passageways on the west (separating the store room from the library) and south (parallel to Lakeside Avenue), the machine shop on the east, and the exterior wall on the north.[440]

A photograph taken by Dickson between 1888 and 1892 shows shelving running from floor to ceiling along the north-south axis of the room, much as it does now (figure 90). In front of this shelving, facing the Lakeside Avenue side, is a line of cabinets, five or six drawers high, which stretches at least three quarters of the length of the store room. These could be the "thousands of small drawers" containing exotic materials which were described by a visitor around the turn of the century.[441] Another visitor about this time remembered that the organic materials such as skin and teeth of animals were kept in the chemical department.[442]

Dickson's account of the store room notes shelves, metal sheets and rods present in this room and these can be seen in his photograph. He also mentions ropes, chemicals, leather, hides, paper, marble, textiles, and an ice cream freezer.[443]

The sheer number of supplies Edison imported to West Orange and the exotic range of materials he kept at hand have become part of the myth of the West Orange laboratory. The stock room contained "bones of birds and animals, feathers, hides, teeth and horns...shining metals, lucent crystals...dainty crystals and coral...among mosses and sea-weed," and "skins of snakes and fishes."[444] The well known quote about stocking everything from "an elephant's hide to the eyeballs of a United States Senator" has been repeated so many times that we

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[439] See figure 88.

[440] Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925), p. 156.

[441] Jones, *The Life Story of Thomas Alva Edison*, p. 302. The first edition of this book was in 1907. This quote also says that these cabinets went from floor to ceiling and that they were labelled--not evident in figure 90.

[442] McClure, *Edison and His Inventions*, p. 21.

[443] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, pp. 291-292.

[444] Ibid., p. 291; see also E.C. Kenyon, *Thomas Alva Edison*, (New York: Whittaker, 1896), pp. 103-04.

tend to forget that it shows us the lasting power and importance of Edison's self promotion. Here was a born showman who needed to attract publicity to the facility he had constructed if he was going to acquire the research contracts he needed to survive. The stock room was one part of the publicity campaign. It was said that Edison defied anyone to name one substance, organic or inorganic, that could not be found in his stock room.[445]

The lists of materials delivered to the new laboratory indicate a wide diversity of materials, including peacock feathers and sea horses, and it is also true that in the blizzard of 1888 laboratory employees Fessenden and Aylsworth were able to survive in the laboratory by eating supplies found in the storeroom.[446] Yet the location of the stock room defines its purpose as a source of materials used in the machine shops, and these materials were primarily tools and pieces of metal. There are some indications that there was more than one stock room in the laboratory and it is possible that some of the exotic materials used in electric light and phonograph experiments might have been stored elsewhere.

Building 5, Stock Room, Period II: 1901-1914

Dyer and Martin's 1910 account of the stock room does not differ much from Dickson's report in the 1880s. Several substances related to phonograph records were present in this store room at this time, including clay, asphalt, waxes, resin, and pitch. Dyer and Martin describe

> ...the famous stock-room, about which much has been written and invented. Its fame arose from the fact that Edison planned it to be a repository of some quantity, great or small, of every known and possible useful substance not readily perishable, together with the most complete assortment of chemicals and drugs that experience and knowledge could suggest...Edison determined to have within his immediate reach the natural resources of the world...it is not surprising to find the stock-room not only a museum, but a sample-room of nature, as well as a supply department. To a casual visitor the first view of this heterogeneous collection is quite bewildering, but on a more mature examination it resolves itself into a natural classification--as, for instance, objects pertaining to various animals, birds, and fishes, such as skins, hides, hair, fur, feathers, wool, quills, down, bristles, teeth, bones, hoofs, horns, tusks, shell; natural products, such as woods, barks, roots, leaves, nuts, seeds, herbs, gums, grains, flours, meals, bran; also minerals in great assortment; mineral and vegetable oils, clay, mica, ozokerite, etc. In the line of

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[445] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, p. 290. This myth was passed on by the first to interpret the laboratory; Norman Speiden told visitors that Edison promised a dollar to any laboratory employee who could name something that was not in the store room. Lab Oral Histories, 1973, Columbia Oral History Project, p. 33.

[446] Supplies found in Lab Notebook N-88-06-01.12; blizzard story is from Fessenden, "The Inventions of Reginald A. Fessenden," *Radio News* 7 (August 1925).

> textiles, cotton and silk threads in great variety, with woven goods of all kinds from cheese-cloth to silk plush. As for paper, there is everything in white and colored, from thinnest tissue up to the heaviest asbestos, even a few newspapers being always on hand. Twines of all sizes, inks, waxes, cork, tar, resin, pitch, turpentine, asphalt, plumbago, glass in sheets and tubes; and a host of miscellaneous articles revealed on looking around the shelves, as well as an interminable collection of chemicals, including acids, alkalies, salts, reagents, every conceivable essential oil and all the thinkable extracts. It may be remarked that this collection includes the eighteen hundred or more florescent [sic] salts made by Edison during his experimental search for the best material for a fluoroscope in the initial X-ray period. All known metals in form of sheet, rod and tube, and of great variety in thickness, are here found also, together with a most complete assortment of tools and accessories for machine shop and laboratory work....a stock clerk is kept exceedingly busy all day answering the numerous and various demands upon him....It has no counterpart in the world! [447]

A 1904 photograph by Byron (figure 92) shows that a fence has been added to the waist-high counter that separated the stock room from the passage way. An elaborate time clock is mounted on the corner of the counter. The built-in shelves retain their earlier configuration, as do both sets of cabinets with drawers visible in figures 90 and 92. The cabinet in the foreground of figure 90 has been replaced by a simple table, but in general, most of the supplies visible in the photographs are stored in essentially the same locations. Light fixtures are the same in both photographs, although the wiring, visible on the ceiling, appears to have been updated in the later photograph.

Building 5, Stock Room, Period III: 1915-1931

Photographs taken in 1929 indicate that the wooden barrier and wire mesh were taken down sometime during this period. They were replaced by a different sort of wire mesh with barbed wire attached to its top. Portions of the old barrier were also used in this new fence which is still in place.[448]

Building 5, Heavy Machine Shop, Period I: 1887-1900

Both the heavy machine shop and the precision machine shop were equipped with general purpose machine tools--lathes, shapers, planers, and milling machines--and there was little in the machine shops that could not be found in any well-

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[447] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 645-47.

[448] Uncataloged 1929 photographs in Photograph Album 16. Two photographs depict an Edison portrait by Ellis M. Silvette propped next to the current stock room fence.

equipped shop at that period. Batchelor made a point of ordering machines from well-known manufacturers with reputations for first class products.

The large machines in the first floor machine shop were built to order. Philadelphia's Bement, Miles, & Company made five of the largest machines in the shop: a horizontal boring mill with a six-foot table, a 20-inch planer, a 20-inch lathe, a six-foot universal radial drill, and a 42-inch planer. The latter two remain in the shop today. They are so big that they are supported by brick piers that had to be built before the shop's floor was framed.[449]

Other large machines included two Putnam engine lathes, one with a huge 64-inch swing and a 17-foot-long bed, the other with a 30-inch swing and a 12-foot bed.[450] Many of the small and medium sized lathes, shapers, and drill presses were purchased as stock items. Vouchers indicate that the shop had at least one Bridgeport engine lathe with a 16- to 20-inch swing and a six-foot bed, a Bogert engine lathe with a 16-inch swing and a six-foot bed, and a Pratt & Whitney lathe of the same dimensions.[451]

A photograph taken by W.K.L. Dickson (figure 99) shows the shop as it appeared around 1890. The benches that line the two long walls today were in place, as were the radial drill and 42-inch planer. The 30-inch Putnam lathe, which now stands on the south side of the shop, was first placed in the aisle on the north side toward the courtyard. The faceplate and tailstock of the 64-inch Putnam lathe are visible through the headframe of the planer. The horizontal boring mill was on the opposite side of the central aisle. At least two small lathes and a drill press were installed on the north (courtyard) side of the shop. The photograph shows three more small lathes and what may be a horizontal drum sander on the south side, toward Lakeside Avenue.

Work in this shop depended almost entirely on daylight. The four or five hanging incandescent bulbs with flat reflectors would have done little to provide necessary light for the work.

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[449] Joseph A. Taft, "Specifications of Machinery Foundations" [summer, 1887] in DF 1887, WOL--General, D-87-55; Planer: Voucher 232, March 31, 1887, also Bement Miles to Charles Batchelor, October 11 and 15, 1887 (in DF 1887, WOL--General, D-87-55); Radial Drill: Voucher 233, February 1, 1888, Inspection Certificate, February 2, 1888 (in DF 1887, WOL--General, D-87-55).

[450] Voucher 784, November 16, 1887; Voucher 725, October 20, 1887.

[451] Voucher 138, May 18, 1887; Voucher 450, April 27, 1888; Voucher 1081, September 24, 1888; Voucher 1422, December 10, 1888. E.P. Bullard was exclusive agent for Brown & Sharpe, Bridgeport Tool Co., Slate Machine Co., and Jno. Bogert. Manning, Maxwell, & Moore controlled sales of Putnam and Hendy tools.

Building 5, Heavy Machine Shop, Period II: 1901-1914

The photograph of the machine shop taken by Dickson around 1890 shows a sparsely furnished shop with only a few pieces of big machinery (figure 99). After 1890 the number of new machines purchased dropped dramatically, the result of the end of the construction phase and Edison's preoccupation with ore milling in the New Jersey mountains.

A Byron photo (figure 100) probably taken around 1904, not only shows new machines, but also reveals the general clutter that is characteristic of a working shop. It is safe to say that activity in this shop increased significantly at the turn of the century.

The low beaded wood partition around the steam engine is still visible at the back of the shop, as is the 64-inch Putnam planer. The 30-inch Putnam lathe had been moved to its present location, its back-gear is just visible behind the faceplate of a new 26-inch Fifield lathe. A chain, used to hoist large workpieces between the centers of the Fifield, hangs from a beam, supported by jack-studs at either end of the lathe. The out-of-focus image of an Allen double-spindle drill press can be made out at the right edge of the photo.

The Niles Tool Works in Hamilton, Ohio, received large orders from the Edison laboratory during this period: a 36-inch planer and travelling head shaper show in figure 100, along with the tools for the vertical boring mill. The Putnam horizontal boring mill was probably gone; the Niles planer stands in its place and the vertical boring mill could have taken over most of its work.

The shop was clearly engaged in large-scale machining. A large (about nine feet long) partially turned shaft sits on a six-wheel truck in the foreground of figure 100. A large assembly with cable sheaves at either end rests in the center aisle; another sheave is leaning against the Fifield lathe. A good-sized cast-iron flywheel stands on edge at the end of the travelling-head shaper.

During this period the machine shop was kept busy making a great number of machines to be used in the mass production of records and storage batteries. It produced the automatic disc presses that went into the disc record plant.[452] It also produced the special recording machines that were used to make master discs in the studios.

A great variety of machine tools and special dies were built for the storage battery factory across Lakeside Avenue. The manufacture of these batteries was highly

[452] "TAE, Incorporated, Statement Showing cost of development work now being done for us at the Laboratory." [as of September 1, 1914] (in DF 1914, Thomas A. Edison, Inc.--Financial).

automated and the design and manufacture of the machine tools was a considerable achievement for the laboratory.[453]

At least four arc lights appear in figure 100. This is surprising because arc lights were notorious for producing harsh light and noxious odors and were seldom used indoors.

Thomas A. Edison, Inc. commissioned an extensive set of large format photographs of the laboratory in April 1914. These included nine views of the first floor machine shop. Figures 101 through 109 show a number of changes since the 1904 Byron photo and include almost all of the machines that are in the shop today. An inventory and floor plan, made by New York Appraisal Company in 1920, provides additional details and specifications.

Figure 101 is a view of the southwest corner of the shop taken from the courtyard door. Figure 102 was taken from the door next to the stock room. The 64-inch Putnam lathe disappeared sometime between 1910 and 1914 and a number of new machines arrived: a Landis cylindrical grinder, a double-spindle drill press near the Lakeside Avenue door, a single-spindle drill press, two lathes, two shapers, and another double-spindle drill press along the north edge of the south aisle. Figures 103, 104, and 105 are of the south aisle of the shop, on the Lakeside Avenue side.

The 1914 photographs are the first to show anything of the north aisle, on the courtyard side (figures 106 and 107). It is difficult to trace changes on that side of the shop any more specifically than saying that there were no milling machines there around 1890 and three in place in 1914.

The steam engine was removed in 1910 and replaced by two DC electric motors mounted on a platform at the east end of the shop (figure 108). These received current from a new powerhouse, Building 10, in the Edison Phonograph Works.

Photographs of the machine shop indicate a subtle change in the use of space. Dickson's ca.1890 photograph shows an open area with a few very large machine tools. The 1906 view shows some rearrangement of the shop and the addition of four more large-scale machines, along with the general clutter of a busy operation. By 1914 the biggest lathe and the steam engine were gone and the shop was crowded with medium-sized general purpose tools.

In early 1914 Hutchison put in a stairway from the heavy machine shop to the precision room upstairs. It began on the east side of the shop, by the toilet, and

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[453] See a series of articles in *American Machinist* in 1911.

came up next to room 10. Its purpose was to save time waiting for the elevator and to cut down the traffic from the second floor to the main entrance, which took workmen past the library (figure 106).[454]

World War I brought a program to train war workers, including women and boys, in the machine shops. This operation was also carried out in Building 6.[455]

Building 5, Heavy Machine Shop, Period III: 1915-1931

The machine tools in this shop remained basically unchanged during this period. In 1918, Charles Luhr, the superintendent of the shop, admitted that it was not equipped with the most up to date machines: "It is very ancient material." The chief engineer complained of the difficulties in persuading Edison to buy new equipment: "The last thing to get anything is the laboratory."[456]

Building 5, Edison's Room (Room 12): Periods I, II, and III

Edison maintained a personal experimental room on the second floor, located by Dyer and Martin: "first in order as one leaves the head of the stairs leading up to [the second] floor."[457] Sidney Davis worked as a laboratory assistant on the second floor in 1899 and remembered "a little laboratory directly across the hall" occupied by Edison.[458]

Dyer and Martin provide more details about the room's furnishings in their 1910 description:

> Plain of aspect, being merely a space boarded off with tongued-and-grooved planks--as all the other rooms are--without ornament or floor covering, and containing only a few articles of cheap furniture, this room seems to exercise a nameless charm for him. The door is always open, and often he can be seen seated at a plain table in the centre of the room, deeply intent on some of the number of problems in which he is interested. The table is usually pretty well filled with specimens or data of experimental results which have been put there for his examination....Always at

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[454] MRH to TAE, February 24, 1914 (in DF 1914, Battery, Storage--Testing).

[455] "Floor Areas Laboratory Building," November 25, 1918, in DF 1918, WOL.

[456] "Meeting of the Executive Committee - Verbatim Report," May 16, 1918, Thomas, A. Edison, Inc. Records, Box 40.

[457] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 649.

[458] Edison Pioneers Records, Box 21.

hand will be found one or two of the laboratory note-books, with frequent entries or comments in the handwriting which once seen is never forgotten.

No. 12 is at times a chemical, a physical, or a mechanical room--occasionally a combination of all, while sometimes it might be called a consultation-room or clinic --for often Edison may be seen there in animated conference with a group of his assistants; but its chief distinction lies in its being one of his favorite haunts, and in the fact that within its walls have been settled many of the perplexing problems and momentous questions that have brought about great changes in electrical and engineering arts...."[459]

A floor plan of 1916 shows that there was a small partitioned room within room 12. It had two doors--one opening into Edison's room and the other opening in room 11. Figure 113 shows Edison standing near what may be the wall of this small room. This 1898 photograph shows rows of shelves covered with chemical bottles along the east wall, although other evidence (cited in the occupancy section of this report), suggests that Edison carried out more than just chemical experiments in his room. Figure 114 shows Edison inside this room, but the image provides little information about the room's furnishings.

The function of this small room remains unknown. The situation of the doors indicate that the room was designed to provide secrecy. Dyer and Martin tell us that the door of room 12 was always kept open and thus Edison would not have had a private place in which to work. Edison wanted a secret experimental room to work in: he made this clear to Batchelor when they were planning the laboratory when he said that he wanted "a special or secret part to Machine shop for special things I want sub rosa."[460]

It was commonplace in the laboratory to set up secret rooms. Hutchison told Edison in 1913 that he had set up an experiment with his assistant Norton: "It's done in secret in a small room, top floor, east end" (on the third floor of Building 5).[461] It was also a regular practice to partition rooms within rooms.[462] The fact that there is little documentation of this room tends to support the argument that it was a secret room. Alterations made after 1916 removed the small office from room 12, Edison's room.[463]

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[459] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 649-50.

[460] TAE to Charles Batchelor, April 6, 1887 (in DF 1887, WOL--General, D-87-04).

[461] MRH to TAE, August 24, 1913 (in DF 1913, WOL).

[462] For example, Shop Order 1493 (ca.1903), Notebook N-99-06-24.1, states "partition off room in Room 13."

[463] Floor Plan, November 26, 1916.

Building 5, Room 10 and Room 11

No direct evidence has been located to indicate the function of these two rooms, directly east of and adjacent to Edison's room 12.

The rooms are alike in that both received power from the machine shop via belts running along the ceiling of the second floor. The marks made by the shaft hangers and pulleys in the ceiling are clearly visible today.

Building 5, Precision Machine Shop, Period I: 1887-1900

Figure 117, the precision department in the eastern half of the second floor of Building 5 before 1893, shows the space divided into experimental rooms on the south side, and a machine shop with light and medium metalworking tools on the north (courtyard) side. The experimental rooms were enclosed by vertical plank walls, similar to those elsewhere on the second floor. Continuing the numbering system used on the rest of the floor, the rooms were numbered from 5, at the western end near the elevator, through 9, at the eastern end of the floor. A 3-1/2 to 4-foot-high railing, also sheathed in vertical beaded planks, ran along the opposite side of the central aisle, forming a clear space between the experimental rooms and the machine shop. (A vestige of that railing survives as a counter near the stairwell.)

Machine tools included a 42-inch Bridgeport planer, at the east end of the shop, a Brown & Sharpe milling machine, several engine lathes, and four or five precision bench lathes. Power was carried from the steam engine and shafting on the first floor by way of a belt-chase at the rear of the shop, next to the planer.

Building 5, Precision Machine Shop, Period II: 1901-1914

A 1904 photograph by Byron (figure 116) shows the eastern end of the north aisle of the second floor machine shop. In this section, the general arrangement of machines is strikingly similar to the arrangement that survives today. The planer, milling machines, and lathes are all in the positions they now occupy. The arc light, seen hanging from the ceiling, was removed by 1914 (probably to the relief of all who had to work near it). The belt chase, that brought power from the steam engine on the first floor, was closed off after electric motors were installed in 1910.

Deep shadows and general gloom on the left side of the photograph suggest that the experimental rooms still lined the south side of the floor, blocking any light from that direction. The interior of one of those rooms is shown in a 1904 Byron photo of Charles Dally and the X-ray machine (figure 128).

A night photograph of Edison leaning on the bench in the precision shop, taken by Underhill about 1905 (figure 117) shows precision bench lathes, vises, stools, and the general clutter of a working shop.

Dramatic changes took place sometime between 1904, when the Byron photos were taken, and 1913. Most of the experimental rooms were dismantled during this period, nearly doubling the open space of the precision machine shop. Only room 5 and an enclosure around the elevator remained.[464]

In February 1914, Miller Reese Hutchison ordered that a stairway be built between the first and second floor machine shops, in order to reduce traffic on the stairs by the library.[465]

An October 1913 inventory and photographs taken in April 1914 show a much larger complement of machine tools.[466] A comparison of photographs show that the north aisle remained largely the same.[467] The newly opened south aisle, shown in figure 122, contained three shapers, two lathes, a filing machine, and a drill press. Tables, probably used for assembly work, or perhaps some experimental activities, occupied the eastern bay of the south aisle. A double-spindle drill press, table saw, rolling mill, and screw press faced the south side of the center aisle, while a long tinsmith's bench occupied the north side.

Figure 123 shows a double row of triangular wood stringers attached to the ceiling. These once supported the upper end of the plank partition around the experimental rooms. Similar cleats are also visible from partitions that divided the rooms one from the other.

[464] The interior of room 5 is shown in figure 129 from the April 1914 series.

[465] MRH to TAE, February 24, 1914 (in DF 1914, Battery, Storage--Testing). The stairs were done by April, when the photographs were taken.

[466] "Edison Laboratory, Inventory taken October 1913, Second Floor Machine Shop," Edison NHS. See photographs 10.388/16, 2528; 10.388/14, 2525; 10.388/21, 2660; 10.388/23, 2677; and 10.388/8, 2515 in Edison NHS collection, not reproduced in this report.

[467] See figures 116, 118, 119, and 121.

Building 5, Precision Machine Shop, Period III: 1915-1931

As in the rest of the Edison complex, wood window frames and sash were replaced by steel during the spring of 1915. Comparison of the 1914 photographs and a 1920 sketch plan suggest that these changes had little, if any, impact on the arrangement of machinery in the second floor shop.

A 1916 floor plan shows room 5, but its partitions were gone by 1920, when J.C. McGarvey drew a sketch map of the second floor machine shop to accompany his inventory and appraisal of its contents. By that time, a small wood and wire tool crib occupied part of the space. Room 5 may have been dismantled by November, 1918, when a memo noted that the second floor machine shop occupied as much floor area as the one below.[468]

The 1920 appraisal, the comprehensive set of photographs and inventory compiled under the direction of Norman Speiden in 1939, and subsequent notes on the E-cards generated by that inventory, provide a general sense of how the precision shop has changed since 1915.

A surface grinder and a universal cutter and reamer grinder by Brown and Sharpe were installed between 1916 and 1920 in the area previously occupied by room 5. Eleven machines were removed between 1920 and 1939--one single-spindle and two double-spindle drill presses, rolling mill, planegraphic engraving machine, table saw, cutter grinder, Brown & Sharpe no. 3 universal milling machine, and two engine lathes. A Binesse surface grinder from the first floor shop replaced the Brown and Sharpe. Nine machines (including four bench lathes) were moved to different locations within the shop.

The most noticeable change involved removing four Sloane & Chase precision lathes from the bench along the north wall and setting them up on a newly constructed bench in the southeast corner of the shop. A large (20-inch) Lindgren drill press, originally installed in the first floor shop between 1920 and 1939, was moved to the second floor in 1942. A 14-inch drill press was moved in from Building 1 after 1939.

The long free-standing tinsmith's benches and bench tools appear to have been fairly mobile. One of them was tucked into the southeastern corner of the shop in 1914, at right angles to the main aisle. The sketch that accompanied the 1920 inventory shows it turned 90 degrees. Both benches are on the north side of the

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[468] "First & Second Floor Plan of N° 5 and Plan of N° Bldgs., Edison Laboratory, West Orange, N.J.," Nov. 26, 1916; J.C. McGarvey, New York Appraisal Company, "Inventory and Appraisal," 1920; "Thomas A. Edison Personal, Floor Areas Laboratory Building," November 25, 1918 (in DF 1918, WOL--General). Some of the cleats that held the partition dividing room 5 are still attached to the ceiling in section 60.

center aisle in the 1939 photos. By 1981, one of them was on the opposite side, but it migrated back during the ensuing decade.

Building 5, Second Floor Vacuum Pump Room and Glass Blower's Room, Period I: 1887-1900

It is likely that the vacuum pump room and glass blower's rooms were located on this floor. A shop order for 1890 describes work on room 11 for experiments on bulbs,[469] and John Dorr stated that he helped Fessenden develop filaments in an upstairs room.[470]

The vacuum pump room would have contained one or more vacuum pumps to evacuate air from the incandescent bulbs. Dickson reported that the vacuum pump room was devoted to experimental bulbs and several notebooks from this period testify to the great amount of experimental work that was done on new types of incandescent bulbs. Presumably there would have been stocks of bulbs on shelves and experimental light bulbs strewn around this room. Dickson described the adjacent glass-blowing room as "devoted to the construction of the experimental lamps."[471] It would have been equipped with glass blower's jets.[472]

Building 5, Second Floor Vacuum Pump Room and Glass Blower's Room, Period II: 1901-1914

The vacuum pump room and glass blower's rooms were still in the laboratory when Dyer and Martin were writing their book before 1910. They noted: "The tools and appliances are kept intact, for Edison calls occasionally for their use in some of his later experiments, and there is a suspicion among the laboratory staff that some day he may resume work on incandescent lamps."[473] Dyer and Martin also mention that these rooms are of historic value "by reason of the strenuous work done on incandescent lamps and X-ray tubes within their walls."

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[469] Shop Order 447 (1890).

[470] Edison Pioneers Records, Box 21.

[471] Notebooks N-87-12-10.1, N-88-02-02, and N-90-11-07; see also Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, p. 295.

[472] Several glass blower's jets have been found in building 2. They are arranged to be attached to a tabletop.

[473] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 648.

However, they also point out that the glass blowing and vacuum pump rooms are "adjacent" to "several others devoted to physical and mechanical experiments, together with a draughting-room."[474] This placement suggests that the two rooms are on the south side of the building, east or west of room 5.

The shop orders for 1907 show that Edison was still experimenting on incandescent and fluorescent lamps and thus it is possible that he did call on the resources of these rooms.[475]

Building 5, Second Floor Experimental Rooms, Period I: 1887-1900 and Period II: 1901-1914

These rooms were devoted to "physical and mechanical experiments" according to Dyer and Martin.[476] The changing experimental projects undertaken at the laboratory probably brought about changes in the experimental rooms. Partitions were erected or removed and new equipment moved in. The old experimental material went into storage.[477]

Building 5, X-Ray Room. The X-ray room was probably one of the experimental rooms on the south side of the precision machine shop. This room could be the one shown in figure 128, a ca.1904 photograph. It shows one of the columns and the typical wood panelling of these rooms. The room contains an Edison fluoroscope, the first X-ray machine, and electrical equipment.

Building 5, Room 5. Room 5 was set up as Dickson's room and it was here that Dickson developed the motion picture camera. This project was carried out in great secrecy. The room was kept locked and only Dickson and his assistant, Charles Brown, were allowed inside. On the door was "a little shutter" for communication.[478]

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[474] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 648-49.

[475] Shop Orders 1963 and 1973, Notebook N-99-06-24.1.

[476] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, pp. 648-49.

[477] TAE to S. Moore, August 1, 1911 (in DF 1911, Phonograph--Manufacture). "Nicoli will have your room ready soon. Let Nicoli store all the stuff you don't want and move what you do want into the new room."

[478] Evidence, *TAE v. American Mutoscope and Benjamin Keith*, Legal Box 173, p. 138.

Edison had acquired Bausch and Lomb microscopic photographic equipment to take the small pictures that Dickson affixed to an enlarged phonograph cylinder apparatus. This would have been used in room 5 along with the various prototype film cameras.

The experiments with motion pictures were moved out of this room in the mid-1890s because Dickson was bothered by the noise of the elevator--the room was probably too cramped to carry out experiments on projection.

A 1914 photograph shows an experimental room which is probably room 5 (figure 129). The room contains a special milling machine to make parts for storage battery manufacture. It is powered by a pulley running off a drive shaft that cuts across the top of the room.

Building 5, Second Floor Experimental Rooms, Period III: 1915-1931

A floor plan of 1916 shows that the experimental rooms that ran along the south side of the precision machine shop extended to the third column, about 20 feet from the elevator. The fronts of these rooms are seen in a photograph taken in 1915 (figure 125). After the fire in 1914 production schedules for the Phonograph Works were laid out for Edison to inspect and they were placed against the doors of experimental rooms on the second floor. The same photograph shows a counter covered with junk, running parallel to these offices.[479]

Alterations made between 1916 and 1920 eliminated experimental rooms on the Lakeside Avenue side of the precision shop. A tool crib was installed on the south side of the precision shop, in place of some experimental rooms, sometime during this period.

In 1920 the partitions between the "old Construction Engineering Dept and the second floor Machine Shop (Tool Cribs)" were removed to give more space to the machine shop.[480] This change may represent the removal of the last experimental rooms (probably rooms 4 and 5) in what is now the precision machine shop.

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[479] See figure 125. Production charts showing the recovery of the Edison enterprise from the fire were also laid out in the library.

[480] Laboratory labor and Material Ledger Pages [unbound], 1918-1931, May 26, 1920, Accounts Books Records.

Building 5, Drafting Room, Period I: 1887-1900 and Period II: 1901-1914

Dyer and Martin mention the drafting room in 1910 and locate it on the second floor of Building 5.[481] Little is known about this room in the period before 1910. It was located on the south side of the floor, between the stairway and the precision machine shop. John Ott supervised the drafting room at some point, as did Charles Schiffl (see p. 67 for more on Charles Schiffl and p. 71 for more on John Ott).

The creation of the Engineering Department brought organizational and physical changes to Building 5 around 1911. The new offices probably occupied the space once reserved for the drafting room. No longer only a drafting department, the new department was called an "engineering and experimental department" by Edison and its job was to design new parts and products, draw and list them, and handle the transfer of blueprints, specifications, and models to the relevant production departments in the Edison Phonograph Works.[482] The Chief Engineer was in charge of this department and he supervised the drawings and the issuing of engineering notices which notified the staff of changes in design.[483]

The shop orders to make up equipment for the Engineering Department were executed in 1911. They included making a cabinet for the testing department and building a filing case for the Engineering Department.[484]

Building 5, Drafting Room, Period III: 1915-1931

In 1921 all the equipment from the second floor drafting room was moved upstairs to the Engineering Department Offices. Henry Altengarten's office and equipment was then moved from the library to these second floor offices.[485]

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481 Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 649.

482 Dyer Memo, March 25, 1910 (in DF 1910, Phonograph).

483 C. Wilson Memo, June 24, 1910 (in DF 1910, Phonograph).

484 Shop Orders 2541 and 2542, Notebook N-09-01-29.

485 Ibid., March 29, 1921.

Building 5, Third Floor, Period I: 1887-1900

Little evidence is available about the configuration and uses of the third floor of Building 5 during Edison's first years at the West Orange laboratory. Dickson mentions the lamp test room, the exhibit hall, and the lecture hall, which was formerly a room "in use for musical experiments in connection with the phonograph."[486] There were several experimenting rooms on this floor: some devoted to chemical experiments to find better waxes for records and others concerned with electrical experiments. A newspaper report described "a score of smaller apartments in the building, each of which is fitted up for some special object."[487] Note that experimental rooms probably existed on both the second and third floors.

Building 5, Third Floor, Recording Studio. The large open space at the west end of this floor was devoted to experiments with recording during this period. The first recording machines were not sensitive enough to require sound proofing of the studio with drapes or fabric. Recording could therefore be carried out in this large open room where there was also space for lectures and performances. This room was also the site of experiments on the phonograph in the late 1890s. Efforts to devise a long playing record, a cylinder of six inch diameter, were made on the north side of this floor in the music room.[488]

Building 5, Third Floor, Lamp Test Room. This room was set up to carry out duration and efficiency tests of Edison incandescent bulbs. The room was filled with a large rack with connections for numerous lamps: an "aggregation of shining bulbs" as Dickson described it.[489]

Building 5, Third Floor, Period II: 1901-1914 and Period III: 1915-1931

A survey of the third floor found evidence of numerous partitioned rooms and other changes in the layout of offices. Photographic evidence indicates that the

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[486] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, pp. 295-98.

[487] The *New Orleans Picayune*, July 22, 1888.

[488] Memorandum, "Long-Playing Records," William A. Hayes to Harold G. Bowen, undated (in DF 1914, Phonograph, Record, Manufacture). Although located in the 1914 Document File, the memorandum was written much later as there are references to 1920's experiments.

[489] Dickson and Dickson, *The Life and Inventions of Thomas Alva Edison*, p. 295; see also "Edison's New Laboratory," *Scientific American*, September 17, 1887, p. 184.

floorboards were completely covered some time between 1904 and 1910. Only one small room at the west end of the floor retains the old floorboards, which are broader than the new ones and run east to west rather than north to south as they do now. This floor was conveniently divided by two central partitions into three broad areas: a storage battery testing area, a central open area, and a music room area. A line of experimental rooms (containing the photographic room) stretched along the Lakeside Avenue side.

Dyer and Martin described the third floor in 1910:

> Passing now to the top floor the visitor finds himself at the head of a broad hall running almost the entire length of the building, and lined mostly with glass-fronted cabinets containing a multitude of experimental incandescent lamps and an immense variety of models of phonographs, motors, telegraph and telephone apparatus, meters, and a host of other inventions upon which Edison's energies have at one time and another been bent. Here also are other cabinets containing old papers and records, while further along the wall are piled up boxes of historical models and instruments. In fact, this hallway, with its conglomerate contents, may well be considered a scientific attic....In the front end of the building, and extending over the library, is a large room intended originally and used for a time as the phonograph music-hall for record-making, but now used only as an experimental-room for phonograph work, as the growth of the industry has necessitated a very much larger and more central place where records can be made on a commercial scale. Even the experimental work imposes no slight burden on it. On each side of the hallway above mentioned, rooms are partitioned off and used for experimental work of various kinds, mostly phonographic, although on this floor are also located the storage-battery testing-room, a chemical and physical room and Edison's private office, where all his personal correspondence and business affairs are conducted by his personal secretary, Mr. H. F. Miller. A visitor to this upper floor of the laboratory building cannot but be impressed with a consciousness of the incessant efforts that are being made to improve the reproducing qualities of the phonograph as he hears from all sides the sounds of vocal and instrumental music constantly varying in volume and timbre, due to changes in the experimental devices under trial.[490]

Additional power for the third floor was also required:

> A new power line (3 wires 240 & 120 volts) was run up from the Phonograph Works, and connected to top floor of Laboratory on April 17, 1910. A wattmeter is connected to each side of the system, the one to the right (South) recording power used in Room #14 exclusively except for a few lights in Anderson's room; the one to the left recording power used in our small cell room and H.F. Miller's and Petits [sic] rooms.[491]

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[490] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 651.

[491] Notebook N-10-05-12,

The third floor underwent a significant change in 1912. The storage battery test department, the major installation since the early part of the twentieth century, was dismantled at this time and the space on the third floor redistributed.

Building 5, Third Floor, Storage Battery Test Department

This department was the major installation during Period II and it occupied most of the floor. The function of the storage battery test department was to test the new alkaline iron nickel storage batteries which were suffering from loss of charge. These rooms contained racks of batteries connected to accumulators and ammeters. Each battery was charged and then the discharge curve plotted as it ran down. A 1905 shop order calls for putting in a charging station, probably on this floor.[492]

A series of photographs taken by Miller Reese Hutchison gives an almost complete picture of this installation. Desks and tables occupied the south Lakeside Avenue side of the floor. Battery testing equipment was placed between this area and the central partition (see figure 137). (See schematic plan 6.) Equipment related to battery testing, such as accumulators and ammeters, was positioned against this partition.

More racks of batteries ran down the north side of the eastern section of the third floor (figures 134 and 136). Some of these banks were parallel to the side wall and some were positioned at right angles. There were also tables on which the youths could note the results on their tests in laboratory notebooks.[493] A partition divided this room; on the south side was the "Speaker Experimental Room" (figure 138).

Building 5, Third Floor, Educational Film Studio

In 1912 the storage battery test department was moved to the storage battery factory. In the same year much of the space used by this department was converted into a film studio for Dinwiddie's educational films.[494] Under Miller Reese Hutchison's direction, several partitions on the south side of the floor were removed and the greatly enlarged area was used by Dinwiddie to make films. This was a large open space that occupied about one quarter of the floor.

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[492] Shop Order 1782, Notebook N-99-06-24.1.

[493] Album 10, (MRH album), pp. 37-41.

[494] Shop Orders 3136 and 3137, Notebook N-09-01-29.

Hutchison also cleared out some of the cubbyholes in the music room to make more space. A floor plan of these projected changes shows the music room at the west end of the building with Dinwiddies's educational film studio at the east end (see schematic plan 7 and cutaway of Building 5). (See p. 37 for more on Walter Dinwiddie.)

A major change was made in 1916 on the east side of the building. A whole new complex of offices and rooms made up the Engineering Department in place of the educational film studio.[495] (See schematic plan 8.)

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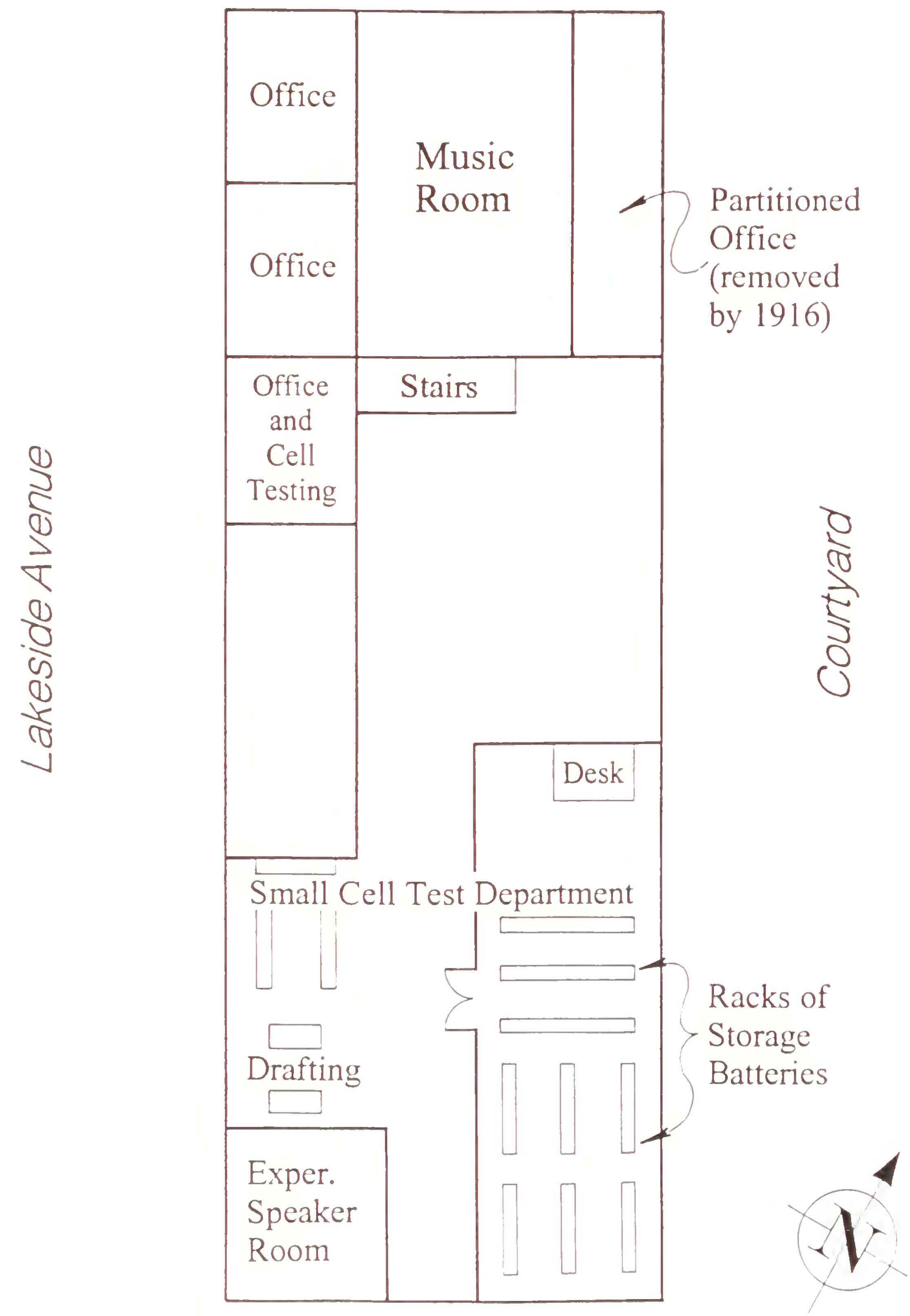
495 In DF 1916, WOL.

Schematic Plan 6

THIRD FLOOR, c. 1910

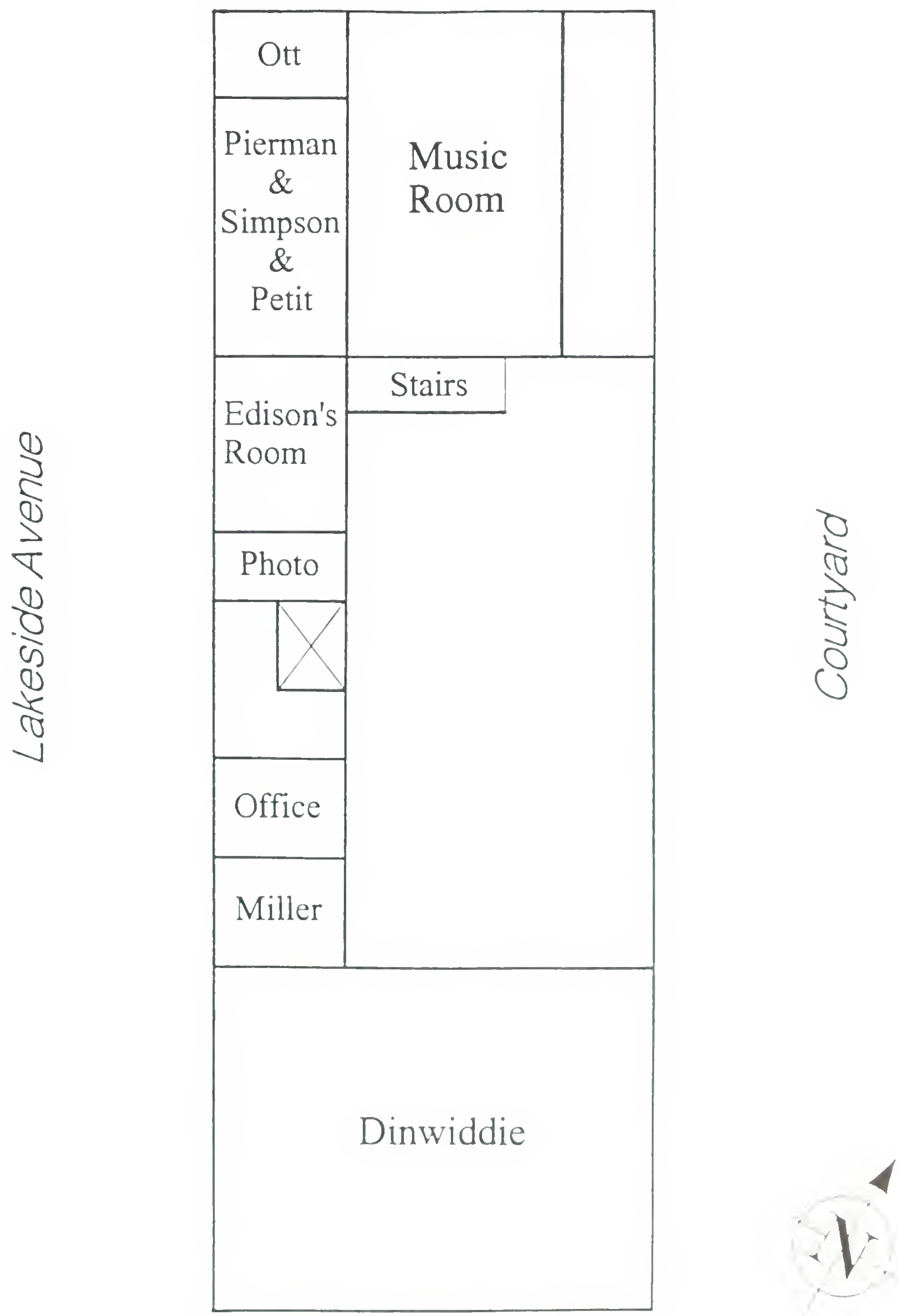
(not to scale)



Schematic Plan 7

THIRD FLOOR, c. 1912

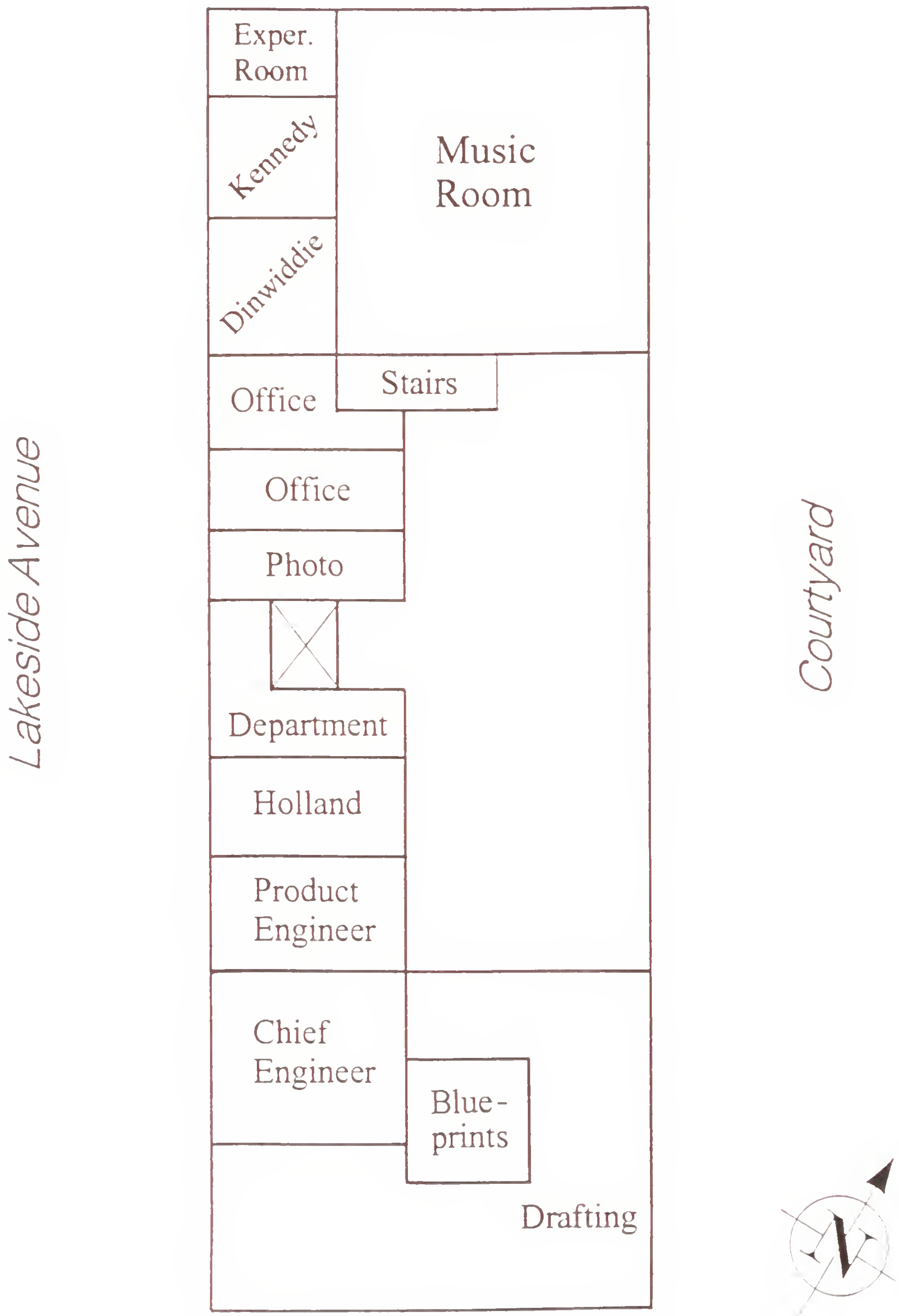
(not to scale)



Schematic Plan 8

THIRD FLOOR, c. 1916

(not to scale)



Building 5, Third Floor, Central Open Area

In between the film studio and the former music room was a large open space. This remained an open area without partitioned rooms, except for the experimental rooms on the Lakeside Avenue side. There are two extant photographs of this area available for this period. One shows Charles Dally inspecting a disc record with the experimental rooms in the background (figure 140). A large three section cabinet with glass doors is situated against the wall of the rooms.[496] The other photograph shows the courtyard side of this area (figure 141). It contains several tables, some film equipment, and some phonographs in dust covers. An overhead pulley is visible.

Building 5, Third Floor, Music Room

By the time Dyer and Martin were writing in 1910, they explain that the former "phonograph music-hall for record-making" was used as an "experimental room for phonograph work."[497] A 1912 newspaper article described the phonograph testing room as a small partitioned room "roughly boarded off from the big room" (the music room) where Edison was intently listening to a phonograph (see figure 139).[498]

In 1916, the partition dividing the music room was removed.[499] By 1917 the music room was used as office space (see figure 143).

Building 5, Third Floor, Offices (South Side)

On the south side of this area was a row of offices, with the photographic department (with dark room) in the middle, next to the elevator. This area also contained experimental rooms and a space reserved for Edison.[500]

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[496] The cabinet (E-1715) is still present on the third floor.

[497] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 650.

[498] The *Milwaukee Sentinel*, August 8, 1912.

[499] John P. Constable to R.W. Kellow, September 23, 1916, Recording Division and Related Records; John P. Constable to Charles Edison, September 19, 1916 (in DF 1916, WOL).

[500] MRH to TAE, October 29, 1912 (in DF 1912, WOL--General).

The offices on this side of the building included:

Albert Petit's experimental room. This room was probably on the west end of this row of offices. It contained a screw press to make molds from disc masters.[501] Petit's room was specifically mentioned when new power lines were installed to the third floor in 1910.[502]

Fred Ott's experimental room. During Period II this room was at the end of the row, in the northwest corner of the building, with windows overlooking Lakeside Avenue and Main Street. A 1914 photograph shows a plain room encircled with a counter top (figure 142). A small lathe stood on the counter connected to an overhead belt. The only furniture visible in the photograph is a chair, stool and a small cabinet.

Photographic department. This group of three rooms around the elevator served as the location of the department charged with producing photographs of the laboratory, its founder, and various Edison products. These were used in public relations and product promotion. One of these three rooms was a darkroom.[503] The amount of work carried out by this department increased during this period. In 1914 Hutchison wrote to Edison about enlarging the operations of the Photographic department. As it was impossible to expand on the third floor of Building 5, Hutchison suggested that this department annex the experimenter Greene's old room in Building 1, which was not being used at that time, and use it as a printing room.[504]

During Period III, the offices on the south side (Lakeside Avenue) of the music room were changed by moving the partitions and three offices were created to replace the two made up in 1912. The row of offices on the south side were further changed by installing product engineers in what had once been occupied by the laboratory general office and Harry Miller's room.

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[501] TAE to Fred Ott, August 1, 1911 (in DF 1911, Battery, Storage).

[502] Notebook N-10-05-12.

[503] See floor plan, appended to MRH to TAE, October 29, 1912 (in DF 1912, WOL--General).

[504] MRH to TAE, January 12, 1914 (in DF 1914, WOL--Photographic Department).

Building 6, Powerhouse, Period I: 1887-1900

Building 6 may have been the site of the infamous electrocution experiments of the "Battle of the Systems" (figure 147). Edison set out to prove that alternating current was dangerous and succeeded in this goal by carrying out a series of highly publicized experiments at the West Orange laboratory. To carry out the experiments, a Siemens alternator was acquired and its output connected to a metal sheet placed on the floor. Several small animals were coaxed onto the sheet and the current applied.[505]

The newspapers provided artist's impressions of the experiments, which were greatly exaggerated, but there were no photographs ever published of the interior of the building that hosted the "Battle of the Systems." David T. Marshall was one of the laboratory staff who witnessed these experiments by looking through the windows of the room from the courtyard.[506] The experiments probably took place either in Building 6 or Building 1, but the evidence does not clearly indicate which building was used.

A review of a drawing and a photograph of Building 6 (figures 145 and 146) shows a lineshaft in the bottom of these figures that was a likely place to attach the Siemens alternator used to generate the high voltage current. If this lineshaft was used, the electrocution experiments were carried out in what is now the museum in the Edison National Historic Site, just across the room from the visitor information desk.

Building 6, Period II: 1901-1914 and Period III: 1915-1931

In the twentieth century electricity to the Edison laboratory complex was supplied by the Phonograph Works. The steam engines were taken out in 1910 and two large electric motors placed in the machine shop to power the overhead shafts.

Laverty noted that "the old steam engine" in the machine shop was stopped in the summer of 1910 but not taken out, and electric motors were installed.[507] The

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[505] Kennelly's meticulous accounts of these experiments, with drawings of the circuits, can be found in "Record Book of Galvanometer Building," Notebook N-88-05-24 and "Record book No. 3 of Galvanometer Building," Notebook N-88-06-06. A detailed account of these events is given by Thomas P. Hughes, "Harold P. Brown and the Executioner's Current: An Incident in the AC-DC Controversy," *Business History Review*, XXXII (1958), pp. 143-65.

[506] Marshall, *Recollections of Edison*, p. 66.

[507] Historian's Note 90.

boilers continued to supply steam to the laboratory buildings until around 1914-1915 when steam was piped in from the Works.[508]

The boilers and steam plant of this building were removed to make another garage. Into this space went one of Edison's automobiles and the automobile motors used to test lighting equipment devised in Building 1. In 1914 Hutchison reported to Edison that this equipment was taking up all the room in this space.[509] By 1917 an automobile battery charging station was installed in Building 6 as part of the project to develop electrical systems for Ford motor cars.[510]

THE POST-EDISON YEARS: Period IV: 1932-1962

Historical Occupancy and Furnishings

The activities of the laboratory in the years after Edison's death are not well documented at the West Orange site. The fame and prestige of the great inventor were responsible for the accumulation of documents and for the publication of memoirs and accounts of his life. With Edison dead there was no reason to be interested in the remnants of his laboratory and what it was doing in the 1930s and 1940s. The records of a small laboratory basically concerned with production engineering were not deemed important enough to preserve.

The collapse of Edison's phonograph business in 1929 was nearly as great a disaster to the laboratory as the death of its leader. The phonograph product had been the basis of the prosperity of Thomas A. Edison, Inc. and had been a foundation of the West Orange laboratory in the twentieth century. Even in decline in the 1920s the revenue from phonographs and records had been an important source of income for both laboratory and company. With the phonograph gone, the laboratory and Works were deprived of a major function. Thomas A. Edison, Inc. continued with the manufacture of radios, dictating machines and batteries.

The Great Depression had already begun when Edison died and it reduced the declining business of Thomas A. Edison, Inc. even more. Only the dictating machine and batteries remained as viable products through the 1930s, supported

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[508] *Edison Phonograph Monthly*, January 1916, p. 9.

[509] MRH to TAE, February 2, 1914 and July 1, 1914 (in DF 1914, Automobiles).

[510] Mr. Horner to John P. Constable, 1917 Thomas A. Edison, Inc. financial accounts, Engineering Department files.

by a lesser cast of small products such as spark plugs and medical gases. The management was ready to branch into whatever products could keep its men at work.

The problem for the West Orange laboratory was that each of these products was made by a separate division of Thomas A. Edison, Inc. and each division had its own laboratory and its own production engineering staff. Thomas A. Edison, Inc was made up of several factories in New Jersey: Bloomfield, New Village, Kearney, Silver Lake, and West Orange.[511] Policy introduced in 1915 established a modern divisional structure in the Edison enterprise and had given each division manager freedom to develop his own product. These managers naturally wanted to control research and development on their products and soon set up their own laboratories. By 1920 there were signs of rivalry between these divisional laboratories and the central laboratory at West Orange.

While Edison was alive he looked after the interests of his West Orange laboratory and ensured that it got the funds to continue work. It was understood within Thomas A. Edison, Inc. that "the laboratory is under the special protection of Mr. Edison" in the struggle to obtain research dollars within the organization.[512] With Edison dead, money for research immediately reverted to the divisional laboratories. Edison's family closed the facility and its employees went into the laboratories and factories of the various divisions. A 24-hour watch was established over the silent buildings of the West Orange laboratory and a special pass was required to gain entrance.[513]

The picture emerging of the laboratory in the 1930s is one of a group of buildings almost empty of people but full of objects: boxes of documents and old files, machinery and "historically interesting equipment," cans of film, magazines and books, and anything that might have come into contact with the great man.[514] The laboratory was described as having the atmosphere of a necropolis.[515]

When Edison died the response of his family and some devoted members of his laboratory staff was to preserve things that had been associated with him. This

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[511] Scrapbook (cat. 44,472), "Miscellaneous 1937-1940," Scrapbook Collection.

[512] "Minutes of Executive Committee Meeting," May 12, 1920, in DF 1920, WOL--Financial.

[513] Norman R. Speiden interview, June 6, 1973, Oral History Project, p. 1.

[514] "Historical Department Progress Report," February 11, 1936, in Historical Research Dept., Reports and Correspondence relating to the History of the Edison Laboratory from 1935 to 1949.

[515] C.S. Williams to Mrs. Edward E. Hughes (Mina Edison had remarried), Charles Edison and Theodore Edison, December 15, 1938, Historical Research Dept.

process of preserving historically significant artifacts and documents had begun as soon as Edison arrived at West Orange, for such important inventions as the vote recorder and the automatic telegraph had been deposited in Building 1 and shown on occasional special tours. In fact the conversion of the laboratory into a museum had begun before Thomas Edison died. In the 1920s Charles Edison began a program to clean and preserve "articles of Historical Value."[516] Even Edison's time cards did not last long in the rack next to the time clock outside the library--they were prized as souvenirs.[517]

The impulse to preserve, to create a shrine to the great inventor, ran simultaneously with the more pressing problem of cleaning up the site. Thomas A. Edison, Inc. was in the middle of a serious depression and had to cut back. The half empty laboratory became a place to dump the unwanted material and equipment, as well as junk, that might be needed sometime in the future when times were flush. In 1938 the laboratory was compared to a "jackdaw's nest" where valuable artifacts were mixed in with "paint pots, old cigar boxes...and a general hodge-podge that is sickening to look at."[518]

The laboratory reflects both of these forces; when acquired by the National Park Service in the 1950s it contained both precious artifacts and valueless junk. The placing of useless machinery and empty containers in the heavy machine shop of Building 5 and in Building 2, for example, is evidence of a process that probably began in the 1930s and continued through the 1960s. The space underneath experimental tables and on the floor between machine tools was a convenient site for quick disposal. The great problem facing the people caring for the laboratory from the 1930s through the 1970s was to deal with the great mass of material they inherited and separate the valuable from the valueless--a problem they did not have time to resolve.

The work of this group of Edison employees and family in the 1930s did result in a plan to preserve the laboratory and turn it into a museum. The main focus of this plan was the library. Initial planning for a museum was underway in early 1932, but the project floundered until 1935. The delay troubled Edison's youngest son, Theodore, who worried about the masses of material stored in the old, possibly unsafe laboratory buildings. He wrote to a potential donor of Edisonia:

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[516] Laboratory Labor and Material Ledger Pages [unbound], 1918-1931, July 14, 1924, Account Books Records.

[517] Norman R. Speiden interview, January 8, 1971, Oral History Project, p. 41.

[518] C.S. Williams to Mrs. Edward E. Hughes, Charles and Theodore Edison, December 15, 1938, Historical Research Dept.

> ...I hardly know what to say in regard to making any immediate additions to our exhibit in Orange. The original Laboratory building is a veritable fire-trap and as it already contains a tremendous amount of irreplaceable Edisonia, I dread seeing a further concentration of such items. Furthermore, no one has yet been assigned the specific duty of caring for historical material and old apparatus and instruments which are scattered about the plant are rapidly disintegrating.[519]

To his mother, "the one most deeply concerned with the Museum idea," he wrote "letters in regard to all kinds of historical material are pouring in here at a great rate and I never know what to do with them. I certainly hope that some definite plan can be decided upon soon."[520]

The effort to preserve the laboratory and document its history was formalized in 1928, but the work of the Historical Research Department acquired new urgency after Edison's death. The importance of the library to the company and the department is clear. A departmental progress report submitted in 1936 states that the library is "the most valuable of all the materials in our care" and a 1939 plan recommended "leaving the Library intact...without changing or molesting its contents." Plans were developed to install fire extinguishing and air conditioning equipment and a fire wall in the library; these modifications were never made.[521]

The machine shops, on the other hand, were not considered to be museum material. The plan included the removal of all the machine tools in Building 5 and the conversion of the space into a permanent museum--of smaller artifacts and documents presumably.[522] The fate of the machine shops, and the tools within them, hung in the balance in 1939. Some consideration was given to offering the tools to vocational schools and, although the first floor machine shop still received some use for special jobs, the possibility of losing some machines to various divisions of Thomas A. Edison, Inc. became apparent. It was Theodore Edison who finally made the point that the whole laboratory including the library, machine shops, and experimental rooms was in fact the best expression of Edison's idea of organized research.[523] Theodore acted to prevent the removal of a

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[519] Theodore Edison to Mrs. M. Hammer Asheton, April 10, 1935 (in DF 1935, WOL).

[520] Theodore Edison to Mina Edison, April 10, 1935 (in DF 1935, WOL).

[521] Historical Department Progress Report, February 11, 1936, and Theodore M. Edison to Charles Edison, December 5, 1936 in Historical Research Dept.

[522] B.F. Morris, E.A. Ellwood, J.F. Coakley, and N.R. Speiden to C.S. Williams, "Rearrangement of Edison Laboratories into a Permanent Museum," February 16, 1939, Historical Research Dept.

[523] Theodore M. Edison to Charles Edison, November 22, 1939, Historical Research Dept.

milling machine from the laboratory and the first steps towards the museum as we now know it had been taken.[524]

One reason for the pressure to remove the machine tools from the laboratory was the recovery of Thomas A. Edison, Inc. from the Depression. Its survival is a testament to Edison's strategy of constantly developing new and diverse products. He also managed to pass the burden of leadership on to a new generation of the Edison family. Charles had learned his lessons well, writing "the strength of our situation is that we have a diversity of businesses."[525] The Edison enterprise therefore rode out the greatest depression in American history and by 1939 was manufacturing a wide range of products: dictating machines, primary batteries, storage batteries, spark and glow plugs, magnetos and ignition coils, medical gases, and control valves and devices.[526]

Thomas A. Edison, Inc. had called itself the Thomas A. Edison Industries since the 1920s as part of its promotional activities. This title suited an organization with numerous diverse operations, ranging from the manufacture of automotive parts (by the Edison-Splitdorf Corporation), to the production of Edison Portland Cement, and the fabrication of children's and nursery furniture (by the Edison Wood Products Company of Wisconsin).[527] Only the dictating machine division, with its factories in the old Phonograph Works, used the West Orange laboratory as its research and development arm. The Ediphone therefore became the one living link with the past in Building 5.

As with World War I, the coming of war in 1939 brought new work and new research challenges to the West Orange complex. Again many experiments were carried out for the US Navy and again they remained secret.[528] For a brief time Army Air Force machinists trained in the machine shop, but because the machines were so antiquated, the program was discontinued.[529] Organization of the museum progressed, but slowly. By March 1943 only one person was responsible for the full-time collections care originally assigned to the entire Historical Research Department. At this time, and in the late 1930s as well, tours of the

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[524] Theodore M. Edison to R. B. Lockhart, November 22, 1939, Historical Research Dept.

[525] Charles Edison to TAE, [undated, but prior to 1929], D-Box Collections, Box D1, Battery, Primary, History folder.

[526] Brochure of Thomas A. Edison, Inc. product line, 1939.

[527] "The Thomas A. Edison Industries" promotional pamphlet, in Ediphone Division records.

[528] John D. Nichols to S.F. Larchar, March 2, 1942, Historical Research Dept.

[529] Frank J. Foley to S. F. Larchar, November 19, 1942, Historical Research Dept.

laboratory were given by former Edison employees under the supervision of the corporation; tours given during the war were subject to tight security and were required to have a police escort.[530]

At the end of World War II, Thomas A. Edison, Inc. stood ready to apply the expertise it had gained manufacturing war material and was eager to join the military industrial complex. By 1952 it had a prosperous instrument division making electrical resistance bulbs, temperature indicators and thermal time delay relays. It also provided control devices and instrumentation for the aircraft industry. Thomas A. Edison, Inc. made a wide range of batteries from heavy duty nickel iron storage batteries for railroad cars to the battery that powered the light in coal miners' caps. The dictating machine division successfully manufactured a range of "Voicewriter" equipment which included tape, cylinder, and disc recorders.[531]

The Edison family had long looked on the West Orange laboratory as a museum to the memory of Edison the inventor. After World War II the laboratory was operated as a public use facility by the Thomas A. Edison foundation which had a lease from the Edison Industries. Building 1 was converted to museum use and opened to the public in 1948.[532]

In 1952, ground was broken for a new laboratory on Watchung Avenue, a few hundred feet to the south of the old Phonograph Works. It consisted of nine laboratory rooms and nine offices. The laboratories were equipped to carry out experiments in physical, chemical and engineering research. The Director of Research was Dr. Donald Collier. The staff and equipment which had been installed in Building 4 were transferred to the new building by February 1953.[533]

In 1954 Charles Edison contacted the National Park Service for advice on preserving Glenmont; subsequent negotiations lead to the donation of Edison's house to the nation.[534] The Edison Home National Historic Site became part of

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530 E.A. Ellwood to Norman Speiden and notations, February 12, 1942; Report to Mr. Eckert, March 26, 1943; Plan of Action in the Project to Care for the Laboratory Group, Norman Speiden, June 28, 1939, and Norman Speiden to W.E. Brennan, May 23, 1944, in Historical Research Dept.

531 Annual Report, Thomas A. Edison, Inc., 1952. In Charles Edison Fund collections.

532 NPS, "HSR, Physics Laboratory, Building 1," p. 10.

533 "The New Laboratory," Thomas A. Edison, Inc., Annual Report, 1953, in the collections of the Charles Edison Fund.

534 Historian's Note 129. This Note is a summation of a memorandum from Superintendent Melvin J. Weig to James Whitehouse [Regional Director?], Northeast Region, NPS, November 13, 1967.

the National Park System in December 1955 as a National Site under non-federal ownership. At the same time Thomas A. Edison, Inc. gave the land and buildings of Edison's West Orange laboratory to the nation with the intent of establishing it as a national monument. Most of the contents and personal property in these buildings were given to the United States in 1956. A project to inventory and appraise the contents was begun at this time. The agreement between Thomas A. Edison, Incorporated and the National Park Service specified that the property not given to the United States would come under the management and safekeeping of the latter.[535]

The West Orange laboratory buildings were handed over to the National Park Service in 1955, just before Thomas A. Edison Incorporated was bought out by the McGraw Electric Company.[536] The reconstituted Mcgraw-Edison Company made a gift of the remaining contents of the site to the National Park Service in 1957, after an inventory was completed. In 1959 the company gave the land and buildings of the Edison home to the nation, and over the next few years the contents were also conveyed to the United States.

On July 17, 1956, President Dwight D. Eisenhower issued a Proclamation establishing the Edison National Monument, "to commemorate the outstanding achievements of the great American inventor, Thomas Alva Edison." An Act of Congress in September 1962 combined Edison Home National Historic Site and Edison Laboratory National Historic Monument into Edison National Historic Site.

Building 1

By 1935 Building 1 was in poor repair and had become more of a junk room than a store room. The 1939 photographs show that much of the rear part of the building was occupied by equipment used in the storage battery/starter motor experiments which had been terminated at Edison's death. The photographs show battery charging apparatus and testing instruments. Two presses which were once in the machine shop can be seen in figure 15.

In 1940 the Edison family decided to restore the building as it had been in 1931. The building was cleared of its contents in 1948 and remodelled by the Thomas A. Edison Foundation. The two offices at the front of the building were made into

[535] Paul Christiansen to Conrad Wirth, June 5, 1956, Accession Records, Edison NHS.

[536] Venable, *Out of the Shadows: The Story of Charles Edison*, pp. 237, 240-43. Thomas A. Edison, Inc., merged with McGraw Electric Company on January 2, 1957.

museum space and the rooms in the back were used for offices of the foundation.[537] The museum space was filled with documents and artifacts describing Edison's career as an inventor. Some large Edison generators were acquired from the Henry Ford Museum at Dearborn, Michigan, and these were added to the phonographs, film projectors, and an electric car which were arranged in the two exhibit rooms.[538]

Building 2

The plan for Building 2 was to restore it to the way it had been when Edison died. The idea was that "it will remain as nearly as possible in the condition it was left by Mr. Edison."[539] Even the contents of chemical bottles were to be replaced with the solutions that had once been in them and then sealed up. A laboratory employee, F. Schimerka, had the task of relabelling bottles in the chemistry laboratory, but it is not known how far this project progressed.[540]

By the 1950s the laboratory bore some resemblance to its present state (figure 40). Equipment connected to the rubber project had been carefully laid out on the experimental tables. Crushing machinery was on the table to the left of the door as one enters the building, Soxhlet and other extracting equipment were on tables on the right, without an empty space to be seen anywhere. Although this display accurately reflects the type of equipment used in the rubber project, it does not reflect the way Building 2 looked at the time of Edison's death. A comparison of the 1930 and 1939 photographs shows a completely different laboratory in 1939. An analysis of the labor records presents even more evidence to reject the idea that Building 2 looks as it did when Edison died. One conclusion might be that this space was turned into an exhibit area during the 1930s to demonstrate certain aspects of the rubber research carried out by Edison in the waning years of his career.

The only accurate reflection of Edison's work in this laboratory in the late 1920s was the stock of chemicals which was left unchanged until the 1940s. Great care was taken to preserve chemical solutions and label bottles in the years immediately after Edison's death. One former employee stated "all of the

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[537] Ibid., pp. 9-10.

[538] Speiden memo, January 28, 1948; see photographs 12.440/441, neg. no. 6646 and 12.440/474, neg. no. 0-902, dated September 1952, in Edison NHS collection, not reproduced in this report.

[539] B.F. Morris, E.A. Ellwood, J.F. Coakley, and N.R. Speiden to C.S. Williams, "Rearrangement of Edison Laboratories into a Permanent Museum," February 16, 1939, Historical Research Dept.

[540] Norman R. Speiden interview, June 6, 1973, Oral History Project, p. 25.

chemicals that you see in these bottles and everything in this place is exactly the same as it was the last time Mr. Edison was here. I know that because I was around here before and after Mr. Edison last worked in this building."[541]

Building 3, Chemical Store Room

Photographs taken in 1939 show much more than chemicals stored in this space; there are parts of machines, assorted equipment and metal and paper stores. The interior was divided up into sections of shelving with passageways running through them.

The first plan for this space was to preserve samples of the various material stored here and throw the rest away.[542] An inventory taken of the store room in 1941 ran to 110 pages and listed 3237 items.[543] After examination of the inventory it was decided that many of the chemicals stored in the laboratory were of use to other Edison companies and in the 1940s the usable stock was parcelled out to the various plants in the Edison organization. The unusable stock was then disposed of because its continued presence was a fire hazard.[544]

This room was divided into small offices and work areas after 1941.[545]

Building 3, Pattern Shop

Surprisingly little was removed from this shop in the years after Edison's death. All of the machines and benches, listed in the 1920 inventory and shown in the photographs of 1917 and 1939, are there today. Three motor-driven machines were moved in from the Silver Lake plant sometime before 1939: a disc sander, a vertical drum sander, and a circular saw. An electric grinder was moved from Building 5, sometime after the National Park Service acquired the site in 1955.

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[541] Charles Durr interview, January 10, 1971, Oral History Project, p. 14.

[542] Minutes, Committee on Rearrangement of Edison Laboratory, June 19, 1939, Historical Research Dept.

[543] Norman R. Speiden to Mrs. Thomas A. Edison, Charles Edison, and Theodore M. Edison, August 18, 1941, Historical Research Dept.

[544] Norman R. Speiden to Mrs. Mina Edison Hughes, Charles Edison, and Theodore M. Edison, February 1, 1940, Historical Research Dept.; see also NPS, "HSR, Chemical Stock Room and Pattern Shop, Building No. 3," 1962, p. 4.

[545] NPS, "HSR, Chemical Stock Room and Pattern Shop, Building No. 3," p. 6.

This was the one part of the laboratory that continued to operate after 1931, for its services and patterns were still needed by the factories of Thomas A. Edison, Inc. Its functions included general carpentry and repair work. The Tibbett brothers, who joined Edison's employ some time before 1917, continued to use the machinery in the shop after Edison's death and their subsequent transfer to the Ediphone Division. They made patterns for castings of Ediphone parts.[546] The conversion of the laboratory into a museum created plenty of work for this carpenters' shop. Nick Foselli made cases for the equipment installed in the museum in Building 1 and for numerous artifacts in the museum collection. He also took on extra work from other divisions to keep himself fully occupied.[547] A National Park Service employee, Gordie Whittington, also used the shop in the work of restoring the laboratory.

Building 4

The end of Edison's phonograph business in 1929 meant that the experimental and production facilities for Diamond Disc records were no longer needed. Development and testing of Edicraft kitchen appliances probably continued until 1935 when this project was abandoned.[548] In 1935 the experimenter Karl Berggren moved in to one of the small rooms in the back of the building and worked on "several new products," which might have included the Ediphone dictating machine line. He was still there in 1944.[549]

The front (southern) end of this building was used for storage and housed equipment and supplies. Some of the ore sample collection was also stored here in 1940.[550] In 1942 this area was cleaned out and the Thomas A. Edison, Inc. Research Laboratory moved in. New flooring and partitions were put in. This group carried out general research functions for the company and was also known

[546] Ibid., p. 5; Photograph 10.120/37, neg. no. 4636B (not reproduced in this report) shows the Tibbett brothers.

[547] Norman R. Speiden to H. H. Eckert, March 26, 1943, Historical Research Dept.

[548] Edward Jay Pershey, "Engineering Social Coups: The Design and Marketing of Consumer Goods by Edison Industries 1929-31," p. 13. Paper presented to the meeting of the Popular Culture Association in Wichita, Kansas, April 25, 1983.

[549] NPS, "HSR, Metallurgical Laboratory, Building No. 4," p. 5; also memorandum of April 11, 1944, Plant Service Department, Engineering Department Records [?]. Berggren's exact duties are not known

[550] K.G. Berggren to Norman R. Speiden, January 23, 1940, Historical Research Dept.

as the central laboratory. Its director was Fred Kelly, who jealously protected his department's title as the "Edison laboratory."[551]

Building 5, Library

Great effort was made to change the library as little as possible from the way it looked on the day Edison died. John Coakley, a former Thomas A. Edison public relations executive, explained on a tour of the library given after Edison's death that on the day Edison died, his son Charles came into the library and went through all the papers in Edison's desk, taking those that were needed to continue work in progress at the laboratory. Charles then locked and sealed the desk.[552] A 1939 memo from the Historical Research Department (of which Coakley was a member) states: "An important consideration so far as the Library is concerned is the fact that little if any change has been made in the physical layout of the room in which Mr. Edison did much of his work." This concern translated into physical care of the collections in the library; the original furnishings were some of the first items in the collection to be cataloged and the department began its mountain of work by cleaning and cataloging the library's books and organizing unbound periodicals.[553]

The cataloging project was underway in the 1930s and, before storage vault 12 was completed in February 1942, cataloging and storage of archival materials was probably being worked on in the library itself.

In February 1947, in celebration of the one hundredth anniversary of his birth, Edison's desk was unsealed amid much ceremony, and a description of the contents was broadcast across the country. With another ceremony a year later, the library and the laboratory were opened to the public. After Thomas A. Edison, Inc. donated the laboratory to the federal government in 1955, the Historical Research Department staff was retained; department staff became National Park Service curators and archivists.[554]

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[551] H.H. Eckert to Fred G. Kelly, June 11, 1945, Historical Research Dept.

[552] John Coakley interview, nd, Oral History Project, pp. 21-22.

[553] Historical Research Department to C.S. Williams, Jr., February 16, 1939, and Historical Department Progress Report, February 11, 1936, in Historical Research Dept.

[554] National Park Service, "Historical Research Management Plan, Edison National Historic Site, West Orange-New Jersey," prepared George J. Svejda, Office of Archeology and Historic Preservation, April 17, 1969, p. 14.

Mourners paid their last respects to Charles Edison in the library of Edison's laboratory in August 1969. The open coffin of the former Assistant Secretary of the Navy, governor of New Jersey, and head of Thomas A. Edison, Inc. was placed before the fireplace, just as his father's had been. Again, the coffin was flanked with flowers and palms; the only additions to the scene were the American and U.S. Navy flags placed behind the coffin.[555]

Building 5, Machine Shops

During World War II the machine shops and boiler house were used to train women war workers and an Army Air Force Training Detachment. This was found to be an unsatisfactory arrangement because the machine tools were so old, and operated at such slow speeds, that they did not prepare the machinists for work in a modern factory.[556] Although insufficient for the army, the machine tools in the shops were still used during the war and some women workers trained on them.[557]

Building 5, General

Ediphone Development. It is possible that rooms on the second and third floors became the home of the dictating machine research and development department. This department produced a steady stream of innovations and was the only experimental effort carried out in the West Orange laboratory during the 1930s. In 1932 a new line of dictating machines was introduced, which incorporated the latest dictating machine technology. A new desk Ediphone was produced in 1937, the work of Louis La Forest and Charles Huenlich.[558] These two engineers wrote the Ediphone development reports throughout the 1930s and 1940s. It is possible that this department worked in Building 1 in the 1930s, which was the base of dictating machine experiments in the 1920s.

Engineering Department. References to this department were made in the 1930s and 1940s, but no clear picture of its organization or function has emerged. Its role in the development of the Ediphone product is also unclear, but it appears

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[555] Illustrated in photograph 14.310/110, in Edison NHS collection, not reproduced in this report.

[556] Frank J. Foley to S.F. Larchar, November 19, 1942, Historical Research Dept.

[557] S.E. Charles to F.J. Foley, February 3, 1943, Historical Research Dept.

[558] The Combined Executive and Secretarial Ediphone, February 25, 1932; L. Laforest to S.G. Langley, 1937, Ediphone Development Reports.

from purchases which were made in the 1940s that this department did carry out research on dictating machines.

Historical Research Department. This organization was charged with the task of preserving the laboratory buildings and establishing some sort of museum about Edison. Its creation and support came from members of Edison's family. The leading figure in this department was Norman Speiden, who, unlike every other member of the department, was not a former employee of the laboratory. His department consisted of:

Harold Anderson—Anderson acted as an assistant to Speiden and as a curator of the museum. He joined Thomas A. Edison, Inc. in 1924. In 1939 he began the job of locating, identifying and indexing artifacts in the museum collection. He left the museum in 1969.

F.S. Schimerka—Schimerka was an experimenter who had worked with Edison in the late 1920s. He was put to work cleaning up the chemistry laboratory and the chemical storage room in Building 3.

William Hayes—Hayes served many years as a recording expert at the West Orange laboratory (see p. 51 for more on Hayes). He was in charge of locating, cleaning and sorting items related to the phonograph. He rebuilt experimental recording machines from the parts he found strewn around the laboratory. He also helped to clean up and identify records in the library. In 1939 he had the job of showing visitors around the laboratory site, an indication that it was now functioning as a museum.

Mary C. Barstow—Barstow cataloged the library and in 1939 began unpacking, sorting and filing documents dated 1869 through 1900.[559]

Alice Puffer—Puffer organized and re-filed Meadowcroft's correspondence and in 1939 the plan was for her to type and assist in answering routine correspondence.[560]

Joe Ziemba—A machinist who had worked with Edison on the rubber project, Ziemba repaired and maintained machinery and cleaned up the machine shops. He also worked in the Research Department.

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559 Norman R. Speiden, "Plan of Action in the Project to Care for the Laboratory Group," June 28, 1939, Historical Research Dept.

560 Ibid.

Joseph Whelan—In the 1930s Whelan helped in the preservation of prints and glass negatives. One of the goals of the preservation plan was to microfilm Edison records and Whelan carried out this project in a photography laboratory, probably in Building 5 (see p. 82 for more on Joseph Whelan).[561]

Research Department. This group had organizational and financial links with the Ediphone research and development operation; they may have shared facilities in Building 5.

A payroll analysis for the Research Department for 1944 placed the machine shop under "General Division" and mentioned a "General Division Development Lab" that was in Building 5. Much of the expenses billed by the Research Department were for small repairs to furniture and office equipment and for photocopying.[562]

The research department became heavily involved in the repair of Edison radios and Edicraft appliances during World War II. This was because the public was unable to purchase new consumer durables. The repair work was carried out on the third floor. It carried on in the years after the war.[563]

In 1944, the Research Department consisted of:

William Hayes—Hayes divided his time between research and repair of dictating machines and radios.

Joe Ziemba—Ziemba was a machinist who supplied materials and parts to the unit repairing Edicraft products.

George Meesel—Meesel spent most of his time on Edicraft repair.

Gabriel Pavone—Pavone worked as a janitor and watchman for the laboratory and was incorporated into this department as a laborer.

In 1946, the men involved in Ediphone Research and Development in the laboratory were: C. Huenlich, H. Burt, A. Walsh, Paul Kasakove, F. Price, F. Burns, W. Babbitt, L. Fisher, R. Mahn, S. Langley, J. Sease, and A. Horner.[564]

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[561] Norman R. Speiden, "Plan of Action in the Project to Care for the Laboratory Group," June 28, 1939, Historical Research Dept.

[562] Account set to Mr. Huebner, June 20, 1944, Ediphone Division records.

[563] Time Analysis of Research Department, May through July 1944, Ediphone Division records; Norman R. Speiden to Eugene C. Reed, October 27, 1947, Historical Research Dept.

[564] List of Dictators, November 13, 1946, Ediphone Development Reports.

Comparison with other documents suggests Walsh, Langley and Kasakove were department heads.

Building 6

Much of the equipment in this building was removed during Period II (1901-1914). Part of the building had been used for vocational training during World War II. In 1933 what remained of the boilers was removed and taken to the Henry Ford Museum. The boiler room was cleaned out and used as an exhibit area.[565]

[565] National Park Service, "Historic Structures Report-Part I, Power House-Boiler Room, Building No. 6, Edison National Historic Site," prepared by Melvin J. Weig, Arthur Spiegler, and Gordie Whittington, May 20, 1964; no page numbers, but see Administrative Data and Historical Data sections.

Building 7

The blacksmith shop was located in several different sites during Edison's time at the West Orange laboratory. Over the years, little was recorded about its occupancy and furnishings. In general, it was used to forge metals, and reshape and sharpen tools for the machine shops.[566] Most of the evidence that has survived is consolidated in Susan A. Kopcznski's 1975 "Historic Furnishings Study." The following discussion relies heavily on that study.

History of the Structure. The first blacksmith shop documented at the West Orange site was located in the rear of Building 4. This shop was located behind an ore crushing facility in the front room of the building.[567] It is likely that the blacksmith shop was installed in the summer of 1888, when vouchers document the installation of a "partition in [the] Ore Milling room" and a "Door for [the] Blacksmith Shop."[568]

According to Kopcznski's "Historic Furnishings Study," the operation was moved to a new shop by 1900, when the Laboratory General Ledger documents a new structure, built of hemlock and white pine and requiring "asphalt roofing, sheet iron flooring, and dark red paint."[569] This building was modified after a 1909 government inspection. At that time the roof was cut away to create a two-inch gap around the flue.[570]

In 1911 a fire destroyed the shop; it was rebuilt in August of that year.[571] The rebuilt shop was a square structure made of sheet metal. A 1913 photograph shows the shop adjacent to Building 2. During 1919 the shop was rebuilt to conform to its present shape and moved some distance from Building 2.[572]

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[566] National Park Service, "Historic Structures Report--Part 1, Building No. 7, Blacksmith Shop," prepared by Melvin J. Weig, Benjamin Levy, Arthur Spiegler, and Gordie Whittington, NPS, 1964, p. 2.

[567] 1886 Atlas Map, p. 147 (corrected to 1890) found in the Orange Public Library, New Jersey; see NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," prepared by Susan Kopczanski (Washington DC, April 1975), p. 3.

[568] Voucher 684, June 1888.

[569] "Laboratory General Ledger," January 1, 1897 to December 31, 1901, p. 109; see also NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," p. 3.

[570] Instructions of Middle States Inspection Bureau, January 20, 1909, DF 1909, WOL--General.

[571] Shop Order 2610, August 24, 1911 (in Notebook N-10-07-26) is for rebuilding a burned out blacksmith shop.

[572] NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," p. 4.

Historical Occupancy. The first blacksmith known to work at the West Orange laboratory is Rube Hepworth, who appears on the January and February 1890 payroll records with a helper, George Gilmore. Hepworth earned $21.18 for the week ending February 6, and Gilmore earned $12.10.[573] By 1903 it appears as if Hepworth was in business for himself, and the laboratory was one of his customers.[574]

By the period 1909-10, laboratory labor records note A.L. Gunnerson and Peter Deck, blacksmith, were working in the blacksmith shop. From November 1920 through January 1921, A.C. Anderson was working as a blacksmith for $39.60 per week.[575]

In a 1964 interview, former Edison employee Paul Kasakove recalled that work in the blacksmith shop ceased some time between 1927 and 1931.[576]

Furnishings. Little is known about the interior appearance of the early blacksmith shops. Two 1939 photographs document the appearance of the shop at that time. The 1939 furnishings were cataloged in July 1942, though many of the deteriorated or expendable objects were discarded during a 1969 restoration effort.[577]

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[573] In DF 1890, WOL--General, D-90-64.

[574] Voucher 3148 and others, 1903.

[575] Laboratory Payroll, November 20, 1920-January 20, 1921; see also NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," p. 4.

[576] Conversations with Paul Kasakove, October 8, 1963, in NPS, "HSR-Part 1, Bldg. No. 7, Blacksmith Shop" (1964); also NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," p. 4.

[577] NPS, "Historic Furnishings Study, Bldg. No. 7, Blacksmith Shop," p. 6.

Gate House

The Gate House was erected in the summer of 1890 to provide increased security for the Edison laboratory. In September 1890 Samuel Insull, then a vice president of the Edison General Electric Company, wrote to Alfred Tate, Edison's private secretary: "I have your [letter]...with reference to the precautions which you are now taking to prevent unauthorized persons from getting into the laboratory. I trust that the Gate House will prevent some of the trouble which you have had in the past."[578] Details about the "trouble" Insull referred to are not available, but an early letter to Tate from Reginald Fessenden, a chemical experimenter at the laboratory, gives some idea of the security concerns during this time. Around 1890 Fessenden writes:

> Some time ago, in consequence of the number of tools etc which were taken from the Chemical Room, you were kind enough to give me a notice to put on the door. This improved matters, but as the notice was not entirely regarded, with Mr. Edison's permission I placed a catch lock on the door, which was not of much use, however, as the workmen obtain the key from the table where it is kept. Yesterday morning the room was entered and a drill and holder taken out....Last night it was entered again. A crucible I had cleaned specially...was used for melting Babbitt [metal] in. One of the electric lights was torn down and one of the discs used in the furnace cracked. On another occasion a hole was melted in the asphalt floor through which the water arrives every time it rains and on a great many occasions tools have been taken away and kept by the men....[579]

While Fessenden appears to suspect other Edison employees of thefts and vandalism, this letter points out the easy access to buildings within the laboratory complex in the early years at West Orange.

The scant information gleaned about Gate House furnishings comes from interviews conducted in preparation of the 1959 "Historic Structures Report." The following discussion relies heavily on evidence presented in the Historic Structures Report. Purchase vouchers document construction materials used in the building, though changes and repairs to the Gate House are rarely noted. Limited information on the gatekeepers who worked in the building is available through notes and correspondence in the Document File.

There are no photographs of the Gate House interior from Edison's years at West Orange. However, several early photographs of the exterior are available; the earliest dates from before 1892.

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[578] Samuel Insull to A.O. Tate, September 18, 1890 (in DF 1890, WOL, D-90-64).

[579] Reginald Fessenden to A.O. Tate, undated (in DF 1890, WOL, D-90-64).

History of the Structure. Edison's West Orange laboratory was originally surrounded by a white picket fence. Double-swinging gates opened into the drive separating the north side of Building 5 and the entrances to Buildings 1, 2, 3, and 4. The Gate House, west of the brick archway, was added in the fall of 1890. The wooden fence and gates remained in place until 1917, when they were replaced with brick gate posts, iron gates, and steel fencing.[580]

The single-story Gate House is a one-room shingled structure with two windows in a bay facing Main Street, and single windows on either side of the building. All four windows are double-hung and bordered with red and yellow stained glass; louvered shutters flank the windows. Two paneled wooden doors provide access to the street and the drive.[581] In 1893 one of the windows or doors was repaired with a piece of Venetian glass.[582]

Construction of the Gate House began in August 1890 with deliveries of trench stone and cement, and was complete by December of the same year.[583] The total cost for the building was $670.74. An August 1890 purchase voucher for ash railing and bronze butt hinges indicates that there may have been a partition with a two-way swinging gate originally installed inside the Gate House.[584] The "Historic Structures Report" suggests that bronze and brass fittings were purchased for the Gate House in order to avoid magnetic interference with the laboratory's galvanometers, just as they were for the physics laboratory next door.[585]

The original color of the structure is not known. In 1959, the exterior walls and gable ends were brick red in color, and the doors, shutters, and other wood trim were dark green. According to the report, "These colors have been used for the Gate House as far back as anyone consulted on the subject can remember."[586] In

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580 National Park Service, "Historic Structures Report-Part I, Gate House, Building No. 9, Edison Laboratory National Monument," prepared by Melvin J. Weig and Norman R. Speiden, April 21, 1959, p. 11.

581 Ibid., p. 9.

582 Purchase voucher 679, December 1893.

583 Voucher 745, 1890; see also NPS, "HSR, Gate House, Building No. 9," p. 4.

584 NPS, "HSR, Gate House, Building No. 9," p. 8; also Purchase Voucher 785, 1890.

585 NPS, "HSR, Gate House, Building No. 9," pp. 4-9.

586 Ibid., p. 9.

May 1974, the Gate House was repainted in the same colors, based on the evidence presented in the 1959 report.[587]

Historical Occupancy. According to an interview with a former Edison paymaster quoted in the Historic Structures Report, Fred Devonald was the gate man from 1891 to 1903. Devonald came to the United States from Wales in 1888 or 1889 and was photographed in the library at West Orange some time in the early 1890s.[588] Two hand-written notes from April 1899 suggest that Devonald was in charge of the Gate House, or at least the distribution of keys, at that time. The first, addressed to "Mr. JFR" (probably John F. Randolph, Edison's personal secretary), covers a list of key holders to the front gate of the laboratory, and directs: "Please give the attached to Devonald and tell him to put new lock on gate and give out new keys and call in old ones." An attached note from Edison states, "Devonald/Give Ward a key to the gate."[589]

Devonald's position at the Gate House may not have been too demanding, for apparently he had enough free time to keep birds at work. In his description of wire screening above the partition in the Gate House, George Meister, former Edison paymaster, claimed it was installed "to keep Fred Devonald's pigeons from flying over the partitions."[590] In 1964 Devonald's daughter, Margaret, identified her father in a 1894 photograph of the Black Maria; he is standing beside a coop holding a fighting cock.[591]

In 1903, Pat Brady became gate man and remained in the position until 1931.[592] Paul S. Laverty, a former Edison employee who joined the laboratory in 1909, recalled that Brady was the gate man at the laboratory and that Brady's assistant was Sylvester Ditch.[593] Brady was working for the Edison laboratory in some capacity before he became a gate man, for his name appears on the list of key

[587] Ibid. See also memorandum from Superintendent, Morristown-Edison Group to Regional Director, North Atlantic Regional Office, NPS, dated May 10, 1974.

[588] Historian's Note 101; see figure 49.

[589] Unknown to John F. Randolph, April 18, 1899 and TAE to Fred Devonald, April 18, 1899 (in DF 1899, WOL--Employees).

[590] NPS, "HSR-Part 1, Gate House, Building No. 9," pp. 6-7.

[591] Historian's Note 101.

[592] NPS, "HSR-Part 1, Gate House, Building No. 9," p. 7.

[593] Historian's Note 68; Laverty to Speiden, September 17, 1963.

holders to the front gate of the laboratory forwarded to Devonald in 1899.[594] Payroll records also list a boy assigned to the gate house in 1893. His duties are not known.[595]

Alvin D. Caskey was also working at the gate in 1903, and he too was a gate key holder in April 1899.[596] A letter to Caskey from Colt's Express Company implies that Caskey was in charge of the Gate House at some point during the day:

> Mr. Schermerhorn has made a complaint to us about our drivers taking boys in the yard on our wagons, he says that he thinks they come through your gate on the wagons, we would consider it a great favor if you will not allow any boys to ride in.[597]

One unidentified early gatekeeper became a legend when, in strict adherence to established security measures, he refused Edison entry to the laboratory. The incident is described in the Dicksons' 1894 book on the laboratory, and again in Dyer and Martins' 1910 Edison biography. Dyer and Martin write:

> The keeper of the gate was usually chosen with reference to his capacity of stony-hearted implacability and adherence to instructions; and this choice was admirably made in one instance when a new gate man, not yet thoroughly initiated, refused admittance to Edison himself. It was of no use to try and explain. To the gate man every one was persona non grata without proper credentials, and Edison had to wait outside until he could get some one to identify him.[598]

The Edison paymaster may have used the Gate House for issuing pay, but information about this use is scarce. George Meister, a paymaster by autumn of 1916, remembered paying employees of the Edison Company in the Gate House, but there are no further details about his activities in the structure.[599] Former Edison employees questioned specifically about the Gate House in a 1971 interview make no mention of receiving their pay in that building.

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[594] List of Key Holders to Front Gate of Laboratory, April 18, 1899 (in DF 1899, WOL--Employees).

[595] "Distribution of Labor," August, 1893, Ledger 8, Payroll Records, Edison NHS.

[596] List of Key Holders to Front Gate of Laboratory, April 18, 1899 (in DF 1899, WOL--Employees).

[597] Colt's Express Company to Mr. Caskey, March 27, 1903 (in DF 1903, WOL--General).

[598] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 640.

[599] NPS, "HSR-Part 1, Gate House, Building No. 9," p. 6; Historian's Note 118, Edwin Smith to Norman R. Speiden: "1916, Sept or Oct - Started work for Edison. First pay check handed him by Geo. Meister."

These former employees, A.E. Johnson and K. Ericke, worked at the Edison laboratory from around 1920 until well after Edison's death. Ericke, who left the Edison Company in 1961, described the situation during his time at the laboratory:

> The gate house had a watchman who was there all day. As a matter of fact, one of them, I knew him and liked him very well...he simply sat there all day long, and anybody who wanted to come into the laboratory had to clear through him...he didn't wear anything special. There was no uniform. As a matter of fact, there was one fellow we had here who was a retired cop, and this was a nice easy job. He stayed there till he retired, see. One of the fellows I'm pretty sure we had was Flannigan.[600]

"Flannigan" was John Flanagan, a janitor working at the laboratory in 1920 who acted as watchman on Saturday afternoons and Sundays.[601] A.E. Johnson, who worked at the laboratory until 1938, claimed that the Gate House was "more or less of a ceremony in our time" and that the gate opened up and cars "just came in."[602]

Occupancy and Use After Edison's Death. The time period discussed in Johnson and Erickes' interview is unclear, but it appears that while the Gate House was staffed during Edison's later years and immediately after his death, the amount of traffic passing through the gate was slacking off and the gate man's position was not a taxing one. In 1939 one watchman covered the Edison plant, as well as the laboratory buildings; whether he worked out of the Gate House is unknown.[603] Later documentation indicates that "watchman" and "gate man" were separate positions.

During World War II, the Gate House's function grew in importance as security measures increased significantly around the Edison plant. Gate men were combined with watchmen and police on the Plant Protection Department payroll: "in order that all such services, in the present emergency, come under one head."[604] Information on the nationality of all visitors was obtained before they

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[600] A.E. Johnson/K. Ericke interview, March 29, 1971, Oral History Project, p. 12.

[601] "Assistant to Mr. Edison" to Samuel F. Wilson, November 29, 1920, Biographical File, Edison NHS.

[602] A.E. Johnson/K. Ericke interview, March 29, 1971, Oral History Project, p. 12.

[603] Report of the Committee on Rearrangement of the Edison Laboratory, June 19, 1939, Historical Research Dept.

[604] March 23, 1942, memorandum, Historical Research Dept.

were admitted to the plant, and gate men were instructed to admit only authorized non-citizens to the plant.[605]

By 1959 the Gate House was used as a visitor entrance and reception station by the National Park Service. After the National Park Service took over the operation of the site in 1955, an information receptionist was stationed in the Gate House to collect admission fees, arrange tours, and sell slides, postcards and literature.[606] Early in 1972, the visitor's entrance was moved to Building 6, the laboratory's Power House, to relieve "the horrendous problems posed over the past years when using the tiny, cramped Gate House."[607] Today, the Gate House serves as a security station.

Furnishings. There is very little information on Gate House furnishings. No interior photographs exist, and interviews conducted when the "Historic Structures Report" was written in 1959 reveal little about the Gate House interior. Until at least 1959, the room was divided by a low partition with a wire screen that extended from the top of the partition to the ceiling. Charles Edison thought the partition, screen, and two circular topped pay windows had been installed before his father's death in 1931, but acknowledged that the screen and pay windows may have been installed as late as 1933. George Meister, the former Edison pay master quoted above, believed the screen was put up some time during Fred Devonald's tenure as gate man, which was 1891 through 1903. He also recalled using the windows to issue pay.[608]

Charles Edison and George Meister remembered a round, pot-bellied stove used to "over heat" the Gate House. John Brady, son of former gate man Pat Brady, remembered a kerosene stove. This type of stove makes sense in view of the fact that physical and photographic evidence indicates that the Gate House never had a chimney.[609]

The only other information on furnishings in the Gate House is from the period in the 1950s and 1960s when the National Park Service used the room as a visitors center and souvenir stand. The 1959 "Historic Structures Report" describes the

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[605] John D. Nichols to S.F. Larchar, March 2, 1942, Historical Research Dept.

[606] NPS, "HSR-Part 1, Gate House, Building No. 9," p. 1.

[607] Chief, Visitor Services and Protection, Edison NHS to Chief, Harpers Ferry Center, NPS, March 22, 1972.

[608] NPS, "HFR, Gate House, Building No. 9," p. 6.

[609] Ibid., p. 7.

> drab interior, with the attendant employee practically screened off from the entrance door, as if in a cage....Besides this, the existing partitions, shelving, cabinets, etc., do not afford proper facilities, either for attractive display or efficient storage of the free literature, sales stock, files, and other supplies and materials which must be kept and used in the building.

Chairs or benches were not provided for visitors to use while waiting for their tour to begin.[610]

A 1969 photograph of the Gate House interior shows the west side of a spruced up visitor reception area, with linoleum flooring and a waist-high wooden counter extending almost the length of the room. The counter top displays slides and books and the Park Ranger behind the counter appears to be presiding over a visitors' register. A small shelf bearing a bust of Edison is mounted between the two windows in the bay behind the counter. The east side of the building is not shown in this photograph (see figure 151).

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[610] Ibid., p. 1.

FURNISHING PLAN

RECOMMENDED FURNISHINGS and WORKING DRAWINGS

Furnishings recommended for the West Orange laboratory reflect the period 1910-1920. This period is very well documented by a series of photographs taken in 1914, and photograph albums compiled by Miller Reese Hutchison from 1910 to 1918. In addition, several inventories were made in the aftermath of the 1914 fire, including one of the chemistry laboratory.

While the inventories provide important documentation of the site, the fire itself inspired some physical changes in the five original buildings, which were untouched by the blaze. Significant among these changes was the installation in 1915 of new windows in these buildings. Later structural changes were made to the library and stock room, and are discussed in the introduction to the individual plans. Because it would be impractical to alter the layout and windows of the laboratory buildings, interpretation of spaces that have been altered should acknowledge structural changes but note that most changes do not substantially affect the function and furnishings of the rooms.

The labor records for this period are detailed, giving an idea of the duties of each member of the laboratory staff and enabling cross referencing of daily tasks with entries in shop order books. An analysis of the labor records indicates that the period from 1912 to 1914 marked the greatest size of the work force at the West Orange laboratory. This was a period of intense activity at the West Orange laboratory, comparable only to the 1888-1890 period in terms of the number of experimental projects undertaken. The 1910-1914 period was also important because the primary experimental projects--the disc phonograph and the storage battery--became the new products that carried the Edison enterprise through the next two decades.

The phonograph experiments were carried out on the second and third floor of Building 5 and the development of the materials for records was done in the chemistry laboratory. Although the prototype plant for duplicating discs was established in Building 4, equipment to make test pressings was installed and production methods were perfected in the chemistry building. The Robertson hydraulic disc press is still in place.

The one part of the phonograph campaign that cannot be interpreted through historic furnishings is the recording of a new catalog of songs for the Diamond Disc machines. This was carried out in the music room on the third floor of Building 5 and in the New York City studio. However, Edison himself reviewed all recordings, probably in rooms on the second and third floor of the building. Edison's own disc machine, used for reviewing, and the notebooks in which he recorded his evaluations survive. These items can be used in interpreting spaces on the second floor of Building 5 to show Edison's involvement in recording.

The storage battery campaign was also centered in Building 5 and in Building 2. The perfection of the storage battery required the close cooperation of chemical and mechanical expertise: the chemistry laboratory was used for compiling, analyzing, and improving the electrolyte and the materials used in the battery, while the machine shops produced the special machines to make batteries. Although most testing of batteries went on in the small test department on the top floor of Building 5, battery testing was also done in Building 2, and this can be illustrated with surviving equipment.

One element of the West Orange laboratory's work that has not been emphasized in the interpretation of the Edison laboratory is the routine testing and analysis of materials. As this played a critical part in the storage battery campaign, evidence of these activities are also included in the furnishings plan.

Building 2, Chemical Laboratory

The guiding principle of this plan is that less is more: the laboratory as it now stands is cluttered with a load of junk accumulated over the years. Comparison with photographs taken during the period 1904-1917 shows a much less cluttered room with plenty of space on top of (and below) the experimental tables. Reducing the number of items in this building will be an important step in returning it to its appearance during the interpretive period.

As the rubber project occupied Thomas Edison's declining years, the building began to fill with equipment (the current interpretation at the site). The experiments required a mass of complicated equipment including glassware and rubber tubing. In the period 1910-1914, the work in the chemistry laboratory focused on developing materials for phonograph records and testing batteries. These two projects require different equipment and much less of it. The concern here is to highlight the materials involved in these projects--phenol resins, waxes, shellacs, nickel plate, sulfuric acid--and the properties of the different combinations of chemicals.

To get the best idea of the way the laboratory looked during the 1910-1914 period, photographs and documents of a broader period have been examined. The evidence from the target period is not sufficient to show how each table in the building looked and how chemicals and equipment were arranged on the table tops. Consequently photographs dating from 1904 to 1917 have been examined and will be used as evidence. The furnishings plan is therefore based on a composite of several photographs from different time periods, in a ddition to a 1914 inventory. Although the arrangement of the chemical laboratory changed from 1904 to 1917, for interpretive purposes, the assumption is that the way chemical experiments were carried out, including use and placement of major pieces of equipment, did not change significantly.

As far as possible this plan assigns an experimenter to each table and a specific experimental project to each table. The visitor should know, however, that in Edison's laboratory men and experiments migrated from table to table and chaos generally ruled. Work in the laboratory has been simplified to make it more intelligible to the visitor.

There are important conceptual links between tables. The work of developing and testing chemicals for phonograph records took place on tables 3 and 4 on the east side of the aisle and tables 7 and 8 on the west side. This forms a block of four tables in the front half of the building devoted to one subject. Interpretation of this area should stress the links between the work done on each table: H.W. Lancaster produced a chemical on table 4 used by Albert Petit on table 8, Laverty did experiments on table 3 related to Jonas Aylsworth's work on table 7, and so on.

The refurnished room will show a working laboratory devoted to testing storage batteries and developing chemical mixtures to be used in phonograph records. Most of the tables at the south end of the building, where the visitor first enters, are concerned with the production, mixing, and testing of chemicals used in records. A record press with various experimental disc records, at the right of the entrance, immediately gives the visitor an idea of the finished product of the work of this laboratory--the Edison phonograph record.

Moving into the building, towards the balance room, the visitor is given more information about record experiments and the production of master recordings, and then introduced to the experiments and testing of storage batteries. The battery charger and experimental batteries on the far (north) wall of the building, between the main room and the balance room, provide a visual key to the battery project. The evidence used here is taken from figure 31, a photograph taken by Byron around 1906. A photograph from 1911, figure 33, shows that the battery installation had been removed by this time, (and probably taken to Building 5, third floor). Yet this installation was such an important part of the work in this laboratory, and is so vital in interpreting the laboratory, that a decision was made to keep it in the furnishings plan. The availability of the battery charger (now stored in the balance room) was an added inducement to keep it in the plan.

General Guidelines for Chemistry Laboratory Furnishings

The photographs from the early twentieth century all show that much of the space on top of the tables was taken up with bottles of chemicals--this is not the case at present. The chemicals were contained in glass-stoppered bottles of various sizes. Some small glass containers with metal screw caps were used to hold samples of metals and ores. Smaller bottles had cork stoppers. Although we know which chemicals were on each table, there is no way to tell the size bottle in which they were stored. In the case of substances such as shellac (which were purchased in bulk from suppliers and used in experiments) the determination of the packaging is taken from the packages found in the lean-to next to the chemistry building.

The shelves underneath the laboratory tables should be cleared of all artifacts except bottles or tins of chemicals. Large bottles (of 1 or 2 liters) were usually kept there. No effort should be made to fill up the lower shelves--some open space is consistent with the laboratory we are trying to portray.

On the other hand, the racks at the end of the tables should be full of bottles of chemicals, as photographs show these racks packed with bottles. It is difficult to determine which chemicals were placed in the rack and what kind of bottles were used there. It appears that there was no method or ordering system in use. To compound these difficulties, development and implementation of a 1973 furnishings plan probably caused chemicals to be removed or replaced. Therefore random bottles of chemicals and labelled samples should be used on the racks. Note that all chemicals on exhibit will be reproductions.

It has been decided not to provide catalog numbers for the all ordinary glassware recommended in the furnishings plan because this will give the installer the job of locating specific items in the large museum collection. Instead, objects that are readily located on table tops and the exact items illustrated in photographs or in chemical suppliers' catalogues have been identified; the remaining items should be located in the collection and compared with the photographs before placement.

Every effort should be made to give this space a "lived in" look: the installation should include cigars on the tables, crumpled paper on the floor, hats and coats hung on the sides of the wall closets, and so on. The laboratory equipment and bottles of chemicals should be placed on the side of the tables nearest the walls, as if laboratory staff were working along the inside aisles, facing the center of the room. This keeps vulnerable equipment away from visitors and hopefully outside the reach of small children who might be tempted to touch or taste.

Some bare space on top of the experimental tables is desirable. Room should be left to show the experimental notebooks clearly. Edison's table, however, should be cluttered with chemicals, as shown in figure 35. This table should be short on equipment and long on bottles and containers: the idea is to get the visitor away from the notion that complicated assemblies of glassware were at the bottom of Edison's chemical genius. Instead, stress the "99% perspiration" of mixing and testing.

Edison's small table next to table 10 should be removed, for it certainly was not in the laboratory around 1910-1914. Removing this table gives interpreters a large area in which to position the visitors and talk to them.

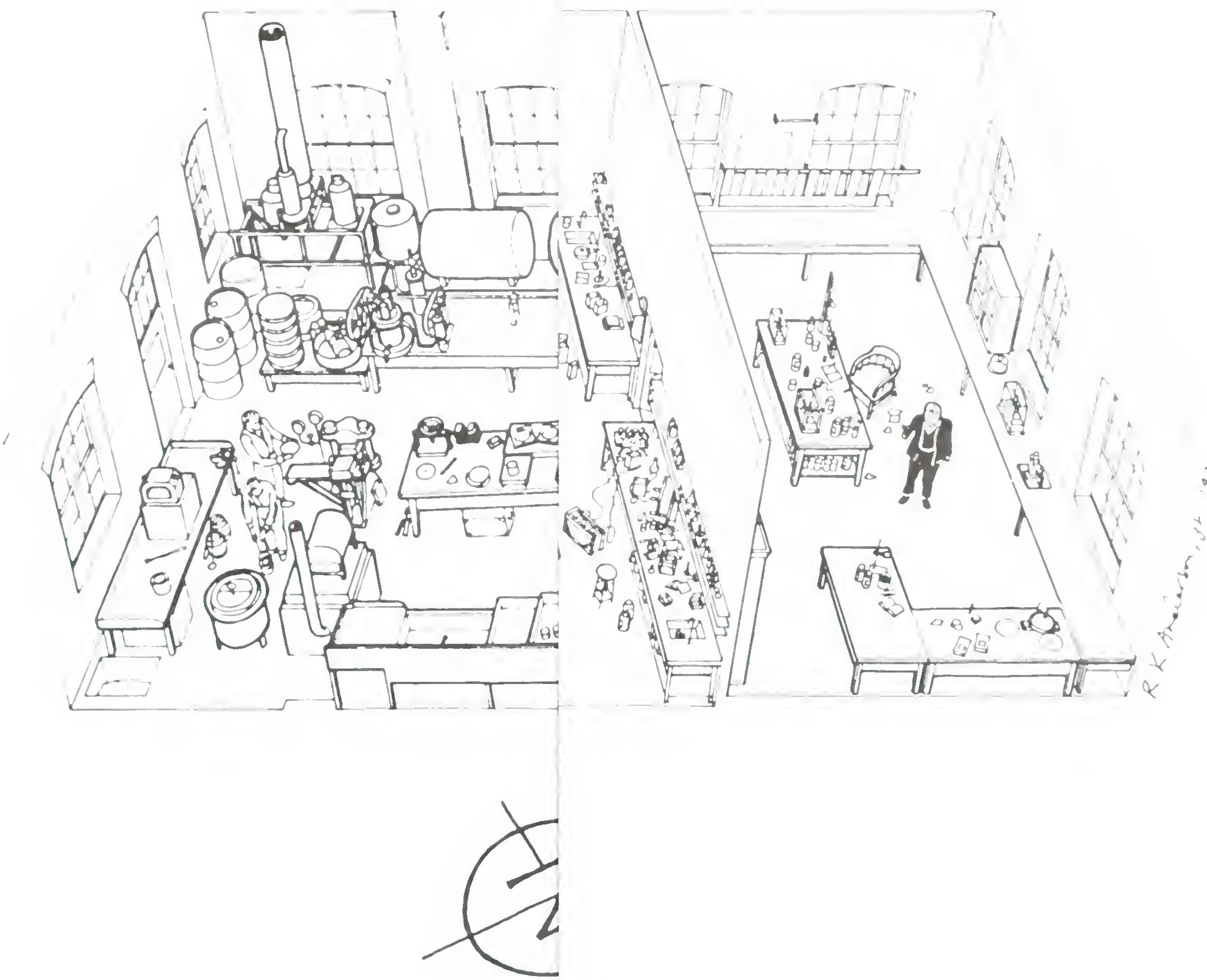
We will show Edison at work in the balance room, rather than at table 10 and the small table next to it. Here the laboratory notebooks, the experimental records, and the diaphragms illustrate the critical role he played in developing the technology of recorded sound. It is also a good place to show his chemical experiments on the storage battery: the electrochemical equipment on his table in the balance room was used in battery experiments and serves as a pointer to his personal role in these experiments.

Most of the equipment in this plan is readily available and should be in the collection. Some of the glassware in the building at present is from the late rather than early twentieth century and if possible should be replaced with earlier examples. For example, colored measuring marks, usually blue, found on some of the glassware are a relatively modern development.

The greatest challenge in terms of reproduction is the condensite still on table 6. This major piece of equipment was probably made at the West Orange laboratory and as this was a secret project it is unlikely that there are detailed plans extant. Only one photograph, figure 34, shows what it looked like and this image does not give very much information. An illustration of a similar still from a contemporary text has been included as a guide (figure 42).

The plan also recommends installing a reproduction of the sign warning visitors away from the chemistry laboratory. The sign, hung outside the door to the laboratory as early as 1917, clearly warns visitors: "Keep Out. Mr. Edison is very busy and does not want to be disturbed. See Mr. Meadowcroft."[611]

[611] See photograph 10.120/28 in Edison NHS collection, not reproduced in this report.



CHEMISTRY LAB

CHEMISTRY LAB

CHEMICAL LABORATORY

(not to scale)

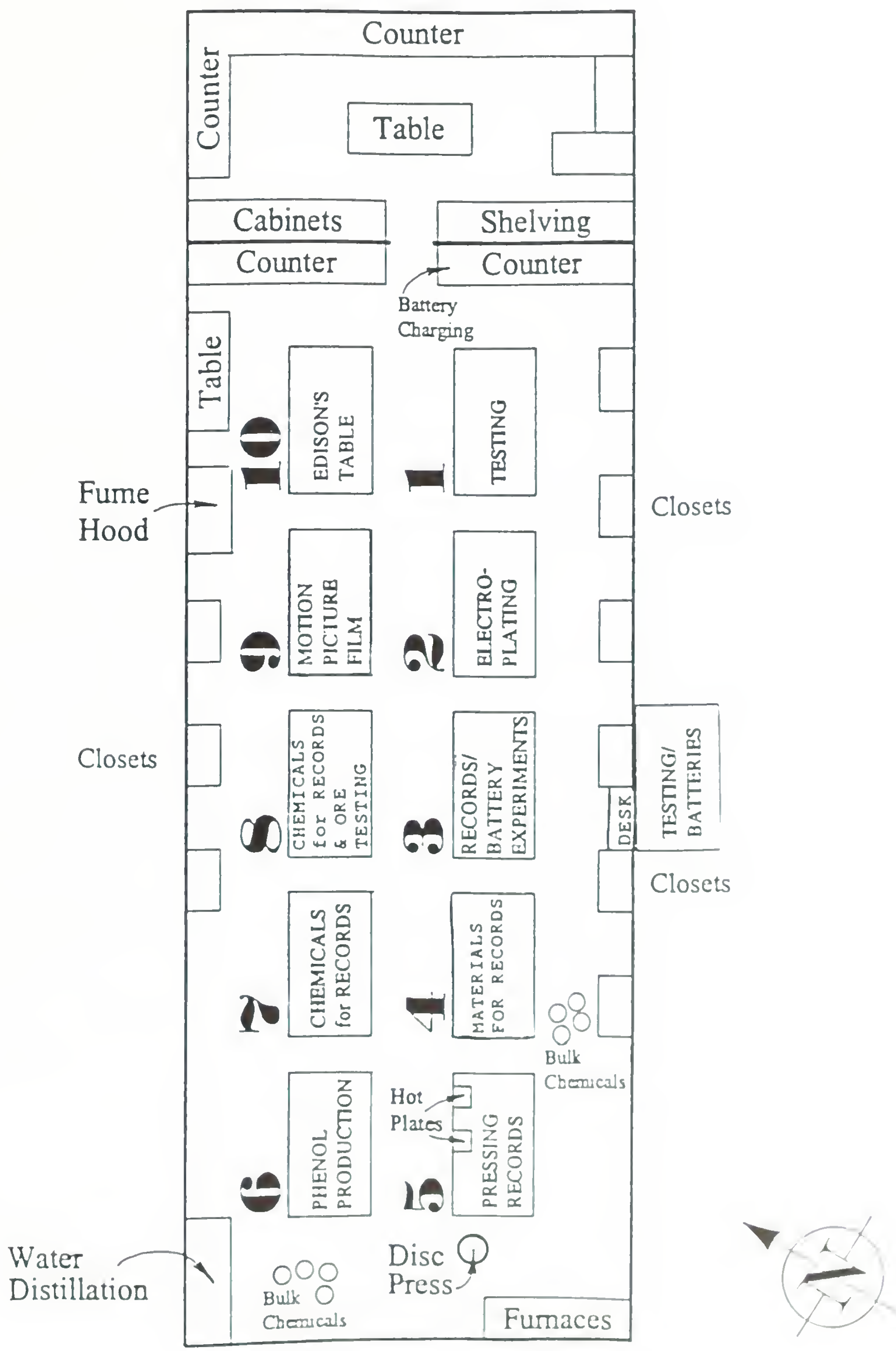


Table 6, Phenol Production. Phenol was a pioneer form of plastic and was the main ingredient in the condensite used to make up the recording surface of Edison Diamond Discs. The condensing distilling machine was located on this table. It was a pressure container in which a vacuum could be created. A vacuum pump was placed nearby. The container was sheathed in a steam jacket to heat the mixture of phenol and formaldehyde and steam pipes were attached. At the bottom of the container was a valve to draw off the hot liquid and a manhole cover attached by large bolts was at the top. The various elements of the mixture were pumped in and then condensed under pressure and at high heat. This created the thick resin, called condensite, which when cooled could be used in records.

The Edison Diamond Disc was composed of a core called the powder blank, and a varnish which set into the hard recording surface. Phenol resins were used in both these parts. The blank contained wood flour, lamp black, phenol resin, denatured alcohol and hexamethylene tetramine. The varnish was made of phenol, paraphenylindiamione, denatured alcohol, pentachlorophenol, hexamethylene tetramine and sandarac--an organic resin.[612]

As the expert on phenol resins, Jonas Aylsworth would have supervised this operation. At this time he was not a member of the staff of this building; he had his own laboratory at his house in Orange. He was under contract to Edison and he would have supervised this work in Building 2.

Object and Location	Evidence	Recommendation
	Table 6	
LAB TABLES, 2 (in place)	Figure 34 and physical evidence.	Use EDIS 350 and EDIS collection.
DRIVE SHAFT (in place)	Figure 34 and physical evidence.	Use EDIS 7411.
PULLEYS (in place)	Figure 34 and physical evidence.	Use EDIS 7374.
Electric MOTOR (in place)	Figure 34 and physical evidence.	Use EDIS 7415.
PHENOL CONDENSER (on table)	Figure 34.	Reproduce.
VACUUM PUMP (on table, connected to drive shaft)	Attached to phenol condenser.	Reproduce.

[612] Leah S. Burt, "Chemical Technology in the Edison Recording Industry," *Journal of the Audio Engineering Society* 25 (November 1977), pp. 716-17; also DF 1914, Phonograph, Record, Manufacture.

SUPER HEATER (on table, connected to steam lines)	Attached to phenol condenser.	Reproduce.
VACUUM FILTER (on table)	Attached to phenol condenser.	Use E-2325.
ROLLING MILL (beside table)	Figure 34.	Acquire.
CENTRIFUGE (beside table)	Figure 34.	Acquire.
CRATE, wood (beside table)	Figure 34.	Use existing crate.
CONDENSING EQUIPMENT (beside west wall)	Figure 34.	Use existing equipment.
WATER TANKS, 2 (along west wall)	Figure 34.	Use existing water tanks.

Table 7, Chemicals For Records. This table is furnished as the work place of Jonas Aysworth, the chemist in charge of the experiments to develop materials to be used in phonograph records. He is such an important figure in the chemical experiments at Edison's laboratory that he has been included in the plan, even though he did most of his work in his private laboratory.

Many of the substances on this table were important ingredients of Edison cylinders and discs: wood flour and asbestos as filler, stearate and other fatty acids for waxes used in cylinders, lamp black to give the record surface the shiny black color, and celluloid.

Celluloid was an inorganic chemical first developed as an artificial substitute for ivory that had great potential as a recording surface. In 1910 it was the best material for records yet devised; it was relatively easy to produce, provided a highly satisfactory recording medium and was difficult to break. It was used to make Edison's Blue Amberol records. Shellac, an organic product derived from insect secretions, was another record compound under examination in this laboratory.

Aylsworth was also testing batches of phenol for use in making condensite. A mortar and pestle would be used to break up the materials in use and there would also be equipment to heat, mix and filter record compounds.

Object and Location	Evidence	Recommendation
Table 7		
LAB TABLE with RACK (in place)	Figure 34.	Use EDIS 351.
Glass RETORT (on table) with SUPPORT and STAND	Figure 34.	Use E-1436 (glass retort), E-1471 (support), and EDIS 6085 (stand).
Glass CONTAINER, large (on table)	Figure 34.	Use EDIS 3209.
1 liter RETORT (on table)	Voucher 40, January 1910.	Acquire.
MORTAR and PESTLE (on table)	Standard laboratory equipment.	Use E-3436.
BUNSEN BURNER (on table) with STAND	Standard laboratory equipment.	Use EDIS 6131 (Bunsen burner) and EDIS 6150 (stand).
Brass Filter SCREENS (on table)	Standard laboratory equipment.	Reproduce.

RETORT (on table) with large TRIPOD	Standard laboratory equipment used to heat mixture.	Use EDIS 6725 (retort) and tripod in EDIS collection.
BUNSEN BURNER (on table)	Standard laboratory equipment used to heat mixture.	EDIS collection.
CHEMICALS (on table): Wood Alcohol Salicylic Acid Alumin Stearate Caustic Potash Nickel Chloride Lanolin Anhydrous Naphtha Solvent	1914 inventory. Naphtha solvent is used to make resin.	Reproduce.
FOR PHENOL RESIN (on table): Iron Kettle Formaldehyde Wood Flour Denatured Alcohol Lamp Black Phenol (in kettle)	See Laboratory Notebook 09-04-20.1 for formaldehyde; Document File "Phonographic Manuscript" for phenol, iron kettle, wood flour, denatured alcohol, and lamp black.	Acquire iron kettle; reproduce formaldehyde, phenol, wood flour, denatured alcohol, and lamp black.
FOR BLUE AMBEROLS (on table): Celluloid Tubing Acetone Methyl Blue BB	Celluloid Co., Voucher 17, September 1910.	Reproduce celluloid tubing, acetone, and methyl blue BB.
OTHER MATERIALS (on table): 5 lb. paper bags of shellac, seven types, I-VII Asbestos Pulp Asbestos Balls Montan Wax	New York Shellac Co., Voucher September 1910 I-VII for 7 types of shellac; Johns Manville Co., Voucher 32, August 1910 for asbestos pulp; and Johns Manville Co., Voucher 60, April 1911 for asbestos balls.	Reproduce shellac, asbestos pulp, asbestos balls, and montan wax.

Table 8, Chemicals For Cylinder Records and Ore Testing for Storage Battery Project. The 1914 inventory records the chemicals for two major projects on this table. This is a table with two experimenters and two unrelated projects. On one hand the bees wax and shellac were both used in experimental cylinder records. On the other, the nickel flake and ore samples on this table were related to analysis of materials involved in the storage battery project.

Albert Petit was involved in the project to alter shellac with solvents to make it into a recording medium. He received solvents made up by Lancaster on table 4. Edison instructed Petit: "I want to get a very hard recording record [a master], work on shellac and tetrachlornapthalene."[613]

Ludwig Ott also carried out experiments involved in record materials, including distilling asphalt residue, which was used as filler in record blanks.[614]

The various forms of nickel flake and ore samples being analyzed were part of the process of testing of materials that was crucial to the storage battery project. The nickel flake produced by electroplating was the critical element in Edison's alkaline battery. Also under analysis was the residue found in the bottom of test cells. The balance on the next table would have been used in measuring the weight of this.

Object and Location	Evidence	Recommendation
	Table 8	
LAB TABLE with RACK (in place)	Figure 34.	Use EDIS 476.
Various CHEMICALS (on rack) [Use samples of chemicals listed below.]	Figure 34.	Reproduce various chemicals.
MIXING BOWL (on table)	Common equipment used to mix solutions.	EDIS collection or acquire.
HOT PLATE (on table)	Common equipment used to heat solutions.	EDIS collection or acquire.
BUNSEN BURNERS, 2 with STANDS, 2 (on table)	Common equipment used to heat solutions.	EDIS collection or acquire.

613 Notebook N-10-09-29.

614 Notebook N-11-10-30.

Copper RETORT (on table) with large TRIPOD	Used to heat asphalt.	Use EDIS 5919 (copper retort); EDIS collection (tripod).
LAB NOTEBOOK (on table)	See Laboratory Notebook 11-10-30.	Reproduce.
FLASKS, 2 (on table)	Used to mix solutions.	Use EDIS 55227 and EDIS collection or acquire.
BEAKERS, 4 (on table)	Used to mix solutions.	EDIS collection.
FUNNELS, 4, ribbed (on table)	Used to mix solutions.	Use EDIS 55229 and EDIS collection or acquire.
GLASS STIRRERS, 4 (on table)	Used to mix solutions.	EDIS collection.
STANDS, 2 (on table)	Used to mix solutions.	EDIS collection.
FLASKS with long necks, 2 (on table)	Used to mix solutions.	Use EDIS 21153 and EDIS collection or acquire.
FLASKS with lip, 2 (on table)	Used to mix solutions.	Use EDIS 5677 and EDIS collection or acquire.
Fluted FUNNELS, 2, small (on table)	Used to mix solutions.	Use EDIS 2500 and EDIS collection or acquire.
MORTAR and PESTLE (on table)	Used to grind shellac.	Acquire.
MIXING BOWLS (on table)	Used to grind shellac.	Use EDIS 4062 and EDIS collection or acquire.
Filter SCREENS, brass (on table)	Used to grind shellac.	Reproduce.
RETORT, copper (on table)	Used to process chemicals.	Use E-3440.
CRUSHER (on table)	Used to process chemicals.	Use EDIS 6076.
LAB NOTEBOOK (on table)	See Laboratory Notebook 10-09-29.	Reproduce.

CHEMICALS for Records (on table): Bees Wax Cresol Resin Ground Shellac Sticks of White Ceresin Hexachlororathan Naphtha Solvent Tetrachlornapthalene Stearic Acid Camphor Zinc and Zinc Stearic Carnauba Wax Japan Wax Soluble Cotton	See 1911 Document File for bees wax; 1914 inventory for bees wax, cresol resin, ground shellac, hexachlororathan; 1911 Document File, WOL, for sticks of white ceresin; and Laboratory Notebook 10-09-29 for remaining chemicals and cotton. Naphtha mixtures are used chiefly as solvents and diluents.	Reproduce all chemicals.
ORE TESTING: Test Tube Rack Bunsen Burners, 2 Stands	Used for testing in storage battery project.	Use EDIS 54478 (test tube rack), EDIS 5408 (Bunsen burner), EDIS collection (stands and second Bunsen burner).
CHEMICALS for Storage Battery Project: Ore Samples Nickel Flake Nickel Hydrate Copper Iron Mix Iron Oxide Potassium Chlorate Potassium Cyanide Tubes of Nickel Flake Lithium Crystals (all located on table)	See 1914 inventory. See Laboratory Notebook 10-06-22 for tubes of nickel flake and lithium crystals.	Reproduce various chemicals. Make up tubes of nickel flake and lithium crystals.
LAB NOTEBOOK (on table)	See Laboratory Notebook 10-06-22.	Reproduce.
HYDROMETER (on table)	Used for analysis of cells.	Use EDIS 2867.
LARGE BEAKERS (on table)	Used for analysis of cells.	EDIS collection.
DRYING TUBE (on table)	Used for analysis of cells.	EDIS collection.
MEASURING CYLINDERS, 2, one large, one medium (on table)	Used for analysis of cells.	Use EDIS 20387 (large measuring cylinder) and EDIS 20578 (medium measuring cylinder).

Table 9, Motion Picture Film. An experimenter called Thomas Greenley worked on a project to find non-flammable film. According to Laverty, he looked at the properties of viscose for use as film stock in this search.[615] By viscose Laverty probably meant a different form of cellulose, obtained by treating it with acetic rather than nitric acid and making it less flammable. The nitrate film in use at the time was volatile and easily combustible.

Object and Location	Evidence	Recommendation
	Table 9	
LAB TABLE (in place)	Figure 34.	Use EDIS 378.
BEAKERS, 2, small (on table)	Needed to conduct experiments.	EDIS collection.
CHEMICALS for making Viscose (on table): Cellulose Glacial Acetic Acid Caustic Soda Carbon Disulfide (all on table)	See Historian's Note 90.	Reproduce.
FILM STOCK (on table)	See Historian's Note 90.	Reproduce.
BOWLER HAT, small (hung from nail on closet)	See figure 29 for example of hat.	Reproduce.
EVAPORATING DISHES (on counter by wall)		Reproduce.

615 Laverty correspondence in Historian's Note 90.

Table 10, Edison's Experiments. Table 10 was an experimental table shared by Edison and his friend and assistant, Fred Ott. Primarily this is the work space of Ott. Edison kept a store of chemicals here and these should dominate the top of the table. The great number and variety of chemicals used by Edison gives an idea of the great range of his interests and underlines the fact that he kept up with the experiments of his numerous experimenters. There are several substances connected to phonograph records. There are also chemicals and iron compounds used in storage batteries. Additionally, Edison had time to look into chemicals related to film stock.

Most of the equipment on this table is related to the simple mixing and heating of compounds.

Object and Location	Evidence	Recommendation
	Table 10	
LAB TABLE with RACK (in place)	Figures 34 and 35.	Use EDIS 383.
LAB COAT (on rack)	Figure 34.	Reproduce.
STAND (on table)	Figure 32.	EDIS collection or acquire.
FLASK (on table)	Figure 32.	EDIS collection or acquire.
GLASS CONTAINER, large, round (on table)	Figure 32.	EDIS collection or acquire.
LAB NOTEBOOKS, 4 (on table)	Common practice.	Reproduce.
BUNSEN BURNER (on table)	Standard laboratory equipment.	Use EDIS 6575.
BEAKERS, 2, (on table)	Standard laboratory equipment.	Use EDIS 6464 and EDIS collection or reproduce.
BEAKER with lip (on table)	Standard laboratory equipment.	Use EDIS 21196.
FLASKS, 3, round bottom (on table)	Voucher 36, May 1909; *Eimer and Amend's Chemical Supply Catalog*, p. 86.	EDIS collection or acquire.
GLASS ROD (on table)	Voucher 36, May 1909; *Eimer and Amend's Chemical Supply Catalog*, p. 86.	EDIS collection or acquire.
PYROMETER (on table)	1912 Document File, Storage Battery.	Use E-1446.

STAND with RING (on table)	Figure 35.	Use EDIS 10965.
FUNNEL, fluted (on table)	Used with stand and ring.	Acquire.
BEAKERS, 2, one small and one medium size (on table)	Used with stand and ring, and fluted funnel.	Use EDIS 6464 (small beaker); EDIS 2474 (medium beaker).
CHEMICALS, "Mr. Edison's Private Table" (on table): Acetone Alcohol Aniline Ammonia Cobalt Anisol Benzene Benzol Bismuth China Wood Oil Camphor Oil Chlorate Ammonia Creosote Cobalt Cyanide of Nickel "Deep Black Fat Color" Dichloro Hydrin Alpha Film Dope Formaldehyde Fuming Nitric Acid Gasoline Glenridge Resin [this is phenol resin made up at the Glenridge plant] Graphite Hexamethylene-tetramine Hydrochloric Acid Hydrogen Peroxide Iron Filings Iron Sulphate Iron Oxide Lamp Black Methylbenzylaniline Mono-chlor-benzol Mono-chlor-phenol Monothyaniline Nitric Acid Nitro Xylol Oil Black	1914 inventory.	Reproduce.

CHEMICALS (con't) Papraphenetidin Phenetole Picoline Sealing Wax Syrian Asphalt Toluisin Meta Turpentine Trichlorphenol Xylidin Para	1914 inventory.	Reproduce.

Northwest Corner, Main Room: Storage Battery Experiments. This area, a counter up against the north wall of the main space of Building 2, is devoted to experiments and testing of storage batteries undertaken by Fred Ott. It is sparsely furnished with a Bunsen burner, stand, and casserole. The storage battery cells have been added to illustrate the function of this space.

The adjoining table against the west wall contained a drying oven and drying crucibles, probably used to recover the residue from the solutions used in batteries.

This plan is based on two sets of images of the chemistry lab: One set from around 1904, and the other from around 1910-1914. Both images have been used to get the greatest amount of detail.

Object and Location	Evidence	Recommendation
West Wall:		
HOOD (west wall)	Figures 32 and 34.	Reproduce or EDIS collection.
TABLE (west wall)	Figure 21.	EDIS collection.
SHELVES (above table)	Figure 21.	Reproduce.
CHAIR (at table)	Figure 21.	Use E-5103.
Drying CRUCIBLES, 6 (on table)	Figure 19.	EDIS collection or acquire.
FILTER PAPER (on table)	Figure 19.	Acquire.
DRYING OVEN (on table)	Figure 21.	Use EDIS 7896.
North Wall: (wall between front and back rooms)		
SHELVES, 3 (on wall; shelves should be full of chemicals as in figures 33 and 35)	Figures 21, 32, and 34.	Reproduce.
TABLE (against north wall)	Figure 21.	Use existing table or reproduce.
TOILET ROLL (attached to table)	Figure 21.	Acquire.
BUNSEN BURNER (on table)	Figure 21.	Use EDIS 15909.

STAND (on table)	Figure 21.	Use EDIS 20775.
CASSEROLE (on table)	Voucher 36, May 1909; *Eimer and Amend's Chemical Supply Catalog*, p. 58.	Acquire.
LAB NOTEBOOKS (on table)	Figure 21.	Reproduce.
BOOKS, reference works (on table)	Common laboratory practice; see figure 21.	EDIS collection.
STORAGE BATTERY CELLS (on floor)	1912 Document File, Storage Battery tests.	Acquire.
HYDROMETER (on counter)	Used to do tests.	Use EDIS 2870.
BEAKERS, 2, large (on counter)	Used to do tests.	EDIS collection.
TOWEL on roller (on door)	Figures 20 and 35.	Acquire.
CLOCK (next to door)	Figures 29 and 33.	Acquire.

Balance Room. According to photographic evidence, the balance room appears to be the place where Edison did much of his experimenting. Figure 20 shows electrolytic equipment used in storage battery work on the main table, and on adjoining tables are the microscopes used to examine the minute grooves in disc and cylinder records. The laboratory notebooks on these tables refer to experiments with record blanks and the assembly and testing of the diaphragms used in the cylinder and disc phonographs. The mica samples were used to make up the thin diaphragm that vibrated with the movement of sound waves. This room also contained the precise balances used in the measurement of chemicals.

The items shown hanging over the west wall in figure 20 are assumed to be paint samples on metal strips. By mounting his samples in this fashion, Edison could test for fading as well as monitor the adhesion of the paint onto the surface of the strips.

Object and Location	Evidence	Recommendation
South Wall:		
CUPBOARDS with glass doors (southwest section of wall)	Figure 20.	Use existing cupboards.
SIDE TABLE	Figure 20.	EDIS collection.
West Wall:		
COUNTER (against west wall)	Figure 26.	EDIS collection.
PAINT SAMPLES on metal strips (hanging over counter)	Figures 20 and 25.	Reproduce.
LAB TABLE in center of room)	Figure 20.	EDIS collection.
WIRES and BULBS (hanging from ceiling)	Figure 20.	Acquire.
Experimental BATTERY STAND (on table)	Figure 20.	Use EDIS 3333e.
CONTAINER, tin (on table)	Figure 20.	Acquire.
CHAIR	Figure 20.	Use EDIS 21385.
BEAKERS, 6 (on table)	Figure 20.	EDIS collection or acquire.
GLASS BOTTLES, 6, large (on table)	Figure 20	EDIS collection or acquire.

PAPER, crumpled (on floor)	Figure 20.	Reproduce.
BALANCES, 2 (on table)	Figure 20.	Use EDIS 8916 and EDIS 8920.
LAB NOTEBOOK (on table)	See Laboratory Notebook 10-05-23; Storage Battery Notes.	Reproduce.
MAGNET WIRE (on table)	Voucher 49, November 1910.	Acquire.
CYLINDER BOXES (under table)	Figure 24.	EDIS collection or acquire.
North Wall:		
COUNTER, open below (against north wall)	Figure 24.	Reproduce.
BALANCE (on counter)	Figure 24.	Use EDIS 8917.
CABINET (on counter)	Figure 24.	Reproduce.
CYLINDER MICROSCOPE (on counter)	Figure 22.	This microscope is no longer in collection; substitute EDIS 8922.
BELL JAR (on counter)	Figure 24.	EDIS collection.
East Wall:		
SIDE TABLES, 2 (against east wall)	Figure 23.	Use EDIS 208.
MICROSCOPE (on table)	Figure 23.	Use E-1327.
LAB NOTEBOOKS, 3 (on table)	Figure 23; Laboratory Notebooks 10-02-11, 10-04-10, and 10-09-29.	Reproduce.
CRUCIBLE (on table)	Figure 23.	EDIS collection or acquire.
BOTTLES, cork-top (on table)	Figure 23; *Eimer and Amend's Chemical Supply Catalog*, pp. 45-46.	EDIS collection or acquire.
STAND, large (on table)	Figure 23.	Use EDIS 21350.
CIGAR (on table)	Figure 22.	Acquire.
VULCAN MATCHES (on table)	See Voucher 16, October 1910.	Acquire.
RED PENCILS (on table)	See Voucher 57, January 1911.	Acquire.

MICA DIAPHRAGMS, 2 (on table) These were made at the Edison Phonograph Works.	See Voucher 78, November 1910.	Reproduce.
MICA SAMPLES (on table)	See Laboratory Notebook.	Acquire.
Clear CELLULOID RECORD (on table)	Used for record experiments.	Use EDIS 25211/25212.
WAX BLANK, brown (on table)	Used for record experiments.	Use EDIS 1283.
DISC RECORD BLANK (on table)	Used for record experiments.	Use EDIS 23792.
DISC MICROSCOPE (on table)	Used for record experiments.	Use E-1328.
OPEN SHELVING (on south section of wall)	Figure 23.	Reproduce.
BOTTLES, various sizes, labelled (on shelves)	Figure 23.	EDIS collection or reproduce.

Northeast Corner, Main Room: Storage Battery Charging and Testing.

This section was where storage batteries were charged by an accumulator, which had light bulbs in its circuit to alter the resistance. Once charged, the batteries could be experimented with and tested on the counter top. This section also had an electrical supply source on the wall.

This area served as a general experimenting and testing area for the storage battery project. The hydrometers measured the specific gravity of the electrolyte inside the experimental batteries. The latter would be left on the counter in various stages of assembly.

Object and Location	Evidence	Recommendation
SHELVES, 3 (on right wall)	Figures 21 and 31.	Reproduce.
SAMPLE JARS, numerous (on shelves)	Figures 27 and 31.	Use EDIS 6548.
BEAKERS, small, numerous (on shelves)	Figures 27 and 31.	Use EDIS 6464.
Experimental BATTERY STAND (on counter)	Figures 27 and 31.	Use EDIS 3333. [This should be modified to look like the one shown in the photograph. Another image of this is figure 20.]
Slips of PAPER (on counter)	Possibly requests for tests.	Reproduce.
CONTAINERS, 2, open, tin (on counter)	Figure 27.	Reproduce.
BEAKERS, 8, small, labelled (on counter)	Figure 27.	Use EDIS 6464 and EDIS collection for seven others.
STAND (on counter)	Figures 27 and 31.	Use EDIS 20821.
FUNNEL (on counter)	Figures 27 and 31.	Acquire.
FLASK, round bottom (on counter)	Figures 27 and 31.	Use EDIS 21153.
WOULFF BOTTLE (on counter)	Figure 27; Voucher 23, June 1909; and *Eimer and Amend's Chemical Supply Catalog*, p. 155.	Use EDIS 6419.
GLASS TUBING as per photograph (on counter)	Figure 27.	EDIS collection or reproduce.

WOODEN STRIP with electrical contacts (on right wall)	Figure 27.	Reproduce.
ACCUMULATOR with bulbs (next to door)	Figure 31.	In balance room.
BATTERY PARTS (on counter)	Used with accumulator.	Use EDIS 6570.
BATTERY CONTAINERS, glass (on counter)	Used with accumulator and battery parts.	Use EDIS 7856.
Experimental BATTERY CONTAINERS (on counter)	Used with accumulator, battery parts, and containers.	Use EDIS 7050.
BATTERY TEST STAND (on counter)	Used with accumulator, battery parts, and containers.	Use EDIS 7862.
BATTERY TESTER (on counter)	Used with accumulator, battery parts, containers, and test stand.	Use EDIS 7062.
HYDROMETERS, 2 (on counter)	Used with accumulator, battery parts, containers, test stand, and tester.	Use EDIS 2869 and EDIS 2871.
Rack of TEST BATTERIES wired up to accumulator (on floor)	Figure 31.	Use EDIS 21398.
Large BOTTLES OF CHEMICALS (on floor)	Figure 31.	Reproduce.
CLOTH SACK (on floor)	Photograph album 7.	Acquire.
CASE for primary battery (on floor)	Figure 31.	Reproduce.
STOOL (near counter)	Figure 21.	EDIS collection.

Table 1, Testing. Testing and analysis was an important part of the work of the chemical laboratory. It ranged from making tests on experimental solutions to find their chemical compositions to analyzing samples of ore. As early as 1888 Reginald Fessenden found that "a good deal of analytical work" was carried out in Building 2.[616] This table contains the racks of test tubes which contained solutions to be analyzed, the stands and bunsen burners to heat up solutions, and the equipment to measure capacity, specific gravity and acidity.

Ignatius Goldstein was in charge of this table.[617] He was Edison's analytical chemist during this period. At this time much of his work was related to the storage battery project and he examined and analyzed the electrolytic solution used in experimental and production batteries.[618] He also made up special solutions to order. He mixed up shellac and other chemicals for Edison in 1910 as part of the phonograph record experiments.[619]

Object and Location	Evidence	Recommendation
	Table 1	
LAB TABLE with RACK (in place)	Figure 29.	Use EDIS 380.
TROEMNER BALANCE (on table)	Used for testing.	Use EDIS 6805.
TEST TUBE RACKS, 2 (on table)	Used for testing.	Use EDIS 7851 and EDIS 7853.
HYDROMETERS, 2 (on table)	Used for testing.	Use EDIS 2872 and EDIS collection or reproduce.
STANDS (on table)	Standard laboratory equipment.	EDIS collection.
BUNSEN BURNERS, 2 (on table)	Standard laboratory equipment.	Use EDIS 3401 and EDIS 3402.
MORTAR and PESTLE (on table)	Figure 29.	Use EDIS 29218.

[616] Fessenden, "The Inventions of Reginald Fessenden," *Radio News 8* (August 1925), p. 237.

[617] Laverty correspondence in Historian's Notes 68, 90, and 95, annotation on figure 29.

[618] Requests for tests in Storage Battery folders found in DF 1911 and DF 1912.

[619] Edison note, April 27, 1910, Notebook N-09-04-20.

FLASKS, 7, four medium-size and three small-size (on table)	See Voucher 39, September 1909 for medium-size flasks and *Eimer and Amend's Chemical Supply Catalog*, pp. 85-86 for both sizes.	EDIS collection.
Measuring CYLINDERS, 2, one large-size and one medium-size (on table)	Used for testing.	Use EDIS 20386 (large measuring cylinder) and EDIS 20604 (medium measuring cylinder).
PIPETTES in wooden stand (on table)	Used for testing.	Use E-1449.
ACID MEASURES (on table)	Marked in *Eimer and Amend's Chemical Supply Catalog*, p. 1.	Use EDIS 18002, EDIS 19756, and EDIS collection.
Slips of PAPER, requesting tests (on table)	1910 Document File, Storage Battery; 1912 Document File, Storage Battery.	Reproduce.
HYDROMETER (on table)	Used to carry out tests requested above.	EDIS collection.
EVAPORATING DISHES (on table)	Used to carry out tests requested above.	EDIS collection.
FILTER PAPER (on table)	Used to carry out tests requested above.	Reproduce.

Table 2, Electroplating Records. The electroplating equipment shown on this table represents the method Edison devised to make numerous duplicates of master recordings. This equipment for disc records was a successor to the method of gold plating cylinder masters that had been successfully developed in the laboratory from 1888-1903. The cylinder or disc was placed inside a vacuum and small particles of gold "spluttered" on it while the disc or cylinder revolved. In the production process a thin layer of graphite was brushed onto the wax master. Both these methods gave the surface of the disc an electroconductive surface.

The plating was done in hard rubber baths with anodes inside them. The master was first copper plated, and then nickel plated on top of this thin layer to form a durable surface. The wax was removed and the surface cleaned. The result was a perfect negative impression of the recording groove, called a matrix. This was used in the record press to make duplicates.

Al Wurth was the electroplating expert in the laboratory and would have supervised this work.

Object and Location	Evidence	Recommendation
	Table 2	
LAB TABLE (in place)	Figure 29.	Use EDIS 376.
VACUUM PUMP (on table)	Figure 29.	Use E-159-5.
ELECTROPLATING DEVICE (on table)	Figure 29.	Attach to vacuum pump.
WAX MASTER (in electroplating device)	Complements artifact.	Use EDIS 2077.
MOLDS, 2, one copper-plated and one copper-master (next to wax master)	Complements artifact.	Use EDIS 23181 (copper plated mold) and EDIS 24845 (copper master mold).
GRAPHITE (in six glass jars)	Used in plating.	Use EDIS 14330 through 14335.
TOOTHBRUSHES, 4	Used in plating.	Use EDIS 14425 through 14428.
BRUSHES, 3 (on table)	Used to clean wax from copper surface.	EDIS collection or reproduce.
KNIFE, sharp (on table)	Used to trim "flash," or pieces of material protruding over the edges of the mold.	Acquire.

CHEMICALS used in Electroplating:		
Caustic Soda Distilled Water, in glass container Alcohol Copper Plating Nickel Sulphate Silverplating Solution Acetic Acid	1914 inventory.	Reproduce.
Sulfuric Acid, two containers Copper Sulphate Sodium Sulphate Nickel Sulphate (all of the above on table, next to electroplating baths)	See Historian's Note 128.	Reproduce.
ELECTROPLATING BATHS, 2 or 3, hard rubber, connected to source of electricity, anodes installed (near electric outlet in wall or ceiling socket)	Used in electroplating.	Use EDIS 24183 and EDIS collection or reproduce.

To Demonstrate the Different Kinds of Electroplating:

COPPER ANODES (near baths)	Used in electroplating.	Reproduce.
NICKEL SHOT (near baths)	Used in electroplating.	Can be found in vault 32.
Fine GOLD POWDER (near baths)	Used in electroplating.	Reproduce.

To Make Up Solutions:[620]

HYDROMETER (on table)	Used to test solutions.	EDIS collection or reproduce.
Measuring CYLINDERS, 2 (on table)	Used to test solutions.	EDIS collection or reproduce.
ACID MEASURES, 2 (on table)	*Eimer and Amend's Chemical Supply Catalog*, p. 1.	EDIS collection or reproduce.
BUNSEN BURNER (on table)	Standard laboratory equipment.	EDIS collection or reproduce.
STAND (on table)	Standard laboratory equipment.	EDIS collection or reproduce.
BEAKERS with lip, 2 (on table)	Used to mix solutions.	Use EDIS 21193 and EDIS 21194.

[620] All of these solutions are described in Burt, "Chemical Technology in the Edison Recording Industry," pp. 716-17.

Table 3, Record/Battery Experiments. We know a lot about the work at this table because the experimenter who worked here from 1909 to 1910 left several letters about his activities. This table has two unrelated experimental tasks occurring at the same time and on the same table--relatively common in Edison's laboratory. Paul Laverty worked both on condensite for phonograph records and on the nickel flake used in the Edison storage battery.[621]

The wax and shellac materials used in cylinders were early attempts to find a recording medium which was easy to mold and difficult to break. Both were inferior when compared to celluloid and phenol resins. They mark the first efforts to find materials for records, which dated from the late nineteenth century. Legal difficulties prevented Edison from using celluloid and forced him to find a substitute. One of his options was shellac, and he experimented to make it soft enough to mould into records and then hard enough to preserve the spiral groove of sound waves, "of such hardness and toughness that it approaches celluloid."[622]

In 1909, Edison began an experimental notebook devoted to recording experiments on solvents used to dissolve shellac and like substances. The idea was to crystallize the solution to provide a hard recording surface.[623] Laverty had the task of testing various solvents used to alter shellac. He mixed shellac and tetrachlornapthalene with numerous solvents and kept a record of the results.[624] Laverty was also involved in experiments on phenol-based record materials. His laboratory notebook records the mixing of chemicals and his letters indicate that he worked on condensite.[625]

One interesting experiment described by Laverty was based on Edison's need to know about the sludge left in the bottom of the electroplating baths to make nickel flake. He asked Laverty to find out why this residue did not plate.[626]

Laverty's co-worker on this table, Paul Christiansen, produced lithium which was used in batteries.[627] He tested his lithium by titration, (a method of determining a constituent in a mixture by volumetric analysis), using the burettes seen in

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[621] Historian's Notes 68, 90, and 95 contain recollections of Paul S. Laverty.

[622] Notebook N-09-04-20.1.

[623] Notebook N-09-04-20 "Solvents" April 20, 1909.

[624] Notebook N-10-07-29.

[625] Notebook N-11-00-00.3.

[626] Historian's Note 68.

[627] Laverty correspondence in Historian's Note 90.

figure 29. Although it is not certain that Christiansen was actually working at Laverty's table at the time the photograph was taken, the presence of lithium hydrate on this table, as recorded in the 1914 inventory, is reason enough to place him here.

Christiansen was also involved in mixing chemicals for records. This was a somewhat trial and error experiment as he mixed a broad variety of chemicals together and noted the results: "dont mix, mix good, hard brittle, soft."[628] With both these experimenters making large numbers of experiments involved in mixing chemicals together, it has been decided to place numerous beakers on the table. The mixing might have been carried out in test tubes, or sample bottles, or whatever. The choice of beakers is based on the assumption that these mixtures would have to be stirred and watched for settling and congealing. The point is to number the containers and place them close to the notebooks which record the outcome.

Object and Location	Evidence	Recommendation
Table 3		
LAB TABLE (in place)	Figure 29; physical evidence.	Use EDIS 355.
TRIPOD (on table)	Standard laboratory equipment.	Use EDIS 7308.
BUNSEN BURNER (on table)	Standard laboratory equipment.	Use EDIS 1478.
TEST TUBE RACK (on table)	Standard laboratory equipment.	Use EDIS 6089.
Round-bottom FLASK with stopper and tube (on table)	Figure 29.	Use EDIS 6089.
BURETTES, 4, two large and 2 small (on table)	Figure 29.	Use EDIS 21353 (large burette) and EDIS collection.
SUPPORTS, 2 (on table)	Figure 29.	Use EDIS 21350 and EDIS collection.
BEAKERS, 4 (on table)	Figure 29.	Use EDIS 5817 and EDIS collection.
FLASK with nickel sludge (on table)	Paul Laverty correspondence.	Reproduce.

[628] Notebook N-10-02-02.

TRIPOD (on table)	Standard laboratory equipment.	Use EDIS 6158.
BUNSEN BURNER on table)	Standard laboratory equipment.	EDIS collection.
LAB NOTEBOOK (on table)	See Laboratory Notebook 11-00-00.3 (PL[averty] experiments).	Reproduce.
CHEMICALS (on table): Formaldehyde Aniline Phenol Hydrochloric Acid	Used to carry out experiments.	Reproduce.
LAB NOTEBOOKS, 2 (on table)	See Laboratory Notebook 10-07-29 (Paul Laverty experiments); Laboratory Notebook 10-02-02 (Paul Christiansen experiments).	Reproduce.
BEAKERS, 25, small, labelled (on table)	Used to carry out experiments.	EDIS collection.
STIRRING SPOONS, 5 (on table)	Used to carry out experiments.	EDIS collection.
Round-bottom FLASKS, 6 (on table)	Used to carry out experiments.	Use EDIS 21157 and EDIS collection.
FLASKS, 4, small (on table)	Used to carry out experiments.	Use EDIS 2495 and EDIS collection.

Christiansen's BASE CHEMICALS for mixes (on table): Sugar Phenol Sulphur Aniline Shellac Montan Wax Lithium Hydrate Nickel Nickel Nitrate Potassium Carbonate Sodium Sulphate Iron Metallic Iron Mix Sulfuric Acid Ammonium Nitrate Calcium Carbonate Copper Sulphate	1914 inventory.	Reproduce.

East Wall. These closets appear to contain the same chemicals as recorded in the 1914 inventory. They should be left the way they are. Desks and shelves were installed between these closets on the east side, and a desk has been included in the furnishing plan. Its location is the result of examination of the photographic evidence and conjecture.

Object and Location	Evidence	Recommendation
CLOSET 1, Alkalies including: Potassium Sodium Ammonium Lithium	1914 inventory.	EDIS collection.
CLOSET 2, Ammonium Carbonate including: Barium Strontium Calcium Magnesia Rare Metals	1914 inventory.	EDIS collection.

CLOSET 3, Inorganic including: Ammonium Sulphide Iron Nickel Cobalt Aluminum Chromium Manganese Zinc	1914 inventory.	EDIS collection.
CLOSET 4, Hydrogen Sulphite including: Bismuth Copper Lead Tin Cadmium Inorganic Acids Arsenic Carbon	1914 inventory.	EDIS collection.

Testing/Batteries—Rosenstein was Goldstein's assistant and helped him in the analysis of various chemicals. There was so much testing required at the laboratory that it was too much for one man on one table. Rosenstein would use the same equipment as his supervisor: mortar and pestle to break up materials, measuring cylinders to record amounts, and hydrometers to test the specific gravity of solutions used in storage batteries. The filter paper and evaporating dishes were used to dry out these solutions to obtain the residue of nickel flake (and other metals used in the batteries) for subsequent testing.

Goldstein and Rosenstein were also involved in finding substitutes for materials used in batteries. They examined the salt nickel hydroxide to help determine if some other salt would do the job better.[629]

Object and Location	Evidence	Recommendation
TABLE (against east wall, between closets 4 and 5)	See figures 16 and 30 for example.	EDIS collection.
STANDS, 3, metal (on table)	Figures 17 and 21.	Acquire.

[629] Laverty correspondence Historian's Note 90.

FUNNELS, 3, fluted (on table)	Figures 17 and 21.	Acquire.
Round-bottom FLASKS, 7, three large and four small (on table)	Figures 17 and 21.	Acquire.
CASSEROLE, large (on table)	Figures 17 and 21.	Acquire.
BUNSEN BURNERS, 2 (on table)	Standard laboratory equipment.	Use EDIS 1478 and EDIS 6131.
Round-bottom FLASK (on table)	Standard laboratory equipment.	Use EDIS 3153.
Measuring CYLINDERS, 2, one small and one medium (on table)	Standard laboratory equipment.	Use EDIS 20586 (small measuring cylinder); EDIS 20578 (medium measuring cylinder).
CHEMICALS: Benzol Benzine Ammonia Nitric Acid Sulfuric Acid (all on table)	1914 inventory.	Reproduce.
Slips of PAPER, requesting tests, 3 or 4 (on table)	See 1910 Document File, Storage Battery; 1912 Document File, Storage Battery.	Reproduce.
HYDROMETER, 2 (on table)	Used to conduct test requested above.	Use EDIS 2866 and EDIS 2866.
HYDROMETER STAND (on table)	Holds hydrometer.	Use E-1437.
EVAPORATING DISHES (on table)	Used in conducting tests.	Reproduce.
FILTER PAPER (on table)	Used in conducting tests.	Reproduce.
PIPETTES in stand (on table)	Used in conducting tests.	Use E-1449.
MORTAR and PESTLE (on table)	Used in conducting tests.	Use EDIS 29218.
FUNNELS, 2 (on table)	Used in conducting tests.	Use EDIS 21180 and EDIS collection.
BEAKERS, 6 (on table)	Used in conducting tests.	EDIS collection or reproduce.

TEST TUBE RACKS, 2 (on table)	Used for testing.	Use EDIS 7082 and EDIS 7083.
TORSION BALANCE (on table)	Used for testing.	Use EDIS 7091.
FILTER PAPER RACK (on table)	Used for testing.	Use EDIS 7296.
CLOSET 5: Organics Alcohols Aldehydes Amines Hydrocarbons Ketones Oils Inorganic Acids (in place, east wall)	1914 inventory.	EDIS collection.
CLOSET 6: Organic, including Dyes: Aniline Dyes Organics (in place, east wall)	1914 Inventory.	EDIS collection.

Table 4, Materials for Records. Phonograph records contained a wide variety of different chemicals and organic substances. Each chemical or organic substance might be the end product of a series of complex transformations. On this table an experimenter was involved in mixing some of the substances used in records, such as oleic acid, and producing an intermediate substance, based on naphthalene, which was used as a solvent in preparing solutions of record materials, including shellac.[630]

According to Laverty, H.W. Lancaster was at work on this table chlorinating naphthalene to make substances such as tetrachlornapthalene to dissolve shellac. This was delivered to Petit as a solvent to use in his experiments on shellac.[631] The chemicals on this table in 1914 suggest that Lancaster experimented with dissolving shellac as part of the process of making up the solvents.

Object and Location	Evidence	Recommendation
	Table 4	
LAB TABLE with RACK (in place)	Physical evidence.	Use EDIS 348.
BEAKERS, 2, small (on table)	Standard laboratory equipment.	EDIS collection.
BUNSEN BURNERS, 2 (on table)	Standard laboratory equipment.	Use EDIS 7099 and EDIS 7098.
TRIPOD (on table)	Standard laboratory equipment.	EDIS collection.
Round-bottom FLASKS, 3 (on table)	Standard laboratory equipment.	Use EDIS 6154 and EDIS collection.

[630] See annotated copy of Henry Watts, *A Dictionary of Chemistry* (London: Longman's, 1883), vol. IV, pp. 1-24 in laboratory library.

[631] Notebook N-10-09-29.

CHEMICALS (on table):		Reproduce all.
Oleic Acid Gallic Acid	1914 inventory.	
Naphthalene	1914 inventory; Historian's Note 90; Paul Laverty correspondence.	
Chlorine	Historian's Note 90; Paul Laverty correspondence.	
Tetrachloronaphthalene	Paul Laverty correspondence.	
Carbon techtrachloride Hydroxylamine Chloride Xylol Chlorinated	1914 inventory.	
Naphtha Solvent	Used to dissolve shellac.	

Table 5, Pressing Records. Once the record material had been mixed and a matrix (or mold as it was called in the laboratory) of the master recording prepared, the task was then to press numerous copies of the original. In the case of disc records, this was a simple matter of using a hydraulic press with the matrix attached to imprint the grooves of sound waves into record blanks. The Robertson disc press on this table was probably used for experimental rather than production purposes (production would have gone in a large factory such as Building 24) and therefore it would be surrounded by experimental disc blanks and fragments. The Edison disc record was a composite of a blank and a layer of recording medium. This press could have been used to fuse these two layers together for test purposes.

Albert Petit was heavily involved in phonograph experiments and was experienced in making matrices and using them in presses. He probably would have supervised the work of test pressing.

Experiments were conducted to find out the effects of heating and freezing on record materials. On one experiment, shellac cylinders were heated to 115°F for one week and then returned to room temperature and played.[632] This could have been done in the southeast corner of Building 2 using hot plates and ice chests.

Object and Location	**Evidence**	**Recommendation**
	Table 5	
LAB TABLE (in place)	Physical evidence; figure 34.	Use EDIS 477.
Steam HOT PLATES, 3 (on table)	Figure 34.	Use EDIS 7496, EDIS 7489, and EDIS 7496.
LID MOLDS (on the floor)	Figure 34.	Use EDIS 57263. [There are several more of these uncataloged in Building 2]
Robertson DISC PRESS (beside lab table)	Figure 34.	Use EDIS 347.
SCREW PRESS for discs (on table)	Figure 34.	Use EDIS 7505.
Experimental DISC (on table)	Complements the disc press.	Use EDIS 4275.
DISC FRAGMENT (on table)	Complements the disc press.	Use EDIS 4218.

632 Meadowcroft Reports, August 25, 1911 (in DF 1911, WOL).

Experimental BLANKS, 9 (on table)	1914 Document File, Phono.	Use EDIS 49227 through EDIS 49235.
Experimental RECORDS (on table)	1914 Document File, Phono.	Use EDIS 49226.
MASTER MOLD, copper (on table)	1914 Document File, Phono.	Use EDIS 24845.
Working MOLD (on table)	1914 Document File, Phono.	Use EDIS 1540.
SACKS of BULK CHEMICALS (on the floor) Bulk chemicals were placed near the south window, which is now the door to the lean-to.	Figure 34.	Reproduce.
ICE CHESTS, 2 (on the floor)	Used to interpret heating and cooling tests done in this room.	Use E-3501 and E-3397.
THERMOMETER, 600 F (on the floor)	Voucher 39, September 1909.	Acquire.

South Wall: Furnaces and Chemical Storage. This area was taken up with the chemistry laboratory's furnaces. Laverty reported that the experimenter Alexander H. Cave was involved in roasting iron sulphate in order to dehydrate it.[633] Shop order 2183 indicates that Cave was carrying out experiments with automobile wheels, perhaps part of the electric car project. Although Laverty said that Cave had his own kiln (somewhere outside the laboratory), both these experiments could have been carried out near the furnaces.

Object and Location	Evidence	Recommendation
LAB TABLES, 2 (against south wall)	Common usage in laboratory. Needed to support equipment.	EDIS collection.
REICKHELM FURNACE (on table)	Historian's Note 90. Used to conduct experiments.	Use E-1518.
POT FURNACE (on table)	Historian's Note 90. Used to conduct experiments.	Use E-1230.
FURNACE (on table)	Historian's Note 90. Used to conduct experiments.	Acquire.
BLACKSMITH'S TONGS (on table)	Historian's Note 90. Used to conduct experiments.	Use EDIS 7777.
VISE (on table)	Historian's Note 90. Used to conduct experiments.	Use EDIS 7779.
LADLE (on table)	Historian's Note 90. Used to conduct experiments.	Use EDIS 7833.
Small SHOVEL (on table)	Historian's Note 90. Used to conduct experiments.	Use EDIS 7801.
CRUCIBLES, 3 (on table)	Historian's Note 90. Used to conduct experiments.	Use EDIS 3271, EDIS 3276, and EDIS 3270.
BARREL of NAPHTHA FLAKES (south wall, west of door)	Voucher 63, February 1910.	Reproduce.
DRUM of CAUSTIC SODA (south wall,west of door)	Voucher 30, February 1910.	Reproduce.
DRUMS of BENZOL, 2 (south wall, west of door)	Voucher 33, May 1910.	Reproduce.

[633] Laverty correspondence in Historian's Note 90.

BARRELS of PLASTER OF PARIS, 2 (west wall, north of water tanks)	Voucher 31, August 1910.	Reproduce.
CLOSETS 7, 8, and 9: Glassware (on shelves along west wall)	Physical evidence; also practical storage area.	EDIS collection or acquire.
SIGN "Do Not Disturb" (on exterior of west door)	Photo no. 10.120/28 (Edison NHS), not reproduced in this report.	Reproduce.

Building 3, Pattern Shop

The pattern shop is largely intact. Very little has to be done to recreate its historic furnishings and make it ready for interpretation, other than removing piles of National Park Service maintenance and curatorial supplies.

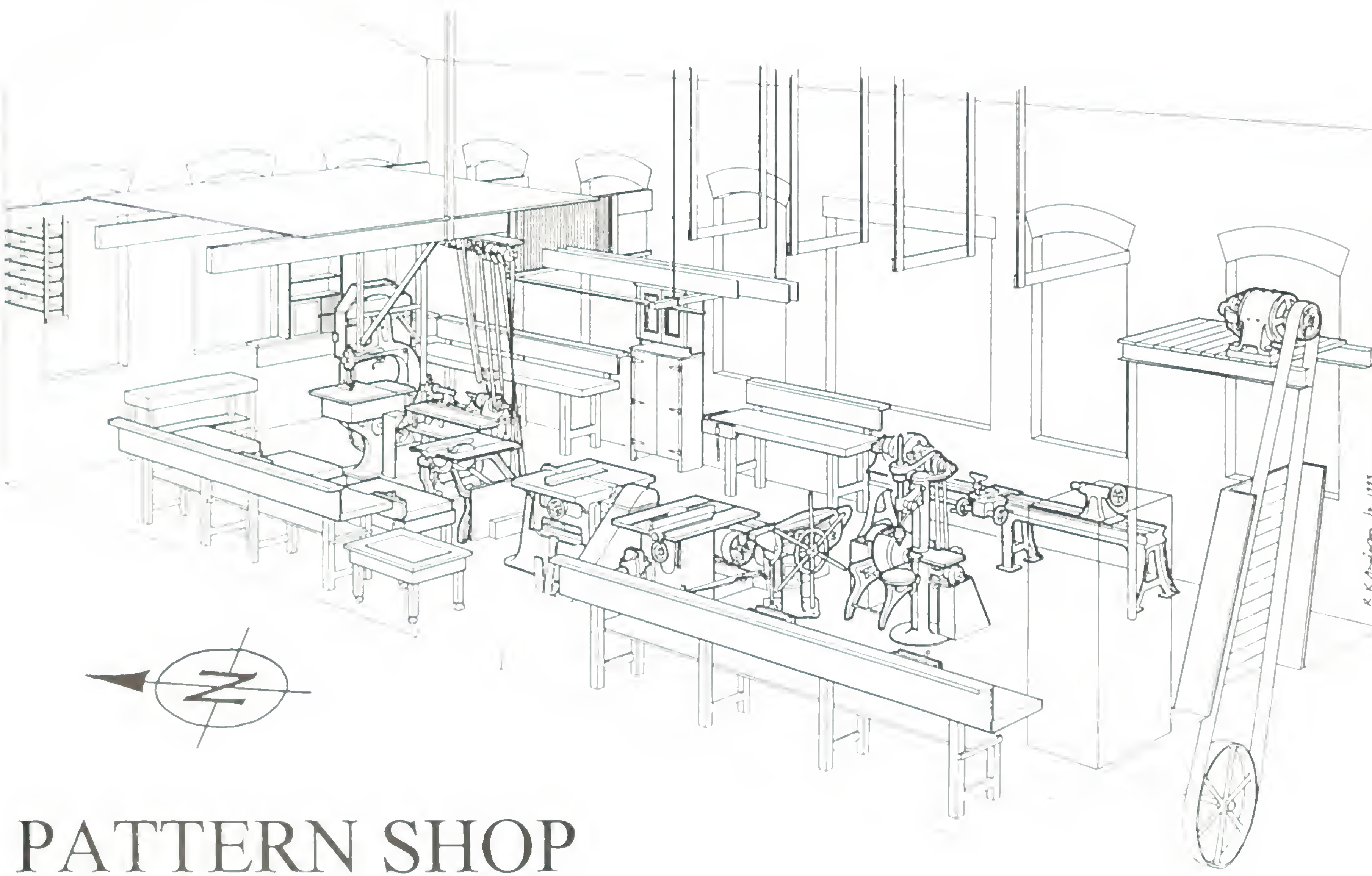
Like many woodworking operations, the laboratory's pattern shop was arranged with a row of machines running down the center of the floor, and benches around the perimeter.

There are only two known photographs of the interior of this space: one taken in 1890 (figure 41), the other on January 6, 1917 (figure 42). The 1890 image shows the southern half of the shop; the 1917 photo was taken from the southeast corner looking north.

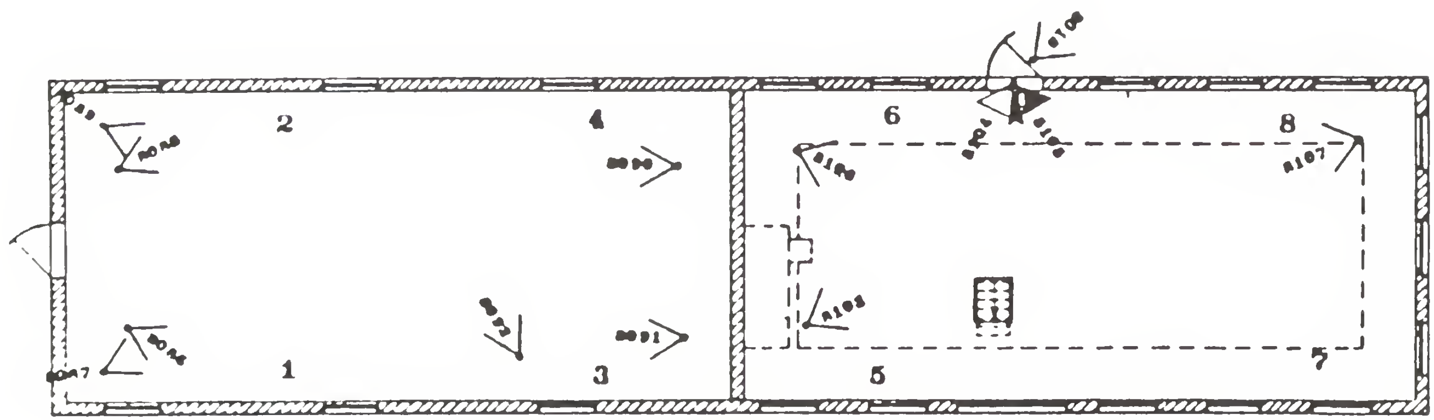
The present arrangement is very similar to that shown in the 1917 photo. All of the machines listed in the plan appear in a 1920 inventory by New York Appraisal Company, and the 1939 inventory conducted under the direction of Norman Speiden. The exception is the shop's motor, which was removed from service in 1961 after it caught fire.

Interpreting this shop to the 1910-1920 period proposed for application throughout the site necessitates removal of five small electrically driven machines that were installed sometime between 1920 and 1939: a grinder (EDIS 26415), drum sander (EDIS 321), disc sander (EDIS 323), drill press (EDIS 26251), and circular saw (EDIS 26420). Modern carbide-toothed combination blades on the table saws should be replaced with steel rip and crosscut blades.

Work space on the long patternmakers' bench, located along the west wall, north of the door, was supplemented by three rolling tables with surface plates mounted on wood stands with casters. These should be pulled out of the corner and positioned opposite the bench.



PATTERN SHOP



BLDG N° 3

100 FT

Building 3, Pattern Shop

Object and Location	Evidence	Recommendation
BENCH, 5' 8" long, 2' deep (section 8; along west wall, north of door)	Figure 42.	Use EDIS 26397/E-5101 (original).
SURFACE PLATE (section 8; on bench EDIS 26397)	Figure 42.	Use EDIS 26412/E-5100 (original).
PATTERNMAKERS' BENCH, 14' long, 28" deep, with two Emmet patternmakers' vises attached (section 8; along west wall, north of door)	Figure 42. Purchased from Manning, Maxwell, & Moore, Dec. 30, 1887, $20.00, voucher 232.	Use EDIS 326/E-5093 (original).
CABINET, pine (section 8; northwest corner)	Figure 42. For patternmakers' leather strips (fillets).	Use EDIS 26434/E-5099 (original).
CABINET, pine (section 8; west wall)	For patternmakers' hardware. Common usage.	Use EDIS 26435/E-5094 (original).
TOOL RACKS with TOOLS (section 8; on benches along west wall)	Figure 42.	EDIS collection or acquire.
COAT and HAT (section 8; on hooks above benches along west wall)	Figure 42.	Reproduce.
CLAMPS (section 8; on racks above benches along west wall)	Figure 42.	EDIS collection or acquire.
PATTERNS, wood, phonograph base plate (section 8; on benches)	Used to show phonograph project was being worked on throughout the laboratory complex.	Reproduce.
Surface Plate TABLE, 34-1/2" x 24-1/2", iron surface plate, E-5119 on wood stand with castors E-5120 (section 8)	Figure 42.	Use EDIS 26407 or EDIS 26409 (original).
Surface Plate TABLE, 49-1/2" x 24", iron surface plate, E-5112 on wood stand with castors E-5113 (section 8)	Figure 42.	Use EDIS 26410 (original).

Surface Plate TABLE, iron surface plate, E-5106 on wood stand with castors E-5107 (section 8)	Figure 42.	Use E-5106 and E-5107 (original).
Surface Plate TABLE, 50" x 24-3/4", iron plate E-5116 on wood stand with castors E-5117 (section 8)	Figure 42.	Use EDIS 26408 (original).
Surface Plate TABLE, (section 8)	Figure 42.	Use E-5128 (original).
BENCH, 6' long, 26-1/4" deep, with Emmet vises EDIS 26401/26403 (section 7; along north wall)	Figure 42.	Use EDIS 26396/E-5109 (original).
STOOL (section 7; under bench)	Commonly used in shop.	USE E-5130 (original).
Clothes CABINET, pine, (section 7; east wall)	Common usage; cabinet is original to room.	Use E-5111 (original).
Card File CABINET, wood, two drawers (section 7; east wall)	See card file in figure 42; cabinet is original to site.	Use EDIS 2644/E-5105 (original).
WALL CLOCK, made by Seth Thomas (section 7; on north wall)	Figure 42.	Use EDIS 26264 (original).
CABINET, for books, numbering stamps, and small tools (section 7; north wall)	Figure 42.	Use EDIS 26433/E-5104 (original).
Candlestick TELEPHONE, ringer attached to north wall (section 7; on counter beneath northeast window)	Figure 42.	Acquire.
CLIPBOARDS with papers attached (section 7; hanging randomly on north and east walls)	Figure 42.	Acquire.
FAN, (section 7; on shelf, on wall between center and eastern window, north wall)	Figure 42.	Acquire.
CHARTS/NOTICES, hung on walls (section 7; on north and east walls)	Figure 42.	Reproduce.

PLANS, rolled, stored in racks above east wall bench, and on benches (section 7; northeast corner)	Figure 42.	Reproduce.
CABINET, hardwood, contains patternmakers' nails (section 7)	Figure 42.	Use EDIS 26419/E-5108 (original).
PATTERNMAKERS' BENCH, includes one Emmet patternmakers' vise EDIS 26401, and one wooden vise EDIS 26403 (section 7; along east wall)	Figure 42.	Use EDIS 26396/E-5110 (original).
GLUEPOT, 1 qt. (section 7; on bench EDIS 26396)	Figure 42.	Use E-5114 (original).
BAND SAW made by Frank H. Clement & Co., Rochester, NY; American Model B 36, 36" throat, 32" square tilting table, "Shop No. 101336" (section 7; at north end of central row of machines)	Figure 42; 1920 Appraisal no. 1.	Use EDIS 325/E-5089 (original).
BANDSAW SETTING MACHINE, made by Goodell & Waters (section 7; attached to bandsaw)		Use EDIS 26416/E-5090 (original).
LATHE, wood, (unknown make) 12" swing, 4' bed (section 7; south of bandsaw)	Figure 42; 1920 Appraisal no. 2.	Use EDIS 320/E-5088 (original).
COUNTERSHAFT, for wood lathe EDIS-320 (section 7; attached to mezzanine floor joists)	Figure 42.	Use E-5088-1 (original).
TOOL HOLDER for lathe, made by Williams, #0-Left (section 7; on wood lathe)		Use EDIS 26565/ E-5088-4 (original).
TOOL HOLDER for lathe; by Williams, #0-Right (section 7; on lathe)		Use E-5088-3 (original).
Adjustable TABLE, 1 ft. cube (section 7; special adjustable table to fit on wood lathe)	Figure 42.	Use EDIS 26630/ E-5088-2 (original).

TABLE SAW, 12" blade, with 31" x 41" tilting table, iron open leg frame, set-up for cross-cutting; by Beach, Brown, & Co., Montrose, PA, (section 8; south of wood lathe)	Figure 42; 1920 Appraisal no. 3.	Use EDIS 324/E-5087 (original); replace modern carbide-tipped blade with steel cross-cut blade.
TABLE SAW with tilting arbor, 14" blade, 31-1/2" x 43-1/2" table, pedestal base, set-up for ripping; by Crescent Machine Co., Leetona, OH, (section 8; south of jointer)	Figure 42; 1920 Appraisal no. 4.	Use EDIS 319/E-5084 (original); replace modern carbide-tipped blade with steel rip blade.
JOINTER with 24" two-knife head, 47" x 24" bed, made by J.A. Fay & Co., Cincinnati, OH, (section 8; south of 12" table saw, opposite door)	Figure 42; 1920 Appraisal no. 5. Purchased Nov. 18, 1887, $205, voucher 784.	Use EDIS 322/E-5085 (original).
PATTERNMAKERS' LATHE with 24" swing, 12' bed, iron legs, compound rest, made by J.A. Fay & Co., #6, serial no. 11021 (section 5; against east wall) [Originally located in center of shop (figure 42). Moved to present location between 1890 and 1917.]	Figures 41 and 42; 1920 Appraisal no. 6. Purchased January 12, 1888, $304.00, voucher 236.	Use EDIS 277/E-5118-2 (original).
TOOL STAND, 3' high, made by J.A. Fay Co., hand rest for patternmakers' lathe (section 5; next to lathe)	Figure 41.	Use original in EDIS collection.
COUNTERSHAFT, for patternmakers' lathe, E-5118 (section 5; attached to ceiling)	Figure 41.	Use E-5118-1 (original).
DRILL PRESS, 12" swing, single spindle, slide head, lever feed, with round and square tables, made by Davies Machine Co., Rochester, NY (section 6)	Figure 42; 1920 Appraisal no. 7.	Use EDIS 316/E-5081 (original).
GRINDSTONE and FRAME, No. 3, stone, 24" diameter x 4" face; by J.E. Hoppen, (section 6)	1920 Appraisal no. 8.	Use EDIS 26413/E-5082 (original).

TRIMMER, No. 6-F Universal Trimmer, W.R. Fox Patents; by Fox Machine Co., Grand Rapids, MI (section 5)	Figure 42; 1920 Appraisal no. 9. Edison purchased no. 4 Fox trimmer from Manning, Maxwell, & Moore, Jan. 10, 1888, voucher 232. This one may have been substituted later.	Use EDIS 317/E-5083 (original).
DC MOTOR, 15 HP, 800 RPM, serial #469528; by Crocker-Wheeler Electric Co., (section 5; on platform in southeast corner of shop. Removed from service, June 30, 1961, now stored behind pattern lathe.) Replaced by: DC MOTOR, shunt wound, 10 HP, 850 RPM, 230 volt; by General Electric	1920 Appraisal no. 11; E-5122 card documents changeover in 1961.	Use EDIS 318/E-5122 (GE motor) or rewound/rebuilt Crocker-Wheeler.
JIGSAW on 39" x 32-1/2" iron table; by J.A. Fay Manufacturing Co., Cincinnati, OH (basement)	Figure 41; 1920 Appraisal no. 12. Purchased 11/18/1887, $175.00, voucher 784. Moved from first floor to basement between 1890 and 1914, head cut down to fit.	Use EDIS 315 (original).
LINE SHAFT, by Edison Machine Works, Schenectady, NY (basement)	Installed 1887. TAE to Batchelor [summer 1887] (WOL--General, D-87-55); vouchers 590, 591, 696, 722 (December 1887).	Use EDIS 276/E-5123 (original).
SAWHORSE (section 5)	Figures 41 and 42.	Use E-5132 or E-5133 (original).
LADDER, 12' long, leading to lumber storage mezzanine (section 5)	Required to access mezzanine; see figure 42 for illustration of mezzanine.	EDIS collection or acquire ladder; use existing mezzanine.
Saw-Filing VISE, wood, 4' long x 8" wide (section 5)	Commonly used in early twentieth century pattern shop.	Use E-5130 (original).
BENCH, 15' 5-1/4" long x 24" deep, with Emmet vises EDIS 26400, EDIS 26402, and EDIS 26404 (section 6, along west wall, south of door)	Figure 42.	Use EDIS 26395/E-5125.

Clothes CABINET, single door (section 6; south wall)	Physical evidence.	Use EDIS 26404/E-5124 (original).
CABINET, 6' 4" long x 11" deep x 22" tall, four doors (section 6; on bench EDIS 26395)	Physical evidence.	Use EDIS 26405 (original).

Building 5, Library

The furnished library illustrates two important themes in the interpretation of Edison's life and achievements. The first, Edison's celebrity and popularity in his own time, can be conveyed by explaining the library's function as a reception area for reporters, dignitaries, and business associates eager to meet with Edison. The relative magnificence of the tiered library itself, as well as the awards, statues and honors filling the room, all serve to initiate discussion of Edison as a public man.

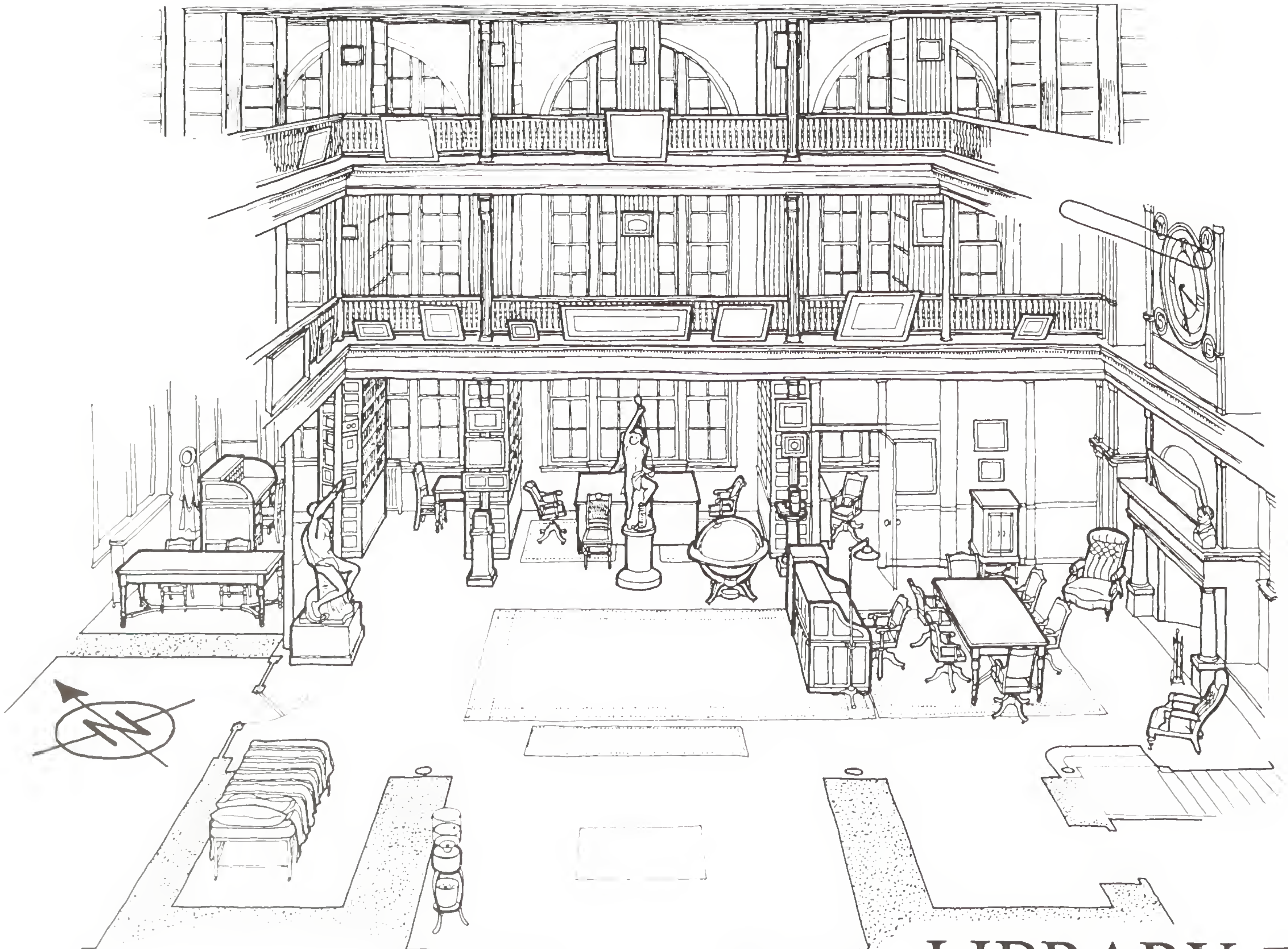
A second theme introduced in the library and carried through to rooms on the second floor of Building 5, is that of the administrative coordination required to maintain an enterprise as vast as Edison's. Edison's own cluttered desk makes the point that all of his life's work was not carried out in a laboratory. The desks and work tables of office employees presented here begin to explain the type of support Edison needed to maintain his widespread research, development, and manufacturing activities. The library also serves as an appropriate place to talk about the role of Charles and Theodore Edison in their father's business.

The overall object is to present the library as it appeared from about 1910 through 1920, when Edison was well established as an international celebrity and still vigorously managing his complex business concerns. Photographic documentation for this period is good, and is supported by memos, correspondence and purchase vouchers from the Edison Archive. Though the library furnishings changed in detail over the years, the general appearance of the room remained the same from the beginning of the interpretive period until Edison's death. Framed prints and photographs were constantly added to and moved around the library with the result that most of the older prints were moved many times over the years. Early prints and photographs seem to have been "bumped" to the balconies during Edison's later years, as new awards and photographs of current friends and associates were displayed on the main floor.

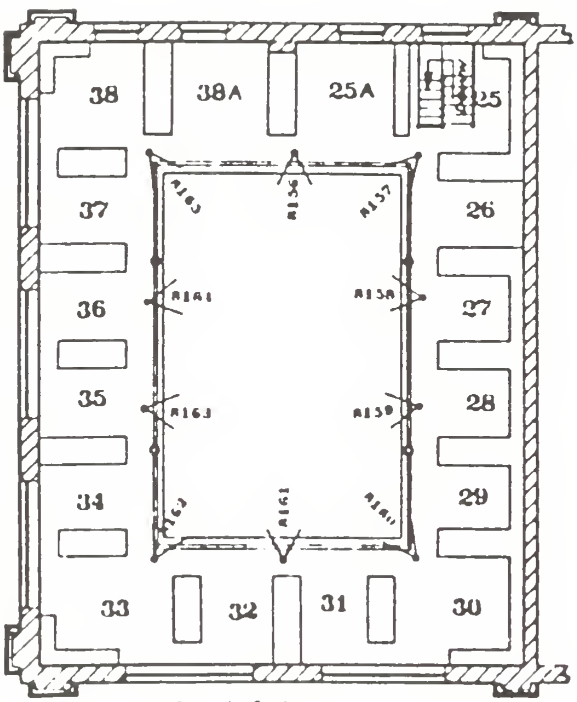
The most common locations for framed prints and photographs were on the columns, on the railings around the balconies, and on the dividers between the alcoves facing the center of the room. A set of prints of the 1893 Columbian Exposition, portraits of famous scientists and inventors, photographs of the 1890 Lenox Lyceum exhibit, photographs of steam generators and boilers, and several prints of Edison plants appear in many historic photographs from the interpretive period. The plan recommends retaining most prints, awards, and memorials added to the library after 1920 because they support the theme of Edison as celebrity, and because they reflect the historic appearance of the room. However, prints that were located historically on the lower levels of the room are returned to their general location before 1920.

Although Edison's 1889 birthday gift added chairs, tables and fashionable carpeting to the room overnight, other furnishings such as statues, photographs, prints, office equipment and books were added gradually over the next 40 years. The addition of two private offices within the library was the only significant structural change to the room and affected furnishings only slightly. These offices, built before November 1916, enclosed alcoves that housed office workers and made these work spaces more private and formal.

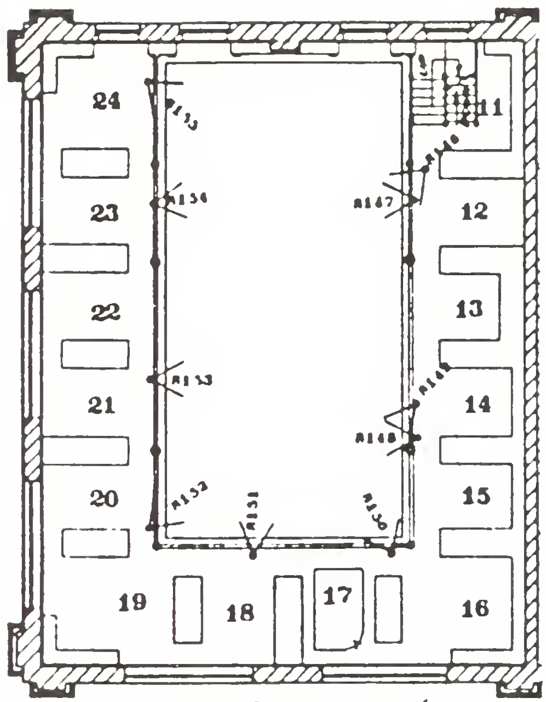
The plan suggests leaving open the door of the office in the library's northwest corner to show visitors a desk, chairs, and other office equipment and supplies. However, until the halon tank near the outside window can be removed, the door to this room should remain closed. Historic photographs show desk tops and work tables heaped with papers, desk baskets, blotters, and other office supplies. Recommendations include adding desks to alcoves 5, 6, and 7, and furnishing desks and work tables with office equipment and supplies. The plan also recommends the addition of oriental-style carpets, reproduction hats and coats, and the use of most of the monogrammed chairs from the 1889 gift. Alcove numbers in the plan refer to numbers used in the floor plan of Building 5.



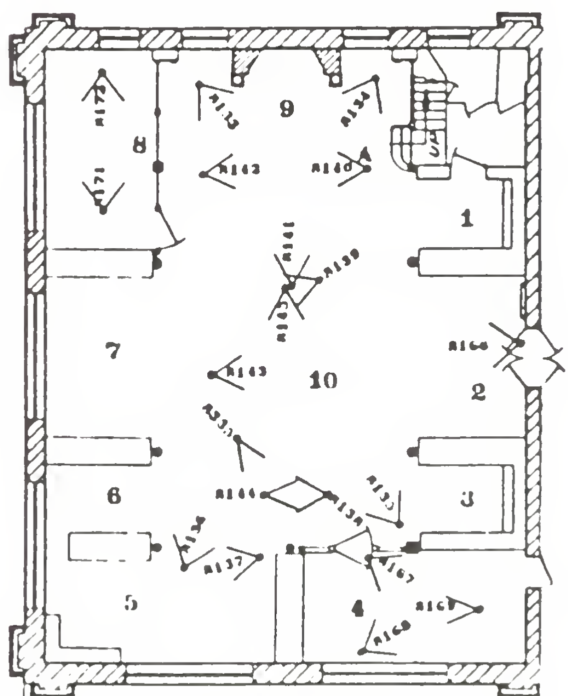
LIBRARY



LIBRARY SECOND BALCONY



LIBRARY FIRST BALCONY



LIBRARY MAIN FLOOR

SCALE 100 FT

Building 5, Library

Object and Location	Evidence	Recommendation
Framed PRINTS, four (on column to left of alcove 1, section 1, mounted at angle)	Figure 65 (top to bottom, EDIS 1839, EDIS 1724, EDIS 176, EDIS 114); figure 69 (same arrangement as above); and figure 76 (EDIS 8065 only)	Use EDIS 1839 (portrait of Magnus); EDIS 1724 (portrait of Liebig); EDIS 176 (portrait of Diesel); and EDIS 114 (portrait of Dunlop).
BOOKS/PERIODICALS (all shelves, section 1)	Figures 73, 76, and 78.	Use books from EDIS collection.
STEP LADDER, wood (alcove 1, section 1)	Figure 65.	Acquire.
FIRE PAIL with sand, galvanized metal (on floor, alcove 1, section 1)	Voucher 183, 1890.	Acquire.
Framed PRINTS, 3 (on column to right of alcove 1, mounted at angle, facing alcove 1, section 1)	Figure 65 (top to bottom, top print unidentified, EDIS 1740, EDIS 820) and figures 69, 73, 84.	Use EDIS 168 (portrait of Otto Kahn); EDIS 1740 (portrait of Plattner); EDIS 820 (birthday gift card).
Framed PRINTS (mounted at angle on column to right of alcove 1, facing section 2)	Figure 65 (top to bottom, EDIS 1842, other three prints unidentified); figure 78 (EDIS 8048 only); figures 74 and 84.	Use two or four portraits from EDIS collection.
BOOKS/PERIODICALS, sets (on all shelves, alcove 2, section 2)	Figures 65, 76, 78, and 84.	Use books from EDIS collection.
Mirrored CABINET with fuse box behind (wall to left of door, alcove 2, section 2)	Figures 78 and 84.	Retain existing original cabinet.

PLAQUE of Native American profile, concrete (below light switch, wall to left of door, alcove 2, section 2)	Figure 78; Historian's Note 121. According to catalog card: "Experimental concrete casting....About 15" wide, 16" high, and 3-1/2" maximum thickness. This is one of the very few specimens known to us resulting from Edison's experiments in concrete casting of decorative art objects. (Mr. H.K. Hamje, of Thomas A. Edison, Inc., brought to the laboratory Nov. 26, 1945, a cast of the same sculpture, of white plaster painted a light reddish tan, which he said had been made by Billy Holderson. Paymaster George Meister advised that Holderson had worked with Edison on the artistic angles of the poured concrete house project. The plaster cast is No. E 5047.)"	Use EDIS 182.
Framed PRINT (on wall to right of door, alcove 2, section 2)	Figures 65 (EDIS 676) and 84.	Use EDIS 676, photograph of Edison lamp factory, Harrison, NJ.
Mounted DISPLAY, primary battery parts (on wall to right of door, below framed print above, alcove 2, section 2)	Figure 84.	Use EDIS 181.
Framed PRINT (above door, alcove 2, section 2)	Figure 62 (two unidentified prints above door).	Use EDIS collection.
PAPER CUP HOLDER with PAPER CUPS (attached to wall above water cooler, section 2)	Physical evidence. Figure 65 documents ca.1912 location of water cooler.	Retain existing fixture and acquire cups.
WATER COOLER, light-colored metal base (right of door, section 2)	Figure 65 shows a water cooler with dark base, inscribed "mountainside"; figure 84 shows a light colored water cooler: "[—] spring/[—] orange"; voucher 572, 1888.	Acquire.

MAT, brush-type (inside door, section 2)	Figure 65; James S. Barron & Co. to TAE, November 27, 1903; also a maintenance precaution.	Acquire.
ORIENTAL RUG/RUNNER (parallel to doorway, section 2)	Figures 62 and 65; *Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs."	Acquire.
Framed PRINTS, 4, (mounted at angle between bookcase and column to right of door, section 2)	Figures 62, 64, 76, 78, and 84.	Use EDIS 171 (portrait of Woodrow Wilson); EDIS 122 (Edison after 72 hours of work); EDIS 8066 (Cartoon-"Impending Conflict").
BOOKS, small sets and individuals (on all shelves, section 3)	Figure 65.	Use books from EDIS collection.
COT (in alcove 3, section 3)	Figure 65; *Edison: His Life and Inventions*, p. 645.	Use EDIS 105.
BEDDING, one ticking striped mattress, one white cotton sheet, one Indian-style striped blanket, two ticking striped pillows, two white cotton pillowcases (on cot EDIS 105, in alcove 3, section 3)	Figures 59 and 65.	Use mattress, sheets, pillows and pillowcases in EDIS collection; acquire Indian-style striped blanket.
Framed PRINTS (on wall of southeast office, section 4)	Prints were displayed on the column to the left of alcove 4 and on the column between alcoves 4 and 5 before the office was added, some time after 1916. On the column to the left of alcove 4 (ca.1912) [from top to bottom]: EDIS 3641 <u>or</u> EDIS 1861; EDIS 1836; EDIS 1840; EDIS 1721. On divider between alcove 4 and 5: figure 56 (EDIS 3627, unidentified portrait, EDIS 743, Intercolonial Railway calendar with moose head).	Use EDIS 177 (portrait of Adolph Ochs); EDIS 179 (portrait of Joffre); EDIS 8065 (cartoon, "Our Boyhood Ambitions").

STATUE, *Orpheus Discarding His Lyre* by Lorado Taft, 1922, bronze (south wall, in front of column, section 4)	Laurence H. Lucker to Charles Edison (?), June 13, 1923: The statue was placed "in the south end of the library, which seems to be the most suitable place for it. In this location it can be seen to the best advantage...."	Use EDIS 124.
BOOKS, assorted sets (on all shelves, alcove 5, section 5)	Figures 53, 56, 79, and 82.	Use books from EDIS collection.
Oriental-style CARPET (beneath desk, alcove 5, section 5)	Figure 79. *Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs".	Acquire.
ROLLTOP DESK used by William Meadowcroft (facing south, alcove 5, section 5)	Figure 79. This desk is not the one in the 1917 photograph, but was used by Meadowcroft at some point in his career.	Use EDIS 134.
TELEPHONE on extension arm, ca.1917 (attached to desk, EDIS 134, alcove 5, section 5)	Figure 79.	Acquire complete telephone or repair EDIS 2095.
DESK LAMP with glass shade (on top of desk, alcove 5, section 5)	Figure 79.	Acquire.
FILING CASES, 3 (one on desk, two on shelves behind desk, alcove 5, section 5)	Figure 79; voucher 713, 1888.	Use cases stored on third floor, section 83.
MEMO BOOKS, 3 (on desk, alcove 5, section 5)	Voucher 770, 1887; voucher 1069, 1888.	Acquire or reproduce.
DESK BASKETS, 3, wire (on desk, alcove 5, section 5)	Voucher 1306, 1888.	Use EDIS 134 (basket), and EDIS collection.
MIMEOGRAPH SILKS (stacked on desk, alcove 5, section 5)	Voucher 1252, 1888.	Acquire.
CARBON PAPER (stacked on desk, alcove 5, section 5)	Common early twentieth century office supply.	Reproduce.
LETTER PAPER with letterhead (stacked on desk, alcove 5, section 5)	Voucher 30, 1893; voucher 108, 1890.	Reproduce.

PAY ENVELOPES, 3 (on desk, alcove 5, section 5)	Voucher 53, 1893.	Reproduce.
INKSTAND (on desk, alcove 5, section 5)	Voucher 265, 1888.	Use EDIS 134 (double inkstand) on desk.
WASTEBASKET, round, metal mesh (beside desk, alcove 5, section 5)	Voucher 56, 1888.	Use wastebasket stored in vault 32, C3-2.
PAPER FASTENER (on desk, alcove 5, section 5)	Common early twentieth century office supply.	Use EDIS 54261 ("Sure Shot", pat. 1884).
McGill's STAPLES, #1 (on desk, alcove 5, section 5)	Voucher 110, 1888.	Acquire.
BLUE PENCILS, 2 (on desk, alcove 5, section 5)	Voucher 265, 1888.	Acquire.
Cedar PENCILS, 5 (on desk, alcove 5, section 5)	Voucher 265, 1888.	Acquire.
RUBBER ERASER, *Velvet* brand (on desk, alcove 5, section 5)	Voucher 317, 1890.	Acquire.
RUBBER STAMP HOLDER (on desk, alcove 5, section 5)	Common early twentieth century office supply.	Acquire.
RUBBER STAMPS, 5 (in stamp holder on desk, alcove 5, section 5)	Voucher 506, 1888; voucher 605, 1888; voucher 40, 1893.	Acquire; use two stored in alcove 6.
STAMPING INK, bottle (on desk, alcove 5, section 5)	Common early twentieth century office supply.	Acquire.
FOUNTAIN PENS, 3 (on desk, alcove 5, section 5)	Common early twentieth century office supply.	Use EDIS 54533; acquire two others.
TIMESHEETS, 20 (on desk, alcove 5, section 5)	Voucher 265, 1888.	Reproduce.
DESK CALENDAR (on desk, alcove 5, section 5)	Common early twentieth century office supply.	Acquire 1917 desk calendar.
BOOKS, various (on top of desk, alcove 5, section 5)	Figure 79.	Use items in EDIS collection.
FILES, various (on top of desk, alcove 5, section 5)	Figure 79.	Acquire.
SCISSORS (on desk, alcove 5, section 5)	"Please look in back part of my left hand drawer (where I keep the scissors)...," Meadowcroft to Ryan, August 7, 1922.	Acquire.

SIDE CHAIR, caned back and seat, with TAE monogram (at desk, alcove 5, section 5)	Figure 79; George C. Flint Co. voucher, February 1889.	Use EDIS 193.
UMBRELLA, dark wood handle, black fabric body (leaning against shelves, southwest corner, alcove 5, section 5)	Figure 79.	Acquire.
TABLE, oak, with TAE monogram (facing south windows <u>or</u> facing east shelves, alcove 5, section 5)	Figure 71. George C. Flint Co. voucher, 1889; "[The books] are in the closet at the end of my big table, near the window," Meadowcroft to Ryan, August 5, 1922.	Use EDIS 154.
BOOK, *Boys Life of Edison* (on table, alcove 5, section 5)	"I want you to send me a copy of 'Boys Life'...," Meadowcroft to Ryan, August 5, 1922.	Use book from EDIS collection.
BALANCE SHEETS (stacked on table, alcove 5, section 5)	Voucher 584, 1888.	Reproduce.
LETTER TRAYS, 3 (on table, alcove 5, section 5)	Voucher 1330, 1888.	Acquire.
DISH, glass, with paper clips (on table, alcove 5, section 5)	Common early twentieth century office supply.	Acquire; use EDIS 54126 (box of paper clips).
DESK PAD with BLOTTER (on table, alcove 5, section 5)	Figure 80.	Acquire.
WRITING PADS (on table, alcove 5, section 5)	Voucher 770, 1887.	Acquire.
SPONGE CUP (on table, alcove 5, section 5)	Figure 80; Voucher 786, 1887.	Acquire.
STAMPS, roll (on table, alcove 5, section 5)	Common early twentieth century office supply.	Reproduce.
DESK LAMP, standing (on table, alcove 5, section 5)	Figures 56 and 58.	Acquire.
TELEPHONE (on table, alcove 5, section 5)	Figure 79.	Acquire.
SIDE CHAIRS, 2, oak, caned back and seat, with TAE monogram (at table, alcove 5, section 5)	Common usage in library; George C. Flint Co. voucher, 1889.	Use EDIS 194 and EDIS 196.

OVERCOAT, man's, dark cloth (hanging on hook on shelf to right of south window, alcove 5, section 5) [Use in winter only.]	Figure 56 and 86; common practice in the library.	Reproduce.
SUIT JACKET, man's, dark cloth (hanging on hook on shelf to right of south window, alcove 5, section 5) [Use in spring, summer, and autumn.]	Figure 56 and 86; common practice in the library. [Office workers took off their jackets, see figure 69 (July 1914)].	Reproduce.
HAT, man's black fedora (on desk, alcove 5, section 5) [Use in winter only.]	Figure 86 shows hat used in this manner.	Reproduce.
HAT, straw, with black band (on desk, alcove 5, section 5) [Use in summer only.]	Figure 86.	Reproduce.
Framed PRINTS, various (on column to right of alcove 5, section 5, facing alcove)	Figures 56, 63, 64, and 86.	Retain EDIS prints currently in this location; add EDIS 8037.
BOOKS, assorted sets (on all shelves, alcove 6, section 6)	Figures 64 and 74.	Use books on shelves.
LIBRARY LADDER (leaning against shelf, alcove 6)	Figure 64 shows use in alcove 8.	Use ladder in alcove 6.
TABLE, oak, with TAE monogram, (in alcove 6, section 6)	Figures 56, 64, and 76; *Edison: His Life and Inventions*, p. 642: "...the tables and chairs in the alcoves...."; George C. Flint, Co. voucher, 1889.	Use EDIS 151.
Shannon FILE, with letters (on table, alcove 6, section 6)	Figures 53 and 76; common early twentieth century office supply.	Use EDIS 821 stored in section 81.
Assorted PAPERS (on table, alcove 6, section 6)	Figure 76; common early twentieth century office supply.	Reproduce.
SPINDLE, metal (on table, alcove 6, section 6)	Common early twentieth century office supply.	Acquire.
DESK BASKET (on table, alcove 6, section 6)	Common early twentieth century office supply.	Use wire baskets stored in section 75.
LEDGERS (on table, alcove 6, section 6)	Common early twentieth century office supply.	Acquire.

BLUEPRINTS (on chair, alcove 6, section 6)		Reproduce.
SIDE CHAIR, oak, caned back and seat, with TAE monogram (at table in alcove 6, section 6)	Figure 76.	Use EDIS 193.
FILE CABINET, oak (in alcove 6, section 6)	Common early twentieth century office supply.	Use E-3761, in section 81.
ARMCHAIR, swivel, oak, caned back and seat, with TAE monogram (in alcove 6, section 6)	Common usage in library; *Edison: His Life and Inventions*, p. 642; George C. Flint, Co. voucher, 1889.	Use EDIS 183.
Copper CUBE on stand (in front of alcove 6, section 6)	Figures 64 and 76; T.C. Martin to TAE, October 9, 1911, DF 1911.	Use EDIS 125.
Framed PRINTS, 3 (on column to right of alcove 6, section 6)	Figures 51, 63, 64, 74, 76, 81, and 86.	Use EDIS 8053 (photograph of TAE in chemistry lab); EDIS 702 (photograph of Edison Central Station, Wisconsin).
BOOKS, various sets (on all shelves, alcove 7, section 7)	Figures 62, 63, 64, 74, 76, and 77.	Use books from EDIS collection on shelves.
STATUE, *The Genius of Light* by A. Bordiga, on marble base (in front of alcove 7, section 7)	Voucher 86, 1890; see figures 61, 64, 69, 70, 77, 81, and 86; *Edison: His Life and Inventions*, p. 642: "Directly opposite the main door is a beautiful marble statue...."	Use EDIS 123.
GLOBE, 30" terrestrial, manufactured by G. Joslin and Son (in alcove 7, section 7)	Voucher 778, 1887; voucher 134, 1888; see figures 63, 64, and 74.	Use EDIS 121.
DESK, double, flat-top <u>or</u> two single desks (facing each other, perpendicular to window, alcove 7, section 7)	Roderic Peters interview, p. 22: "...[a] clerk or two clerks, had a desk over here, Ike Walker who was Charles' assistant. Across from him at the same desk was myself."; see figures 81 and 86.	Acquire or use desk(s) in EDIS collection.
ORIENTAL RUG (under desk, alcove 7, section 7)	*The Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs."	Acquire.

ARMCHAIRS, 2, oak, swivel, with TAE monogram (at desks, alcove 7, section 7)	Figure 81; George C. Flint Co. voucher, 1889.	Use EDIS 160 and EDIS 186.
SIDE CHAIR, oak, with TAE monogram (beside desk, alcove 7, section 7)	George C. Flint Co. voucher, 1889.	Use EDIS 191.
DESK LAMPS, 2 (on stand on desk, alcove 7, section 7)	Figure 86.	Acquire.
TELEPHONE (on desk, alcove 7, section 7)	Common early twentieth century office equipment.	Acquire.
PAPER FASTENERS, 2 (on desk, alcove 7, section 7)	Common early twentieth century office supply.	Use EDIS 54040 and EDIS 54038 ("Sure Shot", pat. 1884).
STAPLES (on desk, alcove 7, section 7)	For use in paper fasteners.	Use EDIS 54111 if appropriate for use with above paper fasteners.
ENVELOPES (stacked on desk, alcove 7, section 7)	Voucher 96, 1893.	Use plain, white, business envelopes in E-3757, section 80.
LETTERHEAD PAPER (stacked on desk, alcove 7, section 7)	Voucher 30, 1893.	Acquire.
Plain LETTER PAPER (stacked on desk, alcove 7, section 7)	Voucher 30, 1893.	Acquire.
Double INKWELL (on desk, alcove 7, section 7)	Voucher 428, 1890.	Use inkwell in drawer of EDIS 821, section 81.
PENCILS, *Eagle* brand, 6 (on desk, alcove 7, section 7)	Voucher 428, 1890.	Acquire.
FOUNTAIN PENS, 3 (on desk, alcove 7, section 7)	Common early twentieth century office supply.	Acquire.
WASTEBASKETS, 2, wire mesh (beside desk, alcove 7, section 7)	Voucher 317, 1890.	Acquire.
DESK BASKETS, 4, wire (on desk, alcove 7, section 7)	Common early twentieth century office supply.	Use EDIS 54089, EDIS 54090, EDIS 54672, and EDIS 55025.

HAT, man's light straw, with black band (on hook to left of window, alcove 7, section 7) [Use in summer months only.]	Figure 86.	Reproduce.
HAT, man's black fedora (on hook to left of window or on desk, alcove 7, section 7) [Use in winter months only.]	Figure 56.	Reproduce.
Wall CALENDAR (hanging on window frame, alcove 7, section 7)	Common early twentieth century office supply; see figure 56.	Acquire.
DC BIPOLAR GENERATOR, from the Edison Machine Works, ca.1887 (on alabaster pedestal, in front of column to right of alcove 7, section 7)	Figures 62, 64, 70, and 81.	Use EDIS 126 (generator); EDIS 127 (pedestal).
Framed PRINTS, 2 (on column, to right of alcove 7, section 7)	Figures 50, 51, 62, 64, 70, and 81.	Use EDIS 665 (photograph of Lenox Lyceum exhibit); EDIS 1842 (portrait of H. Rose).
NOTE: Open door to section 8 only after halon tank in office has been removed.		
BOOKS, various sets or pull shades down over shelves (on shelves along south wall, inside office, section 8)	Figure 81.	Use books on shelves.
Framed PRINTS, 3 (on outer wall of office, section 8)	Figures 50, 51, 64, and 89.	Use EDIS 1829 (photograph of Edison film studio); EDIS 8036 (photograph of telegraph superintendents); EDIS 8069 (oil portrait of Henry Ford).
ORIENTAL RUG (under desk, inside office, section 8)	*The Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs."	Acquire.
ROLLTOP DESK (facing south toward shelves, perpendicular to window in office, section 8)	Base office arrangement on figure 80.	Use EDIS 30491, on second floor, Building 5.
DESK TRAY, oak (on desk, section 8)	Common early twentieth century office supply.	Acquire.

DESK BLOTTER (on desk, section 8)	Figure 80.	Acquire.
PAPER FASTENER (on desk, section 8)	Common early twentieth century office supply.	Acquire.
STAPLES (on desk, section 8)	Common early twentieth century office supply.	Acquire.
ENVELOPES (stacked on desk, section 8)	Common early twentieth century office supply; voucher 96, 1893.	Acquire.
LETTERHEAD PAPER (stacked on desk, section 8)	Common early twentieth century office supply; voucher 30, 1893.	Acquire.
Plain LETTER PAPER (stacked on desk, section 8)	Common early twentieth century office supply; voucher 30, 1893.	Acquire.
INK BOTTLE (on desk, section 8)	Common early twentieth century office supply.	Acquire.
Exchanging INKSTAND (on desk, section 8)	Common early twentieth century office supply; voucher 428, 1890.	Acquire.
PENCILS, *Eagle* brand, 6 and FOUNTAIN PENS, 3 (on desk, section 8)	Common early twentieth century office supply; voucher 428, 1890 for pencils; see figure 80 for fountain pens.	Acquire.
HAND BLOTTER (on desk, section 8)	Figure 80.	Use hand blotter in drawer of EDIS 821.
MEMO PAPER HOLDER with paper, wood (on desk, section 8)	Figure 80.	Acquire.
Various NOTES and ENVELOPES (in pigeonholes in desk, section 8)	Figure 80.	Reproduce.
WASTEBASKET, wire (beside desk, section 8)	Common early twentieth century office supply; voucher 317, 1890.	Acquire.
ASHTRAY, glass (on desk, section 8)	Figure 80.	Acquire.
PIPE and PIPE CLEANERS (on desk, section 8)	Figure 80.	Acquire.

CALENDAR, ca.1918 (hanging from center window, section 8)	Common early twentieth century office supply; see figure 74.	Acquire.
ROLLTOP DESK (facing north wall in section 8, if visible when office door open)	See figures 56, 58, 79, and 80 for examples of desks used in library.	Use EDIS 357 (desk probably used by Mambert, Miller, and/or Walker).
PHONOGRAPH, oak cabinet, Edison Parlor model (outside office, section 8)	Evidence that cement model was in library, Hutchinson to Meadowcroft, February 23, 1914; also appropriate way to include finished phonograph in historic interior.	Use EDIS 2267.
Framed PRINT (on north wall, west side of fireplace, section 9)	Figures 69, 73, and 89.	Use EDIS collection or omit.
Framed PHOTOGRAPH, Edison Portland Cement Company (over fireplace, section 9)	Figures 62, 68, 69, 73; *Edison: His Life and Inventions*, p. 643: "Over the fireplace hangs a large photograph showing the Edison cement plant in its entire length...."	Use frame in Vault 32, unit 2, shelf 2, and reproduce photograph 10.220/005/P1; neg. no. 1251.
BUST of Alexander Humboldt (on mantel, to right of photograph, section 9)	Figures 62, 68, 69, 73, 89; *Edison: His Life and Inventions*, p. 643: "Over the fireplace hangs a...photograph... flanked on one end of the mantel by a bust of Humboldt...."	Use EDIS 129.
STATUE of Eugene Sandow (on mantel, to left of photograph, section 9)	Figures 62, 68, 69, 73, and 89; *Edison: His Life and Inventions*, p. 643: "Over the fireplace hangs a...photograph ...flanked on one end of the mantel by a bust of Humboldt, and on the other by a statuette of Sandow, the latter having been presented to Edison by the celebrated athlete after the visit he made to Orange to pose for the motion pictures in the earliest days of their development."	Omit (missing since 1983).

FIREPLACE ACCESSORIES STAND with Brush, Tongs, Poker, and Shovel (on hearth in front of fireplace, section 9)	Sheldon Manufacturing Co. voucher, February, 1889; see figures 50 and 51.	Use EDIS 17007 (stand); EDIS 17008 (brush); EDIS 17009 (tongs); EDIS 17010 (poker); EDIS 17011 (shovel).
ANDIRONS, wrought iron (inside fireplace, section 9)	Sheldon Manufacturing Co. voucher, February, 1889; see figures 50 and 52; the *Evening Sun*, February 11, 1889: "The gas-log in turn rested on a pair of great wrought iron andirons which were burnt and twisted in the latest aesthetic style."	Acquire.
GAS LOG (on andirons inside fireplace, section 9)	Sheldon Manufacturing Co. voucher, February, 1889; figures 50 and 51; the *Evening Sun*, February 11, 1889: "In the big fireplace itself was an enormous gas-log, whose flames leaped merrily up the wide chimney and sent a genial heat out into the room. The gas-log in turn rested on a pair of great wrought iron andirons...."; *The Life and Inventions of Thomas Alva Edison*, p. 289: "This royal billet...is nothing but a cunning counterfeit, wrought of iron and asbestos and lit by multitudinous jets of gas."	Acquire.
Framed PRINTS (east of fireplace, section 9)	Common usage in library. See figures 54, 62, 67, and 73.	Use EDIS 915 (Edison and Associates from 65 Fifth Avenue).
Framed PRINTS, 2 (east wall enclosing stairway, section 1)	Common usage in library. See figures 54, 62, 64, and 73.	Use EDIS 662 (photograph of Paris exhibition); EDIS 916 (photograph montage of lamp collection).

Leather ARMCHAIRS, 2 (in front of fireplace, section 9)	George C. Flint Co. voucher, February, 1889; the *Evening Sun*, February 11, 1889: "...in front of the big fireplace were too [sic] great easy leather and oak armchairs, so full of springs and fashioned so cunningly that one felt lazy and luxurious just to look at them."; *The Life and Inventions of Thomas Alva Edison*, p. 282, photograph; see figures 50, 51, 54, and 62.	Use EDIS 161 and 162.
ORIENTAL CARPET, large (parallel to fireplace, section 9)	Figures 61, 62, 67, 70, 73, 74, and 81; the *Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs."	Acquire.
TABLE, oak, measuring 60 in. x 36 in. x 30 in. (parallel to fireplace, section 9)	Figures 51, 61, 62, 73, and 86; George C. Flint Co. voucher, February, 1889; *Edison: His Life and Inventions*, p. 642: "...not far from the open fireplace, is a long table surrounded by swivel desk-chairs."	Use EDIS 150; two white buttons on each side of table are buzzers, wires run under table.
ARMCHAIRS, 7, swivel, oak, with TAE monogram (around table, section 9)	Figures 51, 54, 62, 73, and 81; George C. Flint Co. voucher, February 1889; *Edison: His Life and Inventions*, p. 642: "...not far from the open fireplace, is a long table surrounded by swivel desk-chairs."	Use EDIS 184, 185, 187, 188, 159, and EDIS collection.
Desk LAMP, (on table, section 9)	Figure 61 and 73.	Acquire.
Various PAPERS (on table, section 9)	Figures 54 and 73; *Edison: His Life and Inventions*, p. 642: "...at a long table surrounded by swivel desk-chairs. It is here that directors' meetings are sometimes held...."	Reproduce.

WRITING PADS (on table, section 9)	Figures 54 and 73; *Edison: His Life and Inventions*, p. 642: "...at a long table surrounded by swivel desk-chairs. It is here that directors' meetings are sometimes held...if the occasion calls for it, [Edison] will turn around to the table, seize a writing-pad...."	Acquire.
Exchanging INKSTAND (on table, section 8)	Common early twentieth century office supply; voucher 428, 1890.	Acquire.
PENCILS, *Eagle* brand, 6 and FOUNTAIN PENS, 3 (on table, section 9)	Common early twentieth century office supply; voucher 428, 1890 for pencils.	Acquire.
HAND BLOTTER (on table, section 9)	Common early twentieth century office supply.	Acquire.
LEDGER BOOKS, 3 (on table, section 9)	Figure 54; voucher 265, 1888; voucher 1069, 1888; voucher 711, 1890.	Reproduce.
HAT, man's black fedora (on table, section 9) [Use in winter only.]	Figure 86 shows hat in position.	Reproduce.
HAT, straw, with black band (on table, section 9) [Use in summer only.]	Figure 86.	Reproduce.
OVERCOAT, man's black wool (draped over armchair at table, section 9) [Use in winter only.]	Figures 61, 62, and 73.	Reproduce.
ORIENTAL CARPET, large (in center of room, next to carpet under Edison's desk, section 10)	Figures 61, 62, 63, 67, 70, 73, 74, and 81; the *Evening Sun*, February 11, 1889: "On the polished floor...were thirteen thick, soft Smyrna rugs."	Acquire.
DESK, Edison's rolltop (in center of room, facing south, section 10)	Figures 61, 62, 70, 73, 74, 81, and 86.	Use EDIS 131.
CONTENTS of DESK (in Edison's desk above, section 10)		Retain contents currently in desk.

ARMCHAIR, swivel, oak, with TAE monogram (at desk, section 10)	Figures 61, 70, 73, 74, 81, and 86; George C. Flint Co. voucher, February, 1889.	Use EDIS 157.
BOOKS, PAPERS, FOLDERS, FILES (in stacks on top of desk, section 10)	Figures 61, 62, 69, 73, and 74.	Reproduce.
LAMP, standing, with white enameled shade (left of desk, section 10)	Figures 69, 73, 74, and 86.	Use EDIS 132.
SAFE (to right of desk, section 10)	Figures 70, 73, 74, 81, and 86; W.B. Wood Co. to Meadowcroft, May 8, 1912, may refer to this safe.	Use EDIS 396; "Globe Safe Cabinet".
WASTEBASKET, wicker, square (to right of desk, section 10)	Figures 63, 70, and 74; voucher 317, 1890.	Acquire.
SPITTOON, round, white, enamel (to right of desk, section 10)	Figures 61, 63, 70, 74, and 81; *Edison: A Biography*, p. 420.	Acquire.
First Balcony:		
PERIODICALS, assorted (on shelves, alcove 11, section 11)	*Edison: His Life and Inventions*, p. 641: "The remaining shelves of the first gallery are filled with current numbers (and some back numbers) of the numerous periodicals to which Edison subscribes."; see figures 65, 76, and 88.	Use existing periodicals, various technical and popular subjects.
Framed PRINT, dark wood frame (on divider, section 11)	Figure 65.	Use EDIS 3627 (certificate of honorary membership in New York Chamber of Commerce).
Framed PRINT (on railing, section 11)	Figures 50, 62, 65, 73, and 75.	Use EDIS collection or omit.
PERIODICALS (on shelves facing north only, alcove 12, section 12)	Figure 65, 76, and 88; *Edison: His Life and Inventions*, p. 641.	Use existing periodicals in EDIS collection.
CHAIR, low-backed, dark wood, turned legs <u>or</u> side chair with TAE monogram (in alcove 12, section 12)	Figure 76.	Use EDIS 194.

Small TABLE (in alcove 12, section 12)	Figure 64.	Use item from EDIS collection.
MEMO BOOK or JOURNAL (on table, alcove 12, section 12)	Common practice in library.	Reproduce.
PERIODICAL (on table, alcove 12, section 12)	Common practice in library.	Use periodical in collection.
Framed PRINTS (on divider, alcove 12, section 12)	Figures 62, 65, 73, and 76.	Use EDIS 3641 (Columbian exposition print).
Framed PRINTS, 2 (hanging from railing, section 12)	Figures 65, 76, and 88; *Edison: His Life and Inventions*, p. 641.	Use EDIS 652 (Award by National Academy of Sciences); locate and reproduce train print.
ORE AND MINERAL SAMPLES, in bags or boxes, with tags (alcove 13, section 13)	Figure 88; *Edison: His Life and Inventions*, p. 640: "...on two sides of both galleries... [the shelves] are formed by a series of glass-fronted cabinets containing extensive collections of curious and beautiful mineralogical and geological specimens...." Shelves in section 13 did not have glass doors as late as 1915, but by 1931 the glass doors had been added.	Reproduce bags, boxes, and tags or use Theodore Edison mineral collection jars currently in place.
Framed PRINTS, 2, dark wood frame (on divider facing center of room, section 13)	Figures 76 and 88.	Use EDIS 1725 (Fish and Aquarium Building, Columbian Exposition); and EDIS collection.
Framed PRINTS (hanging from railing, section 13)	Figures 76 and 88.	Use EDIS 666 (panoramic view of Edison exhibit at Lenox Lyceum); EDIS 659 (certificate from Sydney, Australia).
PERIODICALS or MINERAL SAMPLES (alcove 14, section 14)	Figure 65.	Use periodicals in EDIS collection or reproduce sample bags/boxes.
Framed PRINTS (on divider facing center of room, section 14)	Figures 65 and 76.	Use EDIS 1834 (Administration Building, Columbian Exposition); EDIS 1862 (portrait of Lord Kelvin).

Framed PRINTS (hanging from railing, section 14)	Figures 65 and 76.	Use EDIS 672 ("Beach Car"); EDIS 706 (aerial view of San Francisco).
BOOKS, set (on top four shelves of alcove 15, section 15)	Figure 65.	Use books in EDIS collection.
MINERAL SAMPLES, in bags (section 15)	Figure 65.	Reproduce sample bags.
Framed PRINT (on divider facing center of room, section 15)	Figure 65 and 76.	Use EDIS 1835 (Mines and Mining Building, Columbian Exposition).
Framed PRINTS (hanging from railing, section 15)	Figure 65.	Use EDIS 3640 (resolution of thanks from Edison jobbers).
Various BOOKS and PERIODICALS (alcove 16, section 16)	Figure 65.	Use items from EDIS collection.
FILE CABINET, oak (visible from the floor, alcove 16, section 16)	Figure 76; voucher 309, 1887 (8-drawer, flat top, antique oak); voucher 143, 1890 ["file cabinet for room 15"].	Use EDIS 1685.
BOOKS or MINERAL SAMPLES (alcove 16, section 16)	Figures 65 and 76.	Omit; shelves not visible from floor.
Framed PRINTS, 2, (on freestanding glass-fronted shelf, section 16)	Figures 65.	Use EDIS 1843 (Electrical Building, Columbian Exposition).
BOOKS or MINERAL SAMPLES (alcove 17, section 17)	Common usage in library.	Omit; shelves not visible from floor.
PROJECTION BOOTH, built in (section 17)	Figures 64, 65, and 76.	Retain.
Framed PRINTS (on divider, section 17)	Figures 64, 65, and 76.	Omit.
BOOKS or MINERAL SAMPLES (in freestanding glass-fronted shelves facing west, alcove 18, section 18)	Figures 64, 65, and 76.	Use books from EDIS collection or reproduce sample bags.
EAGLE (mounted on divider to left of section 18)	Figures 50, 64, and 65.	Use EDIS 653, from the 1889 World's Fair.

SIDE CHAIR, oak, caned back and seats, with TAE monogram (alcove 18, section 18)	Figure 76.	Use EDIS 198.
Framed PRINTS (on divider, section 18)	Figures 64 and 76.	Use EDIS 1838 (Fine Arts Gallery, Columbian Exposition).
OIL PAINTING of Menlo Park Laboratory by Robert F. Outcault, ca.1889 (on railing, section 18)	Figures 64, 65, and 76; Notebook N-28-11-01, p. 58.	Use EDIS 246.
Framed PRINTS, 2, (on either side of Outcault painting above (on railing, section 18)	Figures 63 and 86.	Use EDIS 663 (exhibition at Lenox Lyceum) and EDIS collection.
MINERAL SAMPLES, not in boxes or bags (alcove 19, section 19)	Figure 64; *Edison: His Life and Inventions*, p. 640.	Reproduce or use items from EDIS collection.
Folding TABLE, wood, alcove 19, section 19)	Figure 64 shows a table in section 18; location changed because blower is currently in section 18.	Use EDIS 1962.
Framed PRINT (on divider, alcove 19, section 19)	Figures 64, 76, and 86.	Use EDIS 175 (portrait of Taft).
MINERAL SAMPLES (alcove 20, section 20)	Figure 64; *Edison: His Life and Inventions*, p. 640.	Reproduce or use items in EDIS collection.
Framed PRINTS (on divider, section 20)	Figures 64 and 76.	Use EDIS 163 (portrait of Robert Gair); EDIS 164 (Museum of Art, Winchester).
Framed PRINTS (on railing, section 20)	Figures 64, 76, and 86.	Use EDIS 165 (Naval Consulting Board); EDIS 245 (Legion of Honor).
MINERAL SAMPLES (alcove 21, section 21)	Figures 51 and 64; *Edison: His Life and Inventions*, p. 640.	Reproduce or use items from EDIS collection.
Framed PRINT (on divider, section 21)	Figures 51, 64, and 76.	Use EDIS 1741 (Transportation Building, Columbian Exposition).
Framed PRINTS, 2 (on railing, section 21)	Figures 51, 64, 76, and 86.	Use EDIS 656 (Franklin Medal); EDIS 674 (aerial photograph of West Orange lab).

MINERAL SAMPLES (alcove 22, section 22)	Figures 51, 62, and 64; *Edison: His Life and Inventions*, p. 640.	Use items in EDIS collection or reproduce.
ANATOMICAL MODELS: heart, lungs, brain, eye, ear, skin, teeth, larynx (in glass-fronted shelves visible from ground floor, alcove 22, section 22)	Voucher 778, 1887 [heart, eye, ear, skin, teeth, "brain A, B, C, D"; "head A, B, C"; "Lungs A, Lungs B, Organs, Respiration, Larynx A, B, C"]; *Edison: His Life and Inventions*, p. 641: "Here and there in these cabinets may also be found a few models which he has used at times in his studies of anatomy and physiology"; see figures 51 and 62.	Acquire or reproduce.
Framed PRINT (on divider, section 22)	Figures 51, 62, and 64.	Use EDIS 1837 (Tokyo drawing); substitute for Columbian Exposition print.
Framed PRINT (on railing, section 22)	Figures 51, 62, 64, 76, 77, and 89.	Use EDIS 1856.
MINERAL SAMPLES (alcove 23, section 23)	Figures 51, 62, and 64.	Use items from EDIS collection or reproduce.
Framed PRINT (on divider, section 23)	Figures 51, 62, 64, and 77.	Substitute for Columbian Exposition print. Use EDIS 170 (Edison Science building).
Framed PRINTS, various (on railing, section 23)	Figures 51, 62, 64, 77, and 89.	Use EDIS 713 (Horses and gas cars) and EDIS collection.
PERIODICALS, various series (in all but bottom shelf facing north, alcove 24, section 24)	Common use in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on railing, section 24)	Figures 51, 62, 64, and 89.	Use EDIS 679 (steam driven pump).
FILE CABINET, oak (in passageway in front of section 24)	Figure 89; voucher 309, 1887 (8-drawer, flat-top, antique oak); voucher 143, 1890 ["file cabinet for room 15"].	Use EDIS 1688.
Framed PRINTS, 2 (on north wall: one to left of clock, one to right of clock)	Figures 62, 77, and 88.	Use EDIS 677 (ore milling plant, Edison, New Jersey) and EDIS collection.

CLOCK, built-in, running if possible (north wall above fireplace)	Figures 51, 62, 77, 88, and 89; voucher, Electric Time Co, "1 Clock Movement Heavy," February, 1889; *Edison: His Life and Inventions*, p. 642: "...the huge open fireplace, surmounted by a great clock built into the wall, at one end of the room...."	Use existing face and movement, put in working order.
SCREEN, for motion pictures, white fabric, covered with darker fabric (suspended above first tier, north wall)	Figures 50 (no cover), 51, 62, 67 (screen unrolled), and 88 (covered with greenery); *Edison: His Life and Inventions*, p. 644: "On looking up under the second gallery at this end is seen a great roll resting in sockets placed on each side of the room. This is a huge screen or curtain which may be drawn down to the floor to provide a means of projection for lantern slides or motion pictures, for the entertainment or instruction of Edison and his guests."	Use EDIS 142.
Second Balcony (sections 25-38A)		
Various Framed PRINTS (hung on railing surrounding the library)	Figures 64, 65, and 88.	Use EDIS 669 (portrait of Sir Henry Bessemer); EDIS 8050 (Golden Gate illumination); EDIS 8046 (interior of engine housing); EDIS 8047 (portrait of Lord Kelvin).
MINERAL SAMPLES <u>or</u> PERIODICALS (on shelves visible from floor, alcove 25, section 25)	Common practice in library; *Edison: His Life and Inventions*, p. 641: "The shelves on the remainder of the upper gallery...are filled with countless thousands of specimens of ores and minerals of every conceivable kind gathered from all parts of the world, and all tagged and numbered."	Omit; shelves not visible from floor.
Framed PRINT (on divider, section 25)	Common practice in library; no photographic evidence.	Use EDIS 621 (oil painting of Charles Edison).

MINERAL SAMPLES or PERIODICALS (alcove 26, section 26)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 26)	Common practice in library; no photographic evidence.	Use EDIS 1730 (photograph of A. Theo E. Wangemann on wireless).
MINERAL SAMPLES or PERIODICALS (alcove 27, section 27)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 27)	Common practice in library; no photographic evidence.	Use EDIS 1776 (photograph of New York City at night).
EDISON CYLINDERS or MINERAL SAMPLES (alcove 28, section 28)	Figure 65; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 28)	Figure 65.	Use EDIS 668 (engraving of James Watt).
EDISON CYLINDERS or MINERAL SAMPLES (alcove 29, section 29)	Figure 65; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 29)	Figure 65.	Use EDIS 711 (photograph of Morris Climax boilers).
MINERAL SAMPLES and small STOPPERED BOTTLES (on shelves visible from floor, alcove 30, section 30)	Figure 65; *Edison: His Life and Inventions*, p. 641.	Omit; shelves not visible from floor.
Framed PRINT (on divider, section 30)	Figure 65.	Use EDIS 1697 (photograph of Morris Climax boiler).
MINERAL SAMPLES (alcove 31, section 31)	Figure 65; *Edison: His Life and Inventions*, p. 641.	Reproduce or use items from EDIS collection.
Framed PRINT (on divider, section 31)	Figures 64 and 65.	Use EDIS 709 (photograph of Morris Climax boilers).
MINERAL SAMPLES or PERIODICALS (alcove 32, section 32)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 32)	Figure 64.	Use EDIS 708 (photograph of Morris Climax boilers).
EDISON CYLINDERS or MINERAL SAMPLES (alcove 33, section 33)	Figure 64; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.

Framed PRINT (on divider, section 33)	Figure 64.	Use EDIS 707 (photograph of turbine house).
MINERAL SAMPLES (alcove 34, section 34)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on divider, section 34)	Figure 64.	Use EDIS 1861 (photograph of Edison Film Studio, Bronx, New York).
MINERAL SAMPLES (alcove 35, section 35)	Figure 64; *Edison: His Life and Inventions*, p. 641.	Use items from EDIS collection.
Framed PRINT (on divider, section 35)	Figure 64.	Use EDIS 8040 (photograph of Edison looking at new Storage Battery Building).
MINERAL SAMPLES (alcove 36, section 36)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on divider, section 36)	Common practice in library.	Use EDIS 1841 (photograph of Thomas A. Edison and staff).
MINERAL SAMPLES <u>or</u> PERIODICALS (alcove 37, section 37)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on divider, section 37)	Common practice in library.	Use EDIS 1840 (Thomas A. Edison at desk in library).
MINERAL SAMPLES <u>or</u> PERIODICALS (on shelves visible from floor, alcove 38, section 38)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Omit; shelves not visible from ground floor.
Framed PRINT (on divider, section 38)	Figures 51 and 62.	Use EDIS 8032 (photograph of group).
MINERAL SAMPLES <u>or</u> PERIODICALS (alcove 38A, section 38A)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on divider, section 38A)	Figure 62.	Use EDIS 1723 (an award).
MINERAL SAMPLES <u>or</u> PERIODICALS (alcove 25A, section 25A)	Common practice in library; *Edison: His Life and Inventions*, p. 641.	Use items in EDIS collection.
Framed PRINT (on divider, section 25A)	Common practice in library; no photographic evidence.	Use EDIS 1720 (Edison at Sunbury, Pennsylvania).

WINDOW SHADES, dark green, single (in all windows)	Figures 51, 56, 62, 65, 70, 73, 77, 88, and 89.	Reproduce.
LIGHT FIXTURES, two bulbs, metal shades (throughout library)	Figures 64, 65, 74, 76, 77, 78, 80, 84, and 88.	Use existing fixtures with period light bulbs.
HANGING LAMPS, 4 (from ceiling)	Figures 62, 64, 65, 76, and 88; *Edison: His Life and Inventions*, p. 641: "The open central space of liberal dimensions and height, flanked by the galleries and relieved by four handsome electric-lighting fixtures suspended from the ceiling by long chains...."	Use existing fixtures.

Building 5, Stock Room

The plan proposes to furnish the room as it might have appeared during the period after 1916. The evidence for furnishing this room includes four photographs from the period before Edison's death, and 16 photographs taken in 1939. Dyer and Martin left a detailed description of the room in their 1910 biography of Edison, as did W.K.L. and Antonia Dickson in their 1894 work. Used together, these sources indicate that the stock room contained a diverse mix of the exotic and the practical. It was widely known that Edison stockpiled materials such as tusks, herbs, and silk plush, in addition to a cache of chemicals, and the more pedestrian nails, drills, and stock metals used in the adjacent machine shop. Interpretation of the stock room should provide a balanced presentation, clearly explaining the important function of the room in storing tools and supplies for the machine shop while still acknowledging its eclectic nature and its subsequent power as a public relations tool.

Essentially, this plan recommends placing the objects identified using evidence from the period before 1916 within the existing configuration of the room, which was established some time after 1916. The stock room as it now appears is fundamentally different in shape from the way it appeared during the period before 1916. The 1916 floor plan (figure 4) shows the original layout of the stock room, with the two offices along the west side of the room penciled in. However, although the configuration of the space changed over time, the function of the room remained the same and this continuity of function allows some latitude in establishing the interpretive period.

Producing a furnishings installation completely accurate to the period before 1916 would require moving a large bank of shelving and constructing a wooden wall and counter along the passageway. (See figures 4 and 93.) It would also involve changing the existing stock room boundaries and removing the offices that have been established within it. A telephone booth was appended to the southwest corner of the stock room. Note that a change in the configuration of the stairs in that corner provides insufficient space to reconstruct the booth.

This furnishings plan recommends retaining the offices built on the west side of the room in the 1920s and keeps the present configuration of shelving. Most importantly, however, this plan retains the wire mesh fencing currently running along the south side of the room. In retaining the wire fencing the plan allows the visitor to view the entire south side of the room. Reconstruction of shelving and walls extant in the period before 1916 would block the line of sight from the passageway and make it impossible to see into most of the stock room.

It is important for the visitor to see the length of the room in order to understand it. The lighting of this space has changed little since 1914; the same incandescent bulbs in metal reflectors are now present. In 1939 there were several naked bulbs suspended from the ceiling with only a safety mesh around them. To light this area adequately all lights must be operational and reflectors must be clean. Subject to recommendation by a conservator, installation of bulbs of a slightly higher wattage than the 80 watts now in use will bring in more light. Adding a light fixture east of the third column would make all parts of this area visible to the visitor. The north side of the room, in the rear, gets lots of sunlight. Cleaning the windows would improve visibility in this area.

In the 1890s, the counter visible in figure 90 may have been set up for distribution of stock. The scale, note spindle, and memo books lying on the low counter top suggest that during the period this photograph was taken (sometime before 1895), stock was distributed over the counter directly into the hall area. A 1904 image shows a fence installed on top of the counter (figure 92). It is likely that by this time the service hatch was used to dispense stock. The furnishings plan recommends that items such as office supplies, record books, and a calendar be added to the serving hatch area to illustrate the presence of the stock clerk who was "kept exceedingly busy all day answering the numerous and various demands upon him."[634]

The 1914 photograph of this area (figure 93) shows a padlocked gate in the fence, as well as a new counter and moveable work benches installed in the hall, so it is clear that stock was not distributed through the fence by this time. Note that the hallway door across from the gate opens onto Lakeside Avenue. Large deliveries to the stock room were probably made there, rather than through the machine shop or library entrances. The electric motor (EDIS 759) and the power hacksaw (EDIS 3369) installed near the column in this area should be removed.

The stock room at present is full, with items on the floor, on tables, and on counters. The 1939 photographs reinforce this look but it should be remembered that the process of using the laboratory as a repository for junk had begun well before the 1930s. The 1904 and 1914 images (figures 92 and 93) also depict objects on counter tops and on the floor, and this rather sloppy appearance is reinforced by the Dicksons' 1894 description: "A general and totally unclassifiable litter of trade devices is lying loosely around. A sanguinary meat chopper impedes our path in one direction and an ice cream freezer in another... while pickaxes, saws, coffee-mills, wheelbarrows, ladders and what not bewilder our limited visual scope."[635] The furnishings plan for the stock room recommends that limited amounts of supplies be stored on the floor and strewn across counters to reflect what seems to have been a typical appearance of disarray in Edison's stock room.

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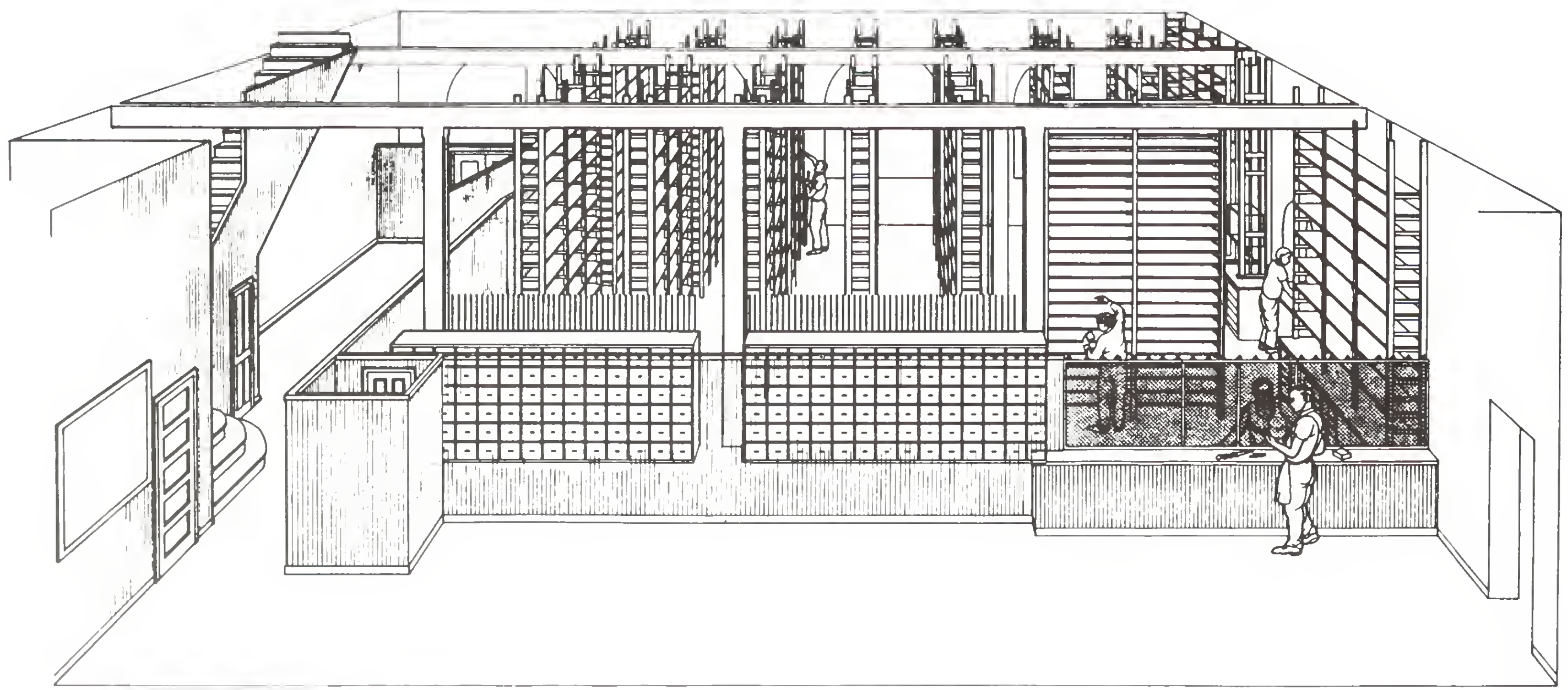
[634] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 647.

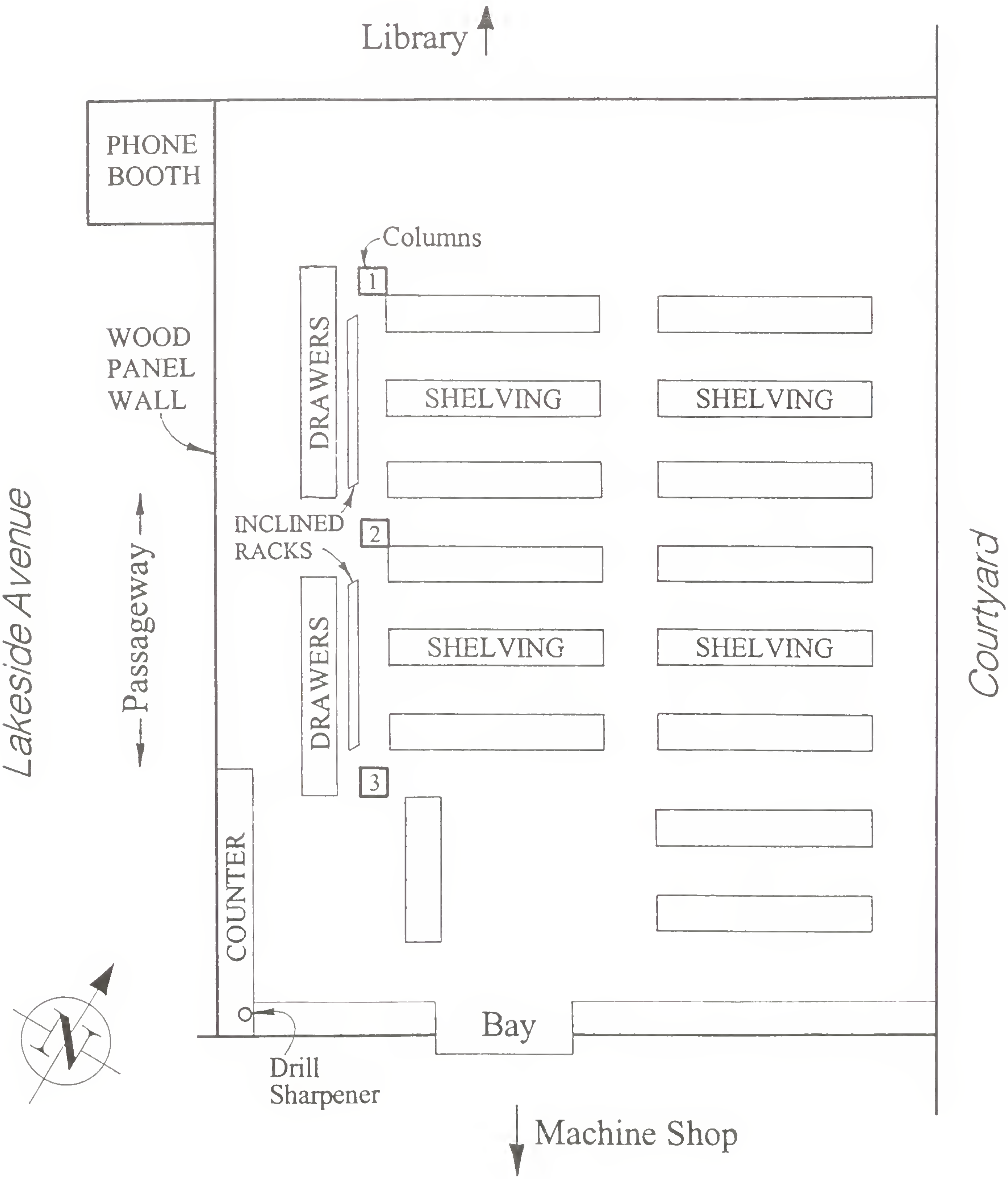
[635] Dickson and Dickson, *The Life and Inventions of Thomas A. Edison*, p. 292.



STOCK ROOM

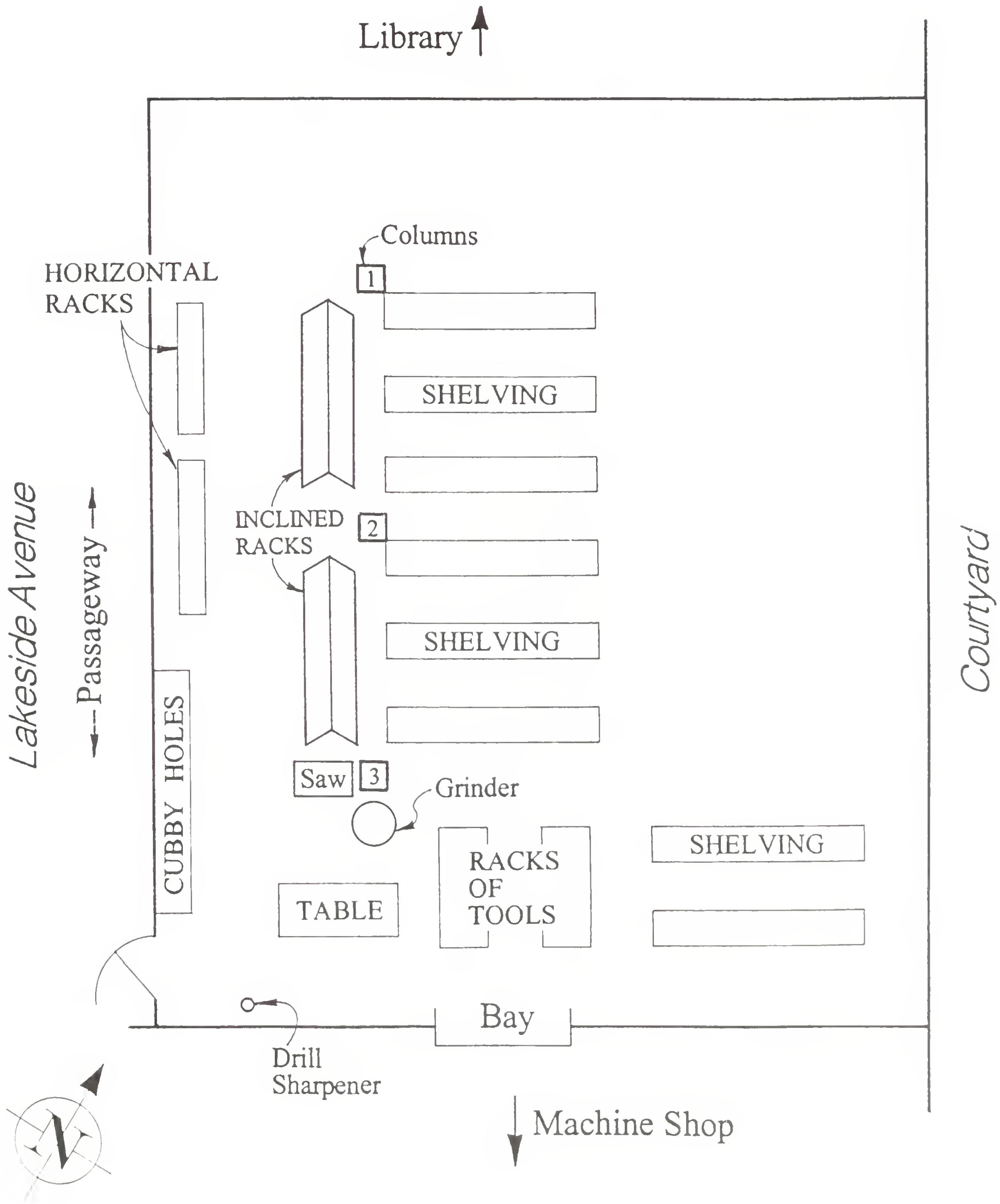
STOCK ROOM c. 1914

(not to scale)



STOCK ROOM c. 1930s

(not to scale)



Building 5, Stock Room

Object and Location	Evidence	Recommendation
CHEST OF DRAWERS, 6 drawers high, 14 drawers wide (several feet away from counter, near eastern-most column)	Figures 4, 90, 92, and 93.	EDIS collection or reproduce.
Framed CHART (on east end of chest)	Figure 93.	EDIS collection or acquire.
BOXES, wood and cardboard, various sizes (stacked on top of chest and against east end of chest)	Figures 92 and 93.	EDIS collection or acquire.
TOOL CASE, closed, to use with micrometer (on chest)	Figure 90.	EDIS collection or acquire.
CLOTH SACK (on floor next to chest)	Figure 93.	EDIS collection or acquire.
CHEMICAL BOTTLES, 2, glass, partially full (on top of chest)	Figure 93.	EDIS collection or acquire.
CALENDAR, ca.1916 (hung on chest of drawers, facing passageway)	See example in figure 92.	Acquire or reproduce.
RACKS, wood, single sided, inclined, with bar stock and strip stock, 2 to 12 ft. in length (behind chest)	Figure 92 and 93.	EDIS collection or reproduce.
WIRE, coiled, various sizes (hung on column near chest)	Figure 92 and 93.	Acquire.
SHELVES, 6, floor-to-ceiling (running north to south; also, retain built-in shelves on east wall) Only shelves seen by visitors are filled with stock.	Figure 93.	Use EDIS originals.
SHELVES, one set (positioned parallel to passageway, running east to west) Only shelves seen by visitors are filled with stock.	Figure 93.	Use shelves in EDIS collection.

SHELF CONTENTS: Boxes; Stacks of various types of Paper; Oil cans, two sizes; Crucibles, various sizes; Bunsen Burner; Spools of Twine; Tubing, Wire, various sizes; Funnels; Dowels; Chemicals in glass jars, to include 500+ jars of fluorescent chemicals; Short pipe stock; Rags; Letter Boxes; Mineral Samples in Bags; Toilet Paper; Rolled Sample of Ingrain Carpet; Samples of Cow and Goat Hair; Nuts; Seashells; Samples of exotic woods; Files; Machine Parts Shelves should also contain sample bolts of various fabrics to include wool, silk, cotton, rubber cloth, embroidery canvas, linen, nainsook, dimity, tarlatan, muslin, duck, calico, flannel, velveteen, corduroy, moleskin, plush, and velvet.	Figures 90, 92, and 93; voucher 760, December 29, 1887; voucher 759, December 28, 1887; voucher 764, January 3, 1888; *Life and Inventions of Edison*, p. 292; and *Edison: His Life and Inventions*, pp. 645-47.	EDIS collection and acquire reproductions.
PAPER SACKS, two sizes (hung on end of shelf)	Used for carrying stock. See figure 90.	Reproduce.
STEPLADDER, 6 ft. tall (leaning against shelves)	Used to access shelves. Voucher 578, May 23, 1888.	EDIS collection or acquire.
RACKS, single or double sided, with bar stock and strip stock, 6 to 12 ft. in length (behind shelf parallel to hallway)	Figure 93.	EDIS collection or acquire.

BOXES, cardboard and wood, various sizes, containing screws, bolts, and other types of hardware used in the machine shop (most of these boxes face the inner aisle; on shelves) An example of the contents of each box was affixed to the front of the box for easy identification of contents.	Figure 93. The boxes face the inner aisle to illustrate that stock dispensing was probably going on through the hatch, rather than over the counter next to the hallway.	EDIS collection and acquire reproductions.
COUNTER/SHELVING (south side of room, inside fence)	Physical evidence.	Retain existing counter/shelving.
ITEMS ON COUNTER: Coils of Belting, 1" and 3" Spools of Wire Spool of flat Sash Chain Scale and Weights C-clamp Needle-nosed Pliers Letter Press Mortar and Pestle	Figure 90.	EDIS collection or acquire.
DRILL SHARPENER (on floor between counter and shelf, parallel to hallway)	Figure 93.	EDIS collection or acquire.
CRATES and BOXES, wood (stacked below counter and either side of gate)	To show deliveries were made through this gate and nearby door to Lakeside Avenue. Deliveries may not have been unpacked immediately.	EDIS collection or reproduce.
SCALE, with weights (on serving hatch counter)	Figure 90 provides an example of the scale.	EDIS collection or acquire.

OFFICE SUPPLIES: Pens Pencils Ink Bottle Wire Desk Baskets Stack of Forms Stack of post cards Rubber Stamps Note Spindle Paperweight Ledger ca.1916 calendar (on serving hatch counter)	Voucher 475, April 1888; see figure 90 for examples.	EDIS collection or acquire.
STOOL (next to serving hatch)	For stock clerk use.	EDIS collection or acquire.
LIGHT BULBS, suspended from ceiling with plain cords (at intervals along passage between shelves and fence) See figure 93 for arrangement.	Figure 93.	Reproduce.

Building 5, Heavy Machine Shop, First Floor

The largest tools in the heavy machine shop have been in place since the laboratory opened in 1887. Smaller machines were rearranged in the early years of this century but beginning in 1906, historic photographs, floor plans, and inventories show a remarkable degree of continuity in the arrangement of the shop's equipment. The shop is divided functionally, with the heaviest machines in the center aisle, where they can be served by the crane-way. Large lathes line the south aisle and milling machines are clustered at the eastern end of the north aisle. Smaller lathes, shapers, and drill presses are scattered throughout the space with the largest drill presses along the cross-aisle near the west end of the shop.

The furnishings listed below were selected to reflect the shop's appearance during the early years of World War I. Structural modifications, including a stairway that was added in 1914 and replacement of wood windows with steel frames and sash in 1915, preclude furnishing the space to an earlier date.

There were a number of significant changes in the management structure of Edison's laboratory during the second decade of this century, but they had relatively little impact on the physical appearance of the heavy machine shop. Because most of the large machines were in their present locations by 1906, the shop can be interpreted from that time, even with a 1915 furnishings plan.

A comprehensive set of large format photographs taken in April 1914, 1916 architectural drawings of Building 5, and a detailed 1920 appraisal and sketch plan of the machine tools are the principal evidence for this plan. An October 1913, inventory is helpful, but contains too many errors to be completely reliable.[636]

Shop furniture and machine accessories were inventoried for the first time in 1939.[637] Benches and cabinets can be identified in earlier photographs and compared with those in photos taken as part of the 1939 inventory to confirm their existence and location. Small benches and stools appear to have been moved

[636] J.C. McGarvey, New York Appraisal Company, "Inventory and Appraisal," 1920; "Edison Laboratory, Inventory taken October, 1913." The 1920 appraisal lists each machine by maker, type, and general size (swing x bed length for lathes, stroke for shapers, table dimensions for milling machines and planers, etc.) Most of the machines, listed in some detail in the 1920 appraisal, appear on the 1913 inventory. The gross numbers of lathes, milling machines, shapers, and other machines match fairly well but the descriptions of some specific machines do not. In several cases the person who compiled the earlier list improperly described particular machines or misattributed them by reading the dealer's plate instead of the builder's. Given this appearance of inexperience or carelessness, the 1913 inventory should be used advisedly.

[637] See Photograph Albums 43 (catalog 547), 44 (catalog 548), and 45 (catalog 549), and the E-Card files. E-Cards were a company-initiated museum cataloging system begun after Edison's death.

around the shop to accommodate different jobs, yet most survive. The foreman's desk, which appears in 1914 photos, is now stored on the second floor.

Machine tool accessories are more of a problem. Surviving 1906 and 1914 images show faceplates, chucks, steady rests, indexing heads, and change gears next to or under almost every machine. Smaller accessories are lost in the general clutter. Fortunately, Edison Company employees working in the late 1930s, assigned numbers and typed E-cards for these accessories as well as for the machines. Many of these items are machine specific; they are not interchangeable with anything other than the same model machine by the same manufacturer. Therefore, the assumption in this plan is that if an accessory was associated with a particular machine in 1939, it was probably there in 1914, even if it is not visible in the photographs.

The shop's brick walls received their first coat of paint or whitewash sometime between 1890 and 1906, but the columns, crane beams, and other woodwork remain unpainted in the April 1914 photographs. A published photo of the north side of the shop, reportedly taken in 1929, shows the existing white and gray color scheme. The paint looks sufficiently dingy to have been there for a while, but no visual or documentary evidence has been found to indicate when the columns were first painted, other than sometime between 1914 and 1929.[638]

Two 1914 photographs, figures 108 and 109, show a low wood and wire-cloth partition, running between columns at the northeast end of the shop. The lower plank sections, about four feet tall, may have been reused parts of a barrier that originally surrounded the steam engine pit (see figure 99). This partition is not indicated on the 1916 floor plan, although it may have been too insignificant to note. It is clearly gone by 1929. The divider and shelves that were attached to it are shown in the perspective drawing of the main shop that accompanies this report but the furnishings plan does not recommend that it be replicated.

Eleven machines were removed between 1920 and 1939: three engine lathes, a speed lathe, a precision bench lathe, three drill presses, a shaper, and a punch press. One drill press was replaced by a different model. Four lathes, a keysetting machine, and two grinders were added during this period. A very large Lucas No. 31 horizontal boring mill was installed at the east end of the central aisle sometime between 1920 and 1939, but had been removed by 1942.

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[638] James A. Cox, *A Century of Light* (NY: The Benjamin Company, 1979) p. 58. The original of this photograph has not been located. It was in the General Electric archives at Nela Park, Cleveland, OH. That collection has since been moved to General Electric's Hall of History in Schenectady, New York, and the image was lost along the way.

Most of the changes took place at the rear of the shop, near the row of columns on the Lakeside Avenue side. The only two machines removed between 1920 and 1939 that would be readily apparent to visitors on the present tour route are a lathe and drill press by the courtyard door, near where the time clock is now mounted.

This plan advocates removing the seven machines that post-date the interpretative period, moving another seven to their 1914-1920 locations, and acquiring replacements for three machines that have disappeared since 1920. Although these may sound like substantial changes involving many tons of cast-iron, differences between this plan and the existing shop are comparatively minor, considering that this was an industrial environment that remained active for 10-15 years after the period we want to interpret.

Three lathes, two grinders, a milling machine, a keysetting machine, and their associated accessories, all installed after 1920, should be removed to storage. A drill press, a shaper, and a lathe should be moved within the shop to their 1914 locations. The shaper, surface grinder, drill press, precision bench lathe, and shop foreman's desk that migrated to the second floor precision shop after 1920 should be returned as well. Replacements should be secured for a double spindle drill press, a speed lathe, and a small shaper. A lathe, a shaper, and a drill press, installed after 1920 to replace pre-1914 machines, can be left in place because they are visually similar to their predecessors.

There are some changes that cannot, or should not, be made in the name of historical veracity. No machine or belt guards are visible in the 1914 photographs nor are they evident in the 1929 image. All of the existing guards were in place by 1939. It would be irresponsible to recommend removing protective devices if any of the shop's machinery is to be operated. Beyond safety and common sense, it can be argued that these guards are historically appropriate, although not to this particular establishment. Guards of this type, built of angle-iron, wire cloth, and perforated sheet metal, were used in other American machine shops as early as the turn of the century.[639]

The shop is now very full, and it will remain so even after the post-1920 machines are removed, but it needs three additional types of objects in order to successfully recreate an historic scene--machinists' tools, personal effects, and work in progress. Edison employment records, cited in the occupancy sections, listed 22 machinists and three machine shop supervisors working in the laboratory in 1910. Machine shop superintendent Charles Luhr signed time cards for 27 to 32

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[639] John Bowditch, "Report on Operating the Machine Shop at the Edison Laboratory in West Orange, New Jersey," November 26, 1991. (Edison NHS Administrative Files).

machinists each month in 1914.[640] The number of machinists peaked during World War I; there were 51 in 1919.[641] Their numbers then fell precipitously during the 1920s. Payroll records do not indicate whether individual machinists were working in the heavy shop, precision shop, or elsewhere in the laboratory complex.

Eight machinists' tool cabinets are visible on the bench on the south side of the shop in figures 105 and 103, taken in 1914. Two more can be seen on the north bench in figure 106, and there may be more out of sight behind the camera. Most of the boxes are set up on blocks, so their drawers can be opened without running into work on the bench. (See Appendix F for a discussion of machinists' tool cabinets and their contents.)

It is difficult to find workers' clothing and other personal effects in the 1914 photographs of the main shop. In figure 101, a jacket hangs from a post. The corner of an apron shows at the edge of figure 103. A work shirt hangs on the cabinet in the background of figure 109, along with a 1914 calendar girl pin-up. Photos of the second floor, from the same series, show a vacuum bottle on the bench (figure 121) and the spectral image of a man in a dirty smock (figure 124). The working garb of machinists and other laboratory employees show more clearly in a 1911 series of photos taken on the occasion of Edison's return from Europe.[642] Machine shop employees also appear in group photos in a commemorative album, given to Edison for his 70th birthday, in 1917, but they look a little too cleaned-up.[643]

For some time, Edison NHS staff have wanted to identify a historically appropriate project that would serve to make Edison's research and development techniques more tangible for visitors. Ideally, the project would be directly related to phonograph or storage battery work, and would provide an opportunity to demonstrate linkages between the library, chemistry laboratory, drafting room, pattern shop, machine shops, and other Edison facilities on and off-site. Visitors would see how laboratory notebooks were translated into drawings, drawings into patterns and patterns into prototypes, then how prototypes were modified and refined before tooling could be built to turn out production models.

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640 Employee Records, Edison Laboratory Time Sheets, Boxes 90-94 (1913-1914).

641 "Functions of Present Laboratory Organization," September 24, 1919, in DF 1919, Thomas A. Edison, Inc.--Organization.

642 See Photograph Album 10, catalog 5209, leaf 81. Photographs of "Mr. E. 'Posing' for Motion Picture" and "Shaking Hands" are particularly good.

643 Photograph Album 42, catalog 541.

Searching for this sort of interpretatively comprehensive project is a laudable quest. Unfortunately, research for the machine shop furnishings plan did not reveal the perfect candidate.

Work in progress, visible in the 1914 photos, includes seven large (3-1/2 feet in diameter) cast-iron pans on castors. These appear to be having the edges and mating surfaces of their top flanges and lids surfaced on the Niles boring mill. Similar pans are shown in a 1911 photograph of the plant at Silver Lake, being used to manufacture nickel hydrate and iron oxide for storage batteries.[644]

Parts for specialized presses can be seen, in various stages of completion, throughout the shop. Eight frame castings are sitting on the floor next to a milling machine in figure 106. Figure 108 shows the assembly station near the back of the shop with three presses nearing completion. Each of the castiron frames carries a vertical cylindrical steel ram. The ram has teeth cut in its back edge, forming a rack gear that engages a pinion gear on the horizontal shaft driven by a handwheel. The ram is hollow and has a rotating shaft on the inside. That shaft is turned, through a pair of bevel-gears, by a pulley grooved to accommodate a round leather belt. Both of the presses on the right side of the photo are fitted with circular tables and four clamps or brackets. Additional tables, handwheels, pulleys, and other parts for the remaining presses are lined up on the bench between the sawhorses and the motor stand. Presumably, many of these parts have just been polished on the speed lathe in the background.

Sadly, we have been unable to determine the purpose of these presses. The frame, ram, and handwheel resemble those of ordinary light-duty arbor presses. The circular table is about the same size as an Edison diamond disc, but its purpose, and that of the clamps and rotating spindle, remains a mystery. (One of these devices survived in Building 1, at least through 1939, and appears in photo 8070 of the inventory as E-4536. Unfortunately, the E-card simply lists it as an "Arbor Press.")

Despite all these ambiguities, it may be worth doing additional research on these curious little presses, if not because they are significant examples of Edison manufacture, then because reproducing them would allow demonstration of a wide variety of machine operations on a comparatively simple object. Rough frame castings have to have their bases milled flat on a milling machine and shaftways bored out and spot faced on a drill press, lathe, or boring mill. The outside surface of the handwheels are smoothed off and the shaft hole is bored out on a lathe. The keyway that secures it to the shaft is cut on a shaper. The hollow rams are bored out and turned on a lathe. Their rack gear teeth could be cut either

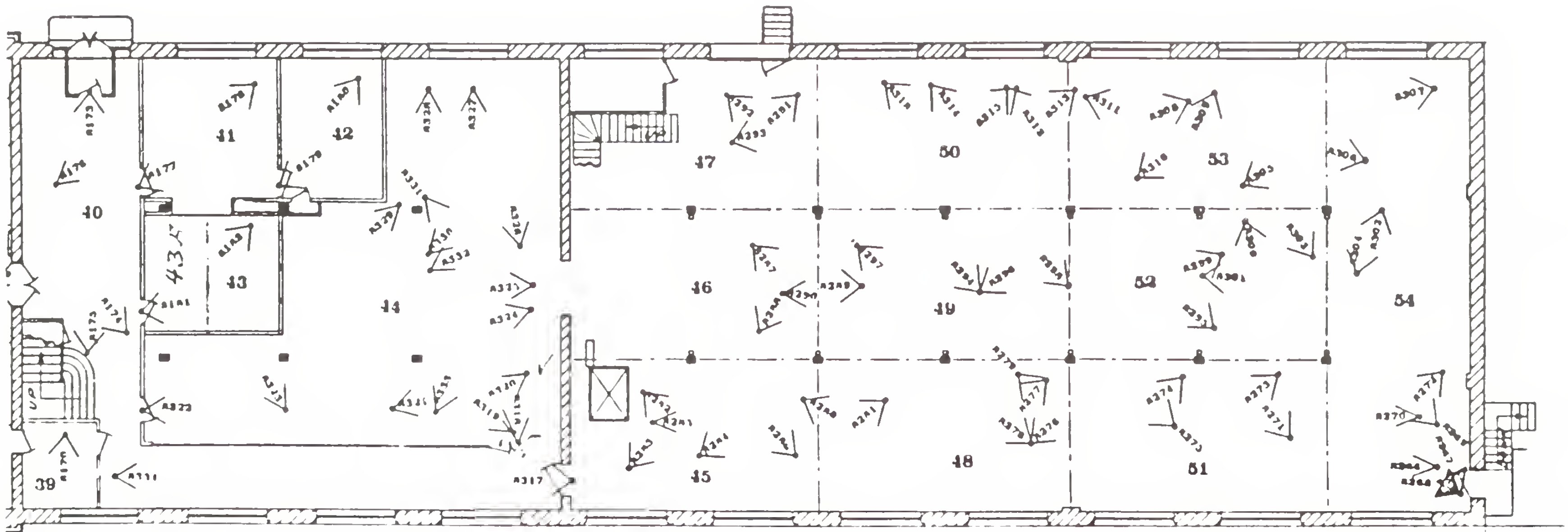
[644] Photograph Album 10, catalog 5209, leaf 75.

with a shaper or a milling machine using a shaped cutter. Pinions and bevel gears probably come from outside suppliers, but they could be produced in-house using indexing heads on shapers or milling machines.

There are also opportunities to tie into work at the pattern shop. The handwheels and pulleys are based on straightforward patterns while the frame castings require matchboards and fairly sophisticated core patterns.

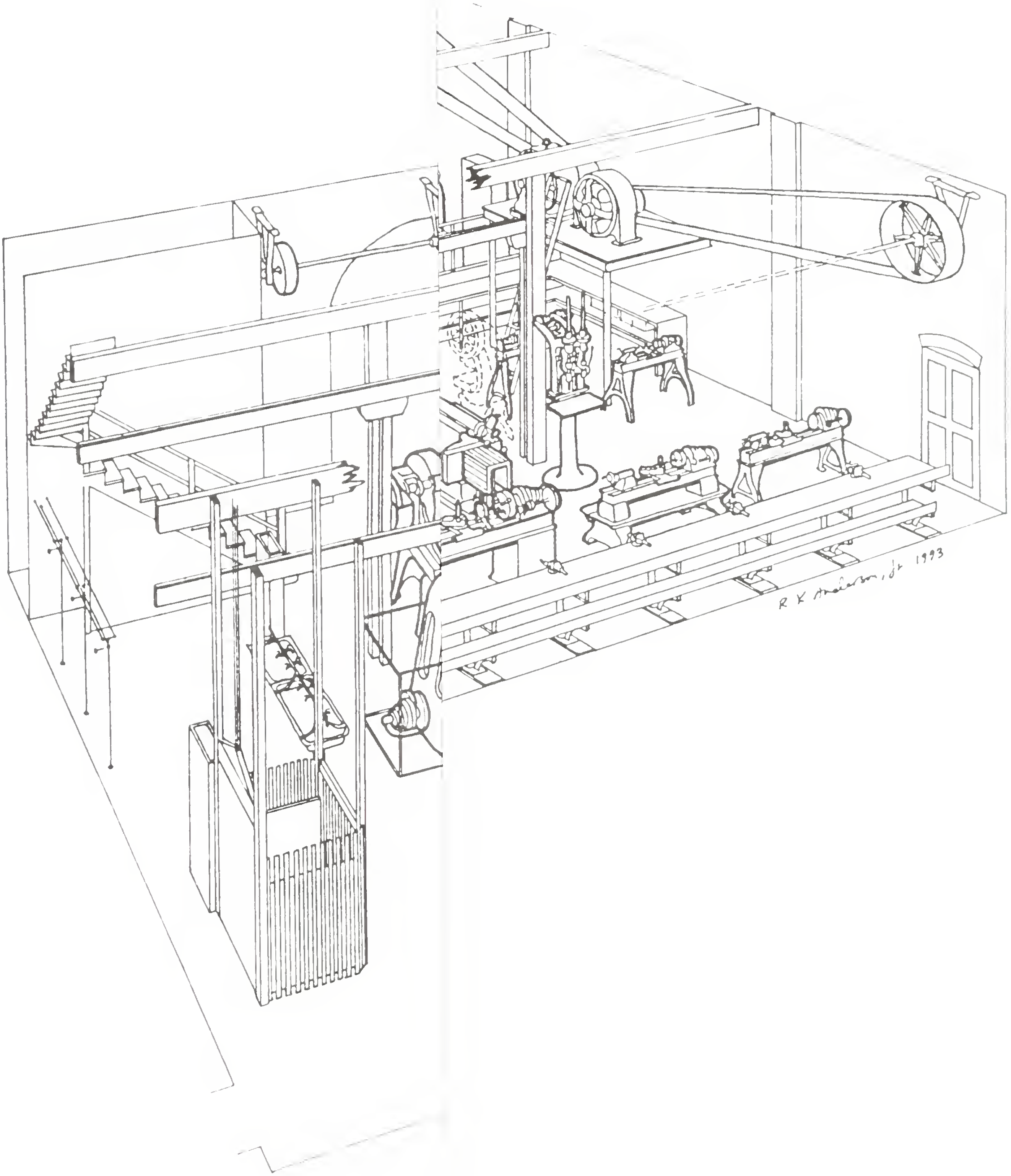
Still, it is important to remember that any item to be reproduced in the shops should be selected not simply to demonstrate virtuosity in machine operations, but to show a representative segment of Edison's integrated research, development, manufacturing, and marketing activities.

Securing appropriate machinists' tools and tool boxes, selecting a project to demonstrate work-in-progress, locating the drawings, and having patterns and castings made, are all long-term undertakings. The first priority in implementing this plan is clearing out all of the modern maintenance equipment and detritus that has accumulated at the rear of the shop. Some of these items are historic, but they have no business here. They were simply deposited after Building 1 was cleared out in the 1960s. After the inappropriate materials are gone, Edison NHS staff can remove seven post-1920 machines and their accessories to storage. Another seven can be moved back to their 1914-1920 locations. Once drive belts have been adjusted, serviced, or replaced, as needed, there will be plenty of opportunity to generate historically appropriate clutter as an inevitable byproduct of demonstration and production.



BLDG No 5 FIRST FLOOR

206 FT



'Y MACHINE SHOP

Building 5, Heavy Machine Shop, First Floor

Object and Location	Evidence	Recommendation
LINESHAFT, 90' long, 3-7/16" diameter; by Edison Machine Works, Schenectady, NY; (south side of shop; sections 45, 48, 51, 54)	Vouchers 590, 591, 696, 722 (Nov.-Dec. 1887); figures 99, 100, 101, 103, and 105; 1920 Appraisal, pp. 9-11. Installed 1887.	Use EDIS 243/E-1841 (original).
LINESHAFT, 88' long, 3-7/16" diameter, with 12 hangers; by Edison Machine Works, Schenectady, NY; (north side of shop; sections 47, 50, 53, 54)	Vouchers 590, 591, 696, 722 (Nov.-Dec. 1887); figures 99, 102, and 107; 1920 Appraisal, pp. 9-11. Installed 1887.	Use EDIS 244/E-1842 (original).
TRAVELING CRANE, by Edison Machine Works, Schenectady, NY (sections 46, 49, 50)	Figures 100, 102, and 107. Installed 1887.	Use EDIS 222/E-1839 (original).
CHAIN HOIST, 6 ton capacity (attached to traveling crane; section 49)	Figures 100, 102, and 107.	Use EDIS 223/E-1840 (original).
Vertical BORING MILL, 48" swing with 50" table; by Niles Tool Works, Hamilton, OH (section 46)	1913 Inventory no. 212; 1920 Appraisal no. 1-20; figure 101.	Use EDIS 213/E-1821 (original). Replace belts as needed.
ACCESSORIES for Niles vertical boring mill above: Jaws, adjustable (2 sets of four) Bits Countershaft	Figure 101.	Use E-1821-1 and 2 (original sets of adjustable jaws); E-1821-3 (original accessories); Use E-1821-4 (original bits) Use E-1821-5 (original countershaft)
SINK (section 46)	Figure 101.	Use original in EDIS collection (no number).
CABINET with five full-width drawers, top rimmed on three sides, 30"x 54"x 40"; (next to elevator; section 46)	Figure 102.	Use E-1752 (original).

CABINET, top rimmed on three sides, supported by two banks of five drawers each; cut down from wider unit, 24"x 48"x 42" (near elevator; section 46)	Figure 101.	Use E-1822 (original).
POWER SHEARS and PUNCH MACHINE, by W.C. Youngs & Co., Worcester, MA. (section 47)	1913 Inventory no. 126; 1920 Appraisal no. 1-29; figures 101 and 106.	Use EDIS 214/E-1829 (original). Do <u>not</u> replace belts - machine is too close to visitor path for safety.
COUNTERSHAFT, for Young power shear above (section 47)		Use E-1829-1 (original)
SHAPER, 30" stroke, traverse head on 8' 4" sliding ways; by Niles Tool Works, Hamilton, OH (section 50)	1913 Inventory no. 117; 1920 Appraisal no. 27; figures 100 and 102. Installed between 1890 and 1906.	Use EDIS 220/E-1837 (original). Replace belts as needed.
ACCESSORIES for Niles heavy duty shaper above: Circle Attachment Countershaft Rotary Table		Use E-1837-1 (original accessories); E-1837-2 (original circle attachment); E-1837-3 (original countershaft); E-1837-4 (original rotary table).
SHELF, part of guard for Niles shaper above (section 50)	Added with the guard between 1914 and 1939.	Use E-1877 (original).
MILLING MACHINE with horizontal plain, model no. 3, 54" x 13" table; by LeBlond Machine Tool Co., Cincinnati, OH (section 50)	1920 Appraisal no. 1-34; figure 106. Purchased from Niles Bement Pond, Miscellaneous Dept; not on 1913 inventory.	Use EDIS 225/E-1836 (original) Replace belts as needed.

ACCESSORIES for LeBlond milling machine model no. 3 above: Head Vertical Bracket Center Bracket Arbor Bracket Bottom Chuck Spindle Cutter Spindle Facing Holder Spindle Facing Cutter Arbors Boring Rods Bushings Adapters Countershaft (section 50)		Use EDIS 641/E-1836-1 through E-1836-4, and E-1836-8 through E-1836-13 (all originals).
TABLE, circular, for milling machine above (section 50)		Use EDIS 366/E-1833 (original).
BENCH, designed to hold milling machine accessories; rack for arbors E-1831 is attached to top (section 50)	Figure 107.	Use E-1832 and E-1831 (originals).
SHAPER, 20" stroke, high duty; by Gould & Eberhardt, Newark, NJ (section 50)	1920 Appraisal no. 1-35; figures 106 and 107. 1913 Inventory lists two 20" G&E shapers under entry no. 120 (other shaper listed below in section 51).	Use EDIS 224/E-1838 (original). Replace belts as needed.
ACCESSORIES for Gould & Eberhardt High Duty Shaper above: Countershaft (section 50)		Use E-1838-1 and E-1838-2 (originals).
CIRCLE ATTACHMENT for shaper above (section 50)		Use E-1814 (original).
RACK, three shelves, for hold-downs and clamps; (next to G&E shaper above; section 50)		Use E-1924 (original).
DRILL PRESS, 26" swing, single spindle, stationary head, back-geared, hand and power feed; by Aurora Tool Works, Aurora, IN (section 50)	1920 Appraisal no. 1-36; figures 101 and 107. Not on 1913 Inventory.	Use EDIS 363/E-1830 (original). Replace belts as needed.

ACCESSORIES for Aurora drill press above: Garvin model 14" drill press vise with 6" jaws, Countershaft (section 47)		Use E-1830-1 (original vise); use E-1830-2 (original countershaft).
ENGINE LATHE, 15" swing, 6 ft. bed; by Flather & Co., Lowell, MA (section 50)	1913 Inventory no. 39; 1920 Appraisal no. 1-39; figure 109. Removed between 1920 and 1939. Replaced by 18" Hendey no.3 [E-1809]. E-card notes that the Hendey was moved to Silver Lake after 1940.	Acquire. Leave space vacant until suitable replacement is found. [Could be replaced by 14 in. x 6 ft. 6 in. Walcott & Wood engine lathe, EDIS 229/E-1784.]
Precision BENCH LATHE, 8" swing, 40" bed; by Rivett Lathe Mfg. Co., Boston, MA; (on bench along north wall, section 50)	1913 Inventory no. 41; 1920 Appraisal no. 1-41. Last Patent: 1895.	Use EDIS 650/E-1817 (original). Replace belts as needed.
ACCESSORIES for 8" Rivett precision bench lathe above: Change Gears Countershaft Collet Set (section 53)		Use E-1817-1, E-1817-2, E-1817-3, and E-1817-4 (originals).
DRILL PRESS, 14" swing, single spindle, round base, 13" x 10" table; by Sigorney/Pratt & Whitney, Hartford, CT; (north wall; section 50)	1913 Inventory no. 112; 1920 Appraisal no. 3; figure 107. Moved from section 50 to 52 between 1920 and 1939 to make way for time clock. Moved to second floor, section 68, December 6, 1948.	Retrieve EDIS 735/E-1820 from second floor and install in 1914 location.
WORKBENCH, 38' long (along north wall; sections 50-53)	Figures 99, 106, and 107. Installed 1887.	Use EDIS 387/E-1834 (original).
FITTINGS on bench above: Bench Vise, 4" jaws Surface Plates, 3 (section 53)		Use E-1896 (original bench vise); use E-1906, E-1907, and E-1908 (original surface plates).

STEP STOOL, wood, and BENCHES, 2, wood one bench measuring 20" x 54" x 13.5"; one bench measuring 15" x 30" x 11" (under workbench above)		Use E-1916 (original bench); E-1919 (original stool); E-1920 (original wood bench).
SURFACE PLATE, (on workbench EDIS-387; section 50)	Moved to Building 3 and built into wood lathe. E-5088 by Joe Ziemba, March 20, 1946.	Locate E-1901 (original), or use substitute.
TABLE, wood with steel top (E-1926) measuring 3' x 4' x 1.5" thick; and cover (section 50)	Figures 104 and 108. Located at east end of central aisle, 1914.	Return EDIS 365/E-1925 to 1914 location.
PLANER, metal, 42" x 42" x 12' with 32" wide table, one head on cross slide, one side head; by Bement Miles & Co., Philadelphia, PA (section 49)	1913 Inventory no. 136; 1920 Appraisal no. 1-18; figures 99, 100, and 102. Purchased March 31, 1887, $2802.50, voucher 232.	Use EDIS 219/E-1798 (original).
ACCESSORIES for Bement Miles planer above: Countershaft (section 49)		Use E-1797, E-1798-1 (original accessories), and E-1798-2 (original countershaft).
RACK, holds gears for Bement Miles planer above (on post; section 52)		Use E-1954 (original).
Power HACKSAW, 4" x 4" capacity, 12" blade; by Millers Falls/Star, Millers Falls, MA (between planer and radial drill; section 49)	1913 Inventory no. 131; 1920 Appraisal no. 1-18A; figure 10o. Moved to second floor, section 62, after 1939.	Retrieve EDIS 722/E-1799 from second floor.
Universal RADIAL DRILL PRESS, model 1558; 4' 6" swing, 27" x 26" x 37-1/2" table; by Bement Miles & Co., Philadelphia, PA (section 49)	1913 Inventory no. 114; 1920 Appraisal no. 1-19; figures 99, 100, and 102. Purchased February 1, 1888, $2000.00, voucher 233.	Use EDIS 218/E-1800 (original).
VISE and ACCESSORIES for Bement Niles radial drill press above (section 49)		Use E-1800-1, E-1800-2, and E-1800-3 (originals).
BENCH, steel top over wood, one drawer; (next to radial drill press; section 48)	Figure 102.	Use E-1951 (original).

PLANER, metal, 36" x 36" x 8', with 32" wide table; by Niles Tool Works, Hamilton, OH (section 49)	1913 Inventory no. 137; 1920 Appraisal no. 1-23; figures 100, 106, and 107. Installed between 1890 and 1906.	Use EDIS 231/E-1793 (original).
ACCESSORIES for Niles planer above: Angle Plate Countershaft Vise Planer (section 52)		Use E-1792, E-1793-1, E-1793-2, and EDIS 364/E-1795 (originals).
DRAWING CABINET, ten drawers, labelled "Plant Layout Prints", "Prints From Outside", etc. (section 49)	Located in Building 28, in 1944. Contained Edicraft drawings. Figure 101 shows very similar cabinet next to the elevator.	Use E-4700 as substitute for cabinet shown in figure 101.
ARBOR PRESS, Greenerd no. 3, on cast iron stand made from old lathe legs (section 53)	1920 Appraisal no. 1-11. Last Patent: 1891. Moved from section 48 to section 53 after 1920.	Use E-1810 (original), move to section 48.
SHAPER, 16" stroke; by Gould & Eberhardt, Newark, NJ (section 53)	1913 Inventory no. 133; 1920 Appraisal no. 1-30; figure 104. Removed between 1920 and 1939.	Acquire or use similar shaper from second floor (such as EDIS 252/E-966, installed after 1920).
Universal MILLING MACHINE, model 2A, 39" x 8" table; by Brown & Sharpe, Providence, RI (section 53)	1913 Inventory no. 43; 1920 Appraisal no. 1-31; figure 109. Last Patent: 1907.	Use EDIS 235/E-1816 (original). Replace belts as needed.

ACCESSORIES for Brown & Sharpe model 2A milling machine above: Vise Reversing Plate (for dividing head) Bracket Center Head Vertical Head Dividing Chuck Universal Center Tail Center Dividing Head Change Gears Index Plates, 3 Countershaft Arbors Bracket Spindle Bracket Support (section 53)		Use E-1816-1, E-1816-2, and E-1816-3 (originals). Use EDIS 646/E-1816-4 and EDIS 647/E-1816-4 (originals). Use E-1816-6 through E-1816-14 (originals).
RACK, wood, for Brown & Sharpe milling machine arbors (attached to column; section 53)		Use E-1815 (original).
MILLING MACHINE, horizontal plain, model no. 5 with 54" x 16" table; by Brown & Sharpe, Providence, RI (section 53)	1913 Inventory no. 121; 1920 Appraisal no. 1-33; figure 106. Last patent: 1892.	Use EDIS 234/E-1835 (original). Replace belts as needed.
ACCESSORIES for Brown & Sharpe no. 5 milling machine above: Vise Vertical Head Center Bracket Dividing Head Jack with V-groove and Center Tail Center Countershaft Change Gears Arbors Boring Rods Bushings and Adapters Top Arbor Support Bottom Arbor Support Adjustable Table (section 53)		Use E-1835-1 (original). Use EDIS 24778/ E-1835-3, E-1835-4, and EDIS 645/E-1835-5 (originals). Use E-1835-7 through E-1835-15 (originals).

SHELF, wood (on post at milling machine; section 53)	Physical evidence.	Use E-1931 (original).
ENGINE LATHE, 16" swing, 6' bed, single back gear, quick change gear, compound rest; by Hendey Machine Co., Torrington, CT (section 53)	1913 Inventory no. 38; 1920 Appraisal no. 1-38; figure 109. Moved from section 53 to position of lathe no. 39, in section 50, sometime after 1939.	Leave EDIS 236/E-1811 in place.
ACCESSORIES for Hendey engine lathe above: Drill Chuck Knockout Bar Accessories Draw Spindle Colletts Independent Chuck, 12" Steady Rest Following Rest Face Plate Carrier Plate Countershaft (section 53)		Use E-1811-1 through E-1811-11 (originals).
ENGINE LATHE, 21" swing, 8 ft. bed; by LeBlond Machine Tool Co., Cincinnati, OH (section 48)	1920 Appraisal no. 1-42; figure 107. Sold by Niles-Bement-Pond, miscellaneous dept. Moved from section 53 to location of 1920 Appraisal no. 1-14, section 48, between 1920 and 1939.	Return EDIS 216/ E-1779 to 1914 location after a suitable replacement is found for 20" Fay & Scott engine lathe.
ACCESSORIES for 20 in. LeBlond engine lathe above: Steady Rest Face Plate, 21" Special Face Plate, 15" Carrier Plate Independent Chuck, 8" Independent Chuck, 14" Following Rest Change Gears Accessories Countershaft (section 48)		Use E-1779-1 through E-1779-10 (originals).
RACK, for gears (at LeBlond engine lathe EDIS-216; section 48)		Use E-1952 (original).

BENCH, 28' long, with 12 drawers. Has cut-out for Rivett precision lathe, plus another dropped section for a machine since removed (along north wall; sections 53-54)	Figures 99, 106, and 107. Installed 1887.	Use EDIS 389/E-1818 (original).
FITTINGS, on bench above: Bench Vise, with swivel base, graduated, with 5.25" jaws; Bench Vise, 4" jaws; Bench Vise, Parker 239; Bench Vise, Parker 229; Bench Vise, Parker 203; Bench Vise, Parker 22; Surface Plates, 9	Figures 106 and 107.	Use E-1891, and E-1893 through E-1898 (originals). Use E-1899, E-1900, E-1902 through E-1909, E-1914, and E-1933 (original surface plates).
CABINET, wood, 12" x 24" x 50" (on bench E-1818; section 53)		Use E-1819 (original).
DC MOTOR, 40 HP at 1100 RPM, 240 volt DC; by Bullard Motor Mfg. Co. (section 54)	Figure 108; 1913 Inventory (no number); 1920 Appraisal no. 1-21. Installed 1910, to replace steam engine.	Use EDIS 241/E-1844 (original).
DC MOTOR, 35 HP, 220 volt DC, 117 amps; by General Electric, Schenectady, NY (section 51)	Figure 108; 1913 Inventory (no number); 1920 Appraisal no.1-21A. Installed 1910, to replace steam engine.	Use EDIS 1845 (original).
PLATFORM, supports two electric motors (section 54)	Figure 108. Built 1910, above former steam engine pit.	Use EDIS 388/E-1843 (original).
LADDER, provides access to motor platform (section 54)	Figure 108.	Use E-1944 (original).
RHEOSTAT, (No. 2); controls motor on north side of heavy machine shop; by General Electric, Schenectady, NY (east wall, center; section 54)	No. 1 is visible in figure 108 but no. 2 is not.	Use EDIS 484/E-1844-1 (original).
RHEOSTAT (No. 1); controls motor on south side of heavy machine shop; by General Electric, Schenectady, NY (east wall, center; section 54)	Figure 108.	Use EDIS 485/E-1845-1 (original).

CONTROL PANEL, slate panel with two-position knife switch, GE-Thomson watt-hour meter, and two ITE circuit breakers; by Industrial Controller Co., Milwaukee, WI (section 54)	Installed between 1914 and 1939. Clearly visible in figures 110 and 111, however, it is not visible in figures 105 or 108.	Use EDIS 390 for the time being. Park should consider rewiring DC system so that rheostats can act as low-voltage controllers to a concealed modern high-voltage system.
ENGINE LATHE, 14" swing, 6' 6" bed, single back gear, quick change gears, compound rest; by LeBlond Machine Tool Co., Cincinnati, OH (section 54)	1913 Inventory no. 107; 1920 Appraisal no. 1-01; figure 105.	Use EDIS 237/E-1778 (original). Replace belts as needed.
ACCESSORIES for LeBlond engine lathe above: Steady Rest Following Rest Face Plate, 14" Carrier Plate Independent Chuck, 6" Independent Chuck, 12" Wrenches, 3 Spring chuck adapter, 1 Chuck Plate Countershaft (section 54)		Use E-1778-1 through E-1778-9 (originals).
DRILL PRESS, double spindle, 15" swing, 12" x 19" table; by Fox Machine Co. (section 54)	1913 Inventory no. 115; 1920 Appraisal no. 1-08; figures 104 and 105. Removed between 1920 and 1939. Space now occupied by lathe EDIS 238.	Acquire and install replacement. Leave LeBlond lathe in place for time being.
Surface GRINDER, 20" x 6" table, with Walker magnetic chuck; by Binesse Machine Tool Co., Newark, NJ (against east wall; section 54)	1913 Inventory no. 45; 1920 Appraisal no. 1-37; figure 109. Moved from first floor to second (section 62), to replace Brown & Sharpe no. 2 surface grinder, after 1942.	Return EDIS 249/ E-1806 to 1914 location.
Precision BENCH LATHE, 8" swing, 40" bed; by Rivett Lathe Mfg. Co., Boston, MA (on bench along north wall; section 54)	1913 Inventory no. 40; 1920 Appraisal no. 1-40. Removed between 1920 and 1939.	Replace with surplus 8" Rivett lathe and countershaft from second floor.

BENCH, 6' long, with one drawer, on two cast iron legs, fitted with gas jets, steel top, and soldering furnace (east wall; section 54)	Figure 109.	Use E-3412 (original).
CABINET (east wall; section 54)	Figure 109.	Use E-1804 (original).
BENCH, 12' long, with two drawers (east wall, under rheostat; section 54)	Figure 108.	Use E-1874 (original).
Power PRESS, model no. 54, serial no. 19-C; by Ferracute Machine Co. (section 52)	1920 Appraisal no. 1-16. Not visible in 1914 photos. A Ferracute press matching this description (E-867) was moved to second floor, section 66, between 1920 and 1939. See neg. no. 8050 (1939), not reproduced for this report. E-card notes that it was removed to Ediphone Division, 10/16/1939 IPO [inter-plant order?] 2749.	Acquire.
DRILL PRESS, 27" swing, single spindle; by B.F. Barnes Co., Rockford, IL (section 52)	1913 Inventory no. 116; 1920 Appraisal no. 1-17. Purchased from Niles Tool Co. Not visible in 1914 photos. Removed between 1920 and 1939.	Leave space vacant.
GRINDSTONE and FURNACE STONE, 24" x 6' (section 52)	Figure 103; 1920 Appraisal no. 1-22. Moved from section 51 to section 52 between 1914 and 1920. Removed between 1920 and 1939.	Acquire.
BENCH, with drawers and shelves, wood, top rimmed on three sides, 21" x 38" x 33" high (section 52)	May be bench shown in figure 109 between shaper and milling machine.	Use E-1935 (original).
Wood HORSE, pair (section 52)	Figure 108.	Use E-1932 (original).
ENGINE LATHE, 14" swing, 6' 9" bed, pan base, four-step cone; by Hamilton Tool Co., Hamilton, OH (section 51)	1920 Appraisal no. 1-02; figures 103 and 104.	Use EDIS 228/E-1777 (original). Replace belts as needed.

ACCESSORIES for Hamilton engine lathe above: Face Plate, 15" Carrier Plate Independent Chuck, 6" Independent Chuck, 15" Change Gears Countershaft Face Plate, special 14" Adapter, special Face Plate, special 9" (section 51)		Use E-1777-1 through E-1777-10 (originals).
ENGINE LATHE, 20" swing, 10' bed, single back-geared, change gear, compound rest, four step cone, pedestal and leg base; by Bridgeport Engine Co., Bridgeport, CT (section 51)	1913 Inventory no. 105; 1920 Appraisal no. 1-03; figure 103. Purchased from E.P. Bullard, May 18, 1887, voucher 138.	Use EDIS 227/E-1776 (original). Replace belts as needed.
ACCESSORIES for Bridgeport lathe above: Steady Rest Following Rest Tool Posts, 2, heavy duty Independent Chuck, 14" Independent Chuck, 18" Face Plate, 19" Countershaft Change Gears (section 51)		Use E-1776-1 through E-1776-10 (originals).
SPEED LATHE, 12" swing, 3 ft. 8 in. bed, (cut down from 5 ft. 2 in. bed), with chuck, face plate, hand rest, and special rest; by Lucius W. Pond (section 51)	1913 Inventory no. 109; 1920 Appraisal no. 1-09; barely visible in figures 104 and 105. Removed between 1920 and 1939. Space now occupied by Walcott & Wood 14" x 6' 6" engine lathe, EDIS 229/E-1784.	Leave Walcott & Wood engine lathe in place until suitable replacement for Pond speed lathe is found.
GRINDER, 2 stones, 12" dia x 2" face, double emery stand on wooden frame (section 51)	1920 Appraisal no. 1-10; figures 100, 103, and 104. Removed between 1920 and 1939.	Acquire.

SHAPER, 20" stroke, high-duty back-geared crank shaper; last patent in 1912; by Gould & Eberhardt, Newark, NJ (section 51)	See figures 103, 104, and 105; 1913 Inventory lists two 20" G&E shapers under entry no. 120 (other shaper listed above in section 50); 1920 Appraisal no. 1-12. Located one bay east in 1914; moved to present location between 1914 and 1920.	Return EDIS 230/E-1782 (original) to 1914 location. Replace belts as needed.
ACCESSORIES for 20" Gould & Eberhardt shaper above: Wrenches, 4 Countershaft (section 51)		Move with EDIS 230/E-1782. Use E-1782-1 and E-1782-2 (originals).
ENGINE LATHE, 30" swing blocked to 36", 12' bed, double back gear, change gears, compound rest, five step cone; by Putnam Machine Co., Fitchburg, MA (section 48)	1913 Inventory no. 104; 1920 Appraisal no. 1-04; figures 99, 100, 103, and 105. Purchased October 20, 1887 through Manning, Maxwell, & Moore, $850.00, voucher 725. Originally located on north side of shop. Moved to present location between 1890 and 1906.	Use EDIS 226/E-1775 (original). Belts are worn but do not need to be replaced immediately. Countershaft clutch needs to be serviced.
ACCESSORIES for Putnam engine lathe above: Face Plate, 30" Carrier Plate Steady Rest Following Rest Change Gears Four-jaw Chuck, 18" Countershaft (section 51)		Use E-1775-1 through E-1775-8 (originals).
STOOL (under Putnam engine lathe EDIS-226; section 51)	Partially visible in figures 99 and 104. Low, homemade wooden step stool (bench), used for access to large workpieces.	Use E-1963 (original).
ENGINE LATHE, 26" swing, 17' bed, double back geared, change gears, compound rest, pedestal base, five step cone; by Fifield Tool Co., Lowell, MA (section 48)	1913 Inventory no. 101; 1920 Appraisal no. 1-05; figures 100, 103, and 105. Purchased from Prentiss Tool & Supply Co., NY.	Use EDIS 215/E-1772 (original). Replace belts as needed.

TROLLEY and TRACK Louden (above Fifield engine lathe; sections 48-51)	Installed after April 1914. Replaced block and tackle shown in figure 105.	Leave E-1773 (trolley), track, and hoist in place.
CHAIN HOIST, Yale & Towne, 1-1/2 ton (section 48)	Installed with track and trolley after April 1914. Replaced block and tackle shown in figure 105.	Leave EDIS 643/E-1774 in place (suspended from trolley, E-1773).
ENGINE LATHE, 16" swing, 6' bed; by LeBlond Machine Tool Co., Cincinnati, OH (section 48)	1920 Appraisal no. 1-13; figures 102, 103, 104, and 105. Removed between 1920 and 1939. Replaced by Walcott lathe, NPS 217.	Use EDIS 217/E-1780 (16" Walcott lathe) as replacement. Differences between the two machines are minor.
ENGINE LATHE, 16" swing, 6' bed, double back gear, quick-change gears, compound rest; by Walcott Lathe Co., Jackson, MI (section 48)	Purchased from Peter A. Frasse & Co., NY. Installed between 1920 and 1939 in position of 16" LeBlond (NY Appraisal Co. no. 13)	Leave EDIS 217/E-1780 in place as replacement for 16 in. LeBlond. Replace belts as needed.
ACCESSORIES for 16" Walcott lathe E-1780: Steady Rest Face Plate, 16" Carrier Plate Independent Chuck, 8" Independent Chuck, 15" Countershaft Face Plate, special, 14" (section 48)		Use E-1780-1 through E-1780-7 (originals).
ENGINE LATHE, 20" swing, 7' bed, friction head, four-way tool post; by Fay & Scott (section 48)	1913 Inventory no. 102; 1920 Appraisal no. 1-14; figures 102, 103, 104, and 107. Purchased from Prentiss Tool & Supply Co. Removed between 1920 and 1939. Replaced by 21" LeBlond lathe (1920 Appraisal no. 1-42), moved from section 53.	Leave EDIS 216/E-1779 (21" LeBlond lathe) in place until suitable replacement for Fay & Scott is acquired. Replace belts as needed.
SHAPER, 12" stroke; by Medey Machine Co. (section 48)	Located in section 48 in 1914 (figure 104). Moved to section 49 between 1914 and 1920 (1920 Appraisal no. 1-25). Removed between 1920 and 1939.	Acquire and install at section 48.

BENCH, 75' long, with 22 drawers, eight vises, supported by 13 cast iron legs (south wall; sections 48, 51, 54)	Figures 99 and 103. Installed 1887.	Use EDIS 386/E-1770 (original).
FITTINGS on bench EDIS 386: Surface Plate Bench Vise, Parker 239 Surface Plate Bench Vise, Parker 239 Bench Vise, 4" jaws Bench Vise, Parker 29K Bench Vise, Athol 730 Surface Plate Surface Plate Surface Plate Surface Plate with cover Surface Plate Surface Plate Bench Vise, Parker 48 Surface Plate Bench Vise, Parker 23	Figure 103.	Use E-1848 through E-1854 (originals). Use E-1864 through E-1868 (originals). Use E-1870 through EDIS 54366/E-1872 (originals). Use E-1892 (original).
TOOL CHESTS (on bench EDIS 386)	Eight machinists tool chests are visible in figures 103 and 105. These chests and their contents belonged to individual machinists and traveled with them.	Acquire suitable replacements. See Appendix F for guidelines.
On shelf under bench EDIS 386: Face Plates, 2 Machine Tool Parts, extras Lathe Rests, extras, 4 of various sizes Lathe Carrier Plates, 9 of various sizes Chucks, 8, extras and misfits Chuck Back Plates 6, extras and misfits Flanged Vise, 4 in. jaws, one jaw missing	E-cards note that these were removed from the bench and placed in the basement, section 97-100-103, after 1940.	Return E-1966 through E-1969, and E-1971 and E-1972 to shelf under bench.

CHANGE GEARS, assorted extras (on bench EDIS 386; section 54)	Moved to basement, section 97-100-103, ca.1940.	Return E-1970 (original).
EXTENSION LADDER (section 48)	Figure 105.	Use E-1962 (original).
STOOLS, wood, 10 (at benches and scattered around shop)	Figure 103 shows four wooden stools along the bench on the south side of the shop. Figure 104 shows a swivel-top stool by the drill press. Figures 106, 107, and 109 show at least three on the north side of the shop.	Use E-1957, E-1958, E-1917, E-1918, E-1936, EDIS 26432/ E-1943 and EDIS collection. Steel stools, scattered throughout the shop, post-date 1914 and are not appropriate.
Double-Spindle DRILL PRESS, 14" swing, 30" x 12" guttered table, vertical spindle, slide heads, lever feed, floor mounted on pedestal; by Charles G. Allen Co., Barre, MA (section 45)	1920 Appraisal no. 1-06; figures 100, 103, and 105. Originally stood in section 45, next to cylindrical grinder. Moved to section 51 between 1920 and 1939.	Use EDIS 367/E-1785 (original). Return to 1914 location. Replace belts as needed.
COUNTERSHAFT, for Allen double-spindle drill press above (section 45)		Use E-1785-1 (original).
Universal Cylindrical GRINDER, 12" swing, 40" between centers, cylindrical (lathe type) surface grinder, belt driven throughout, includes coolant tank, pump, and piping; by Landis Tool Co., Waynesboro, PA (section 45)	1913 Inventory no. 125; 1920 Appraisal no. 1-07; figures 101 and 105. Installed between 1906 and 1914.	Use EDIS 210/E-1767 (original). Clean to remove abrasive dust and rancid lard oil. Do NOT operate.
ACCESSORIES for Landis universal grinder above: Countershaft Steadyrest adapted from Brown & Sharpe no. 1 Four-jaw Universal Chuck, 8" (section 45)		Use E-1767-1 through E-1767-4 (originals).

DRILL PRESS, 26" swing, single spindle, back geared, power feed; by Aurora Tool Works, Aurora, IN (section 45)	Figures 102 and 105; 1920 Appraisal no. 1-15. Probably installed between October 1913 and April 1914. Not listed on 1913 inventory. Removed between 1920 and 1939. Replaced by small radial drill (EDIS 212).	Acquire. Aurora drill presses are fairly common machines. Leave radial drill in place for time being.
RADIAL DRILL PRESS (section 48)	Moved to this location between 1920 and 1939. Sold by Newark S.H. Machinery Co. stamped "143 EPW" [Edison Phonograph Works?]	Leave EDIS 212/E-1768 in place until 26" Aurora can be acquired.
ACCESSORIES for radial drill press above: Vise Drill Press Countershaft (section 48)		Use E-1768-1 and E-1768-2 until radial drill (EDIS 212/E-1768) is removed.
Clothes CABINET (southwest corner, next to door; section 45)	Figure 103.	Use E-1751 (original).
PHOTOGRAPH, shows machine shop crew, pre-1915 (attached to cabinet E-1751 above; section 45)	Figure 103. "Men who worked on Giant Rolls for the Cement Plant at Stewartsville, NJ", key to individuals in folder E313, copy neg. no. 6048 A and B.	Reproduce.
DESK, tall, linoleum top (section 45)	Figures 101 and 105. Shop foreman's desk. Moved to storage in second floor machine shop after 1939.	Use E-1757 (original). Retrieve from second floor.
STOOL, wood, adjustable (at tall desk above; section 45)	Original stool (E-1961) broken and thrown out ca.1940.	Use EDIS collection.
PAPERS (in desk E-1757 above; section 45)	E-card note: "Papers, blue prints, & plans removed from desk, E-1757 and placed in E-160-20."	Use copies of E-1978.
RACK, four shelves, each with four dividers, forming 20 bins, 52" long x 19" deep x 36" high (south wall; section 45)	Installed in present location after windows were replaced in 1915.	Leave E-1763 in place.

MISCELLANEOUS TOOLS and FIXTURES, inventoried in 1939: Angle Plate Files, assorted sizes, miscellaneous cuts Screws and Bolts, misc. (sections 48, 44) Angle Plate (section 49) Surface Plate, slotted Surface Plate, rough (section 51) Tool Posts, 8 assorted Wrenches, assorted (sections 51, 44) Angle Plate, with "V" Angle Plate Angle Plate Angle Plate (section 52) Bench Vise, Prentiss 51-91 (section 54)		It is impossible to tell whether any of these fixtures post-date 1914, but they are all appropriate to a working machine shop of the period. Any that have not been collected and moved should be left in place. Use E-1973, E-1974, E-1976, and E-1993 through E-1995 (six angle plates); E-1986 (assorted files); E-1989 (misc. screws and bolts); E-1959 (slotted surface plate) and E-1980 (rough surface plate); E-1984 (assorted tool posts); E-1985 (assorted wrenches); E-1857 (Prentiss 51-91 bench vise)

Building 5, Rooms 10, 11, and 12

The 1910-1920 interpretive period coincides with major changes in the use and occupancy of the second floor of Building 5. While useful and detailed, Dyer and Martins' description of these spaces, written around 1909 and published in 1910, records the "end of an era" on the second floor.

The 1909 organization which Dyer and Martin describe places both John and Fred Ott on the second floor, quite possibly working in rooms 10 and 11. However, around 1911 Charles Luhr was placed in charge of all work carried out on the second floor of Building 5. By 1913 Luhr was made superintendent of the entire laboratory. It is likely that Luhr's office was on the second floor at this time, and the 1916 blueprint (figure 4) documents his occupancy of room 10. While John Ott retained his status with Edison, it is possible that Luhr replaced him in room 10 as early as 1911.

Meanwhile, Miller Reese Hutchison became Chief Engineer in 1912; Hutchison probably moved into room 11 by 1914, when Fred Ott moved upstairs. The 1916 floor plan (figure 4) confirms that Hutchison and Luhr occupied second floor offices by 1916. Charles Luhr became manager of the Edison Phonograph Works in 1917 and probably moved his office at that time. Only one photograph of these rooms, figure 115 showing John Ott at work at his drawing board, has been located.

Dyer and Martin clearly place Edison's work space in room 12 on the second floor. The description in their biography leaves no doubt as to the location of room 12: "The first in order as one leaves the head of the stairs leading up to [the second] floor...." Their description also provides evidence that the walls and floor in the room were bare and that furnishings consisted of "a few articles of cheap furniture."[645] Figure 113, an 1898 photograph of Edison that shows the northeast corner of the room, is the only historic photograph of room 12. Figure 114, which is not dated, may show the interior of Edison's small, private room within room 12.

It has been determined not to furnish rooms 10, 11 and 12 at this time. Rather, the uses of these important second floor rooms will be addressed through other interpretive media. The method of interpretation will be determined after further discussion. If future research uncovers additional information about the use of these spaces, the recommendation not to furnish can be reconsidered.

[645] Dyer, Martin, and Meadowcroft, *Edison: His Life and Inventions*, p. 649.

Building 5, Precision Machine Shop, Second Floor

The arrangement of machine tools in the north aisle of the second floor precision shop is largely unchanged from that shown in photographs taken ca.1890 and 1900, and in 1904, 1906, and 1914.[646] The south aisle is another matter. It was originally partitioned off into experimental rooms. Most of the walls came down sometime between 1906 and 1913 and the space was gradually filled with additional machine tools. By 1913, the core of shapers, engine lathes, and other medium-duty machines had been established at the center of the south aisle.[647] Assembly, and perhaps some experimental work, took place on an odd assortment of tables and free-standing benches in the southeastern corner.[648] One of the old experimental rooms, room 5, near the elevator, remained intact through 1916.[649]

Later plans and photographs suggest that the arrangement of machines and benches on the south side of the second floor shop remained fluid through the 1920s and 1930s. It may be argued that this fluidity was a lingering manifestation of the flexible layout for the entire laboratory complex that Edison envisioned in 1887.

This plan is designed to furnish the shop as it appeared in 1914-1915, but it makes an attempt to address both characteristics of the second floor shop--the fixedness of the north side and the changeable nature of the center and south aisles. The emphasis is on moving machines and acquiring replacements to furnish the north side as it appeared through the first two decades of this century. Furnishings on the south side are somewhat sparse, because our understanding of what happened there and when it happened is still comparatively vague.

The most noticeable proposed change is the reconstruction of the plank partitions that enclosed room 5. There is plenty of evidence for accurate work, including figures 124 and 126 (taken April 1914), figure 125 (January 1915), a 1916 floorplan (figure 4), cleats that once supported the partitions still attached to the ceiling, and examples of similar construction elsewhere on the second floor. By completely enclosing the 1918-20 tool crib and coat rack, a reconstructed room 5

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646 See figures 116, 117, 118, 119, 121, 123, 124, and 125.

647 "Edison Laboratory, Inventory taken October, 1913" in Edison NHS collection.

648 See figure 122.

649 Figure 129 shows the interior; the exterior appears in figures 124 and 125.

will camouflage modifications to the shop that occurred after the period of significance without removal of any structural fabric.[650]

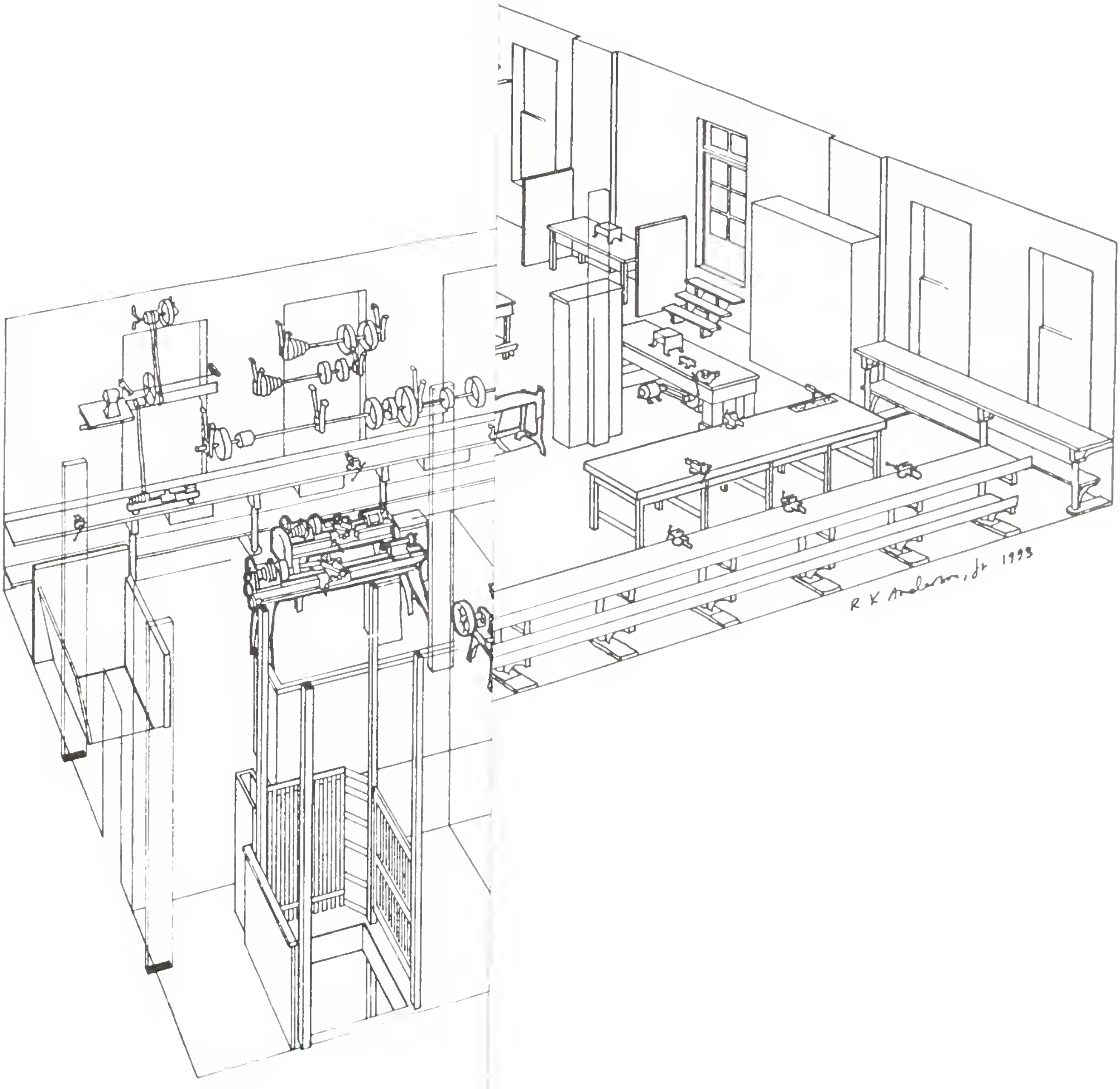
Several machines should be returned to their 1914 locations. Four precision bench lathes were removed from the bench along the north (courtyard) wall, along with their countershafts and foot-treadle controls, sometime between 1920 and 1939. They were set up on a free-standing bench in the southeastern corner of the shop. These lathes should be put back into place on the north bench; their original locations are easily traced through bolt holes and scars on the bench and wall. The later bench should be dismantled and removed. The squaring shear, filing machine, punch press, power hacksaw, one of the drill presses and a LeBlond engine lathe should be moved back to their 1914 positions.

Four machines, installed well after the interpretative period, should be removed in order to establish the historic scene. A large Lindgren drill press, installed in 1942, should be placed in storage. A shaper, surface grinder, and power hacksaw that were moved up from the heavy machine shop on the first floor during the 1920s or 1930s, should be returned to their 1914 locations downstairs.

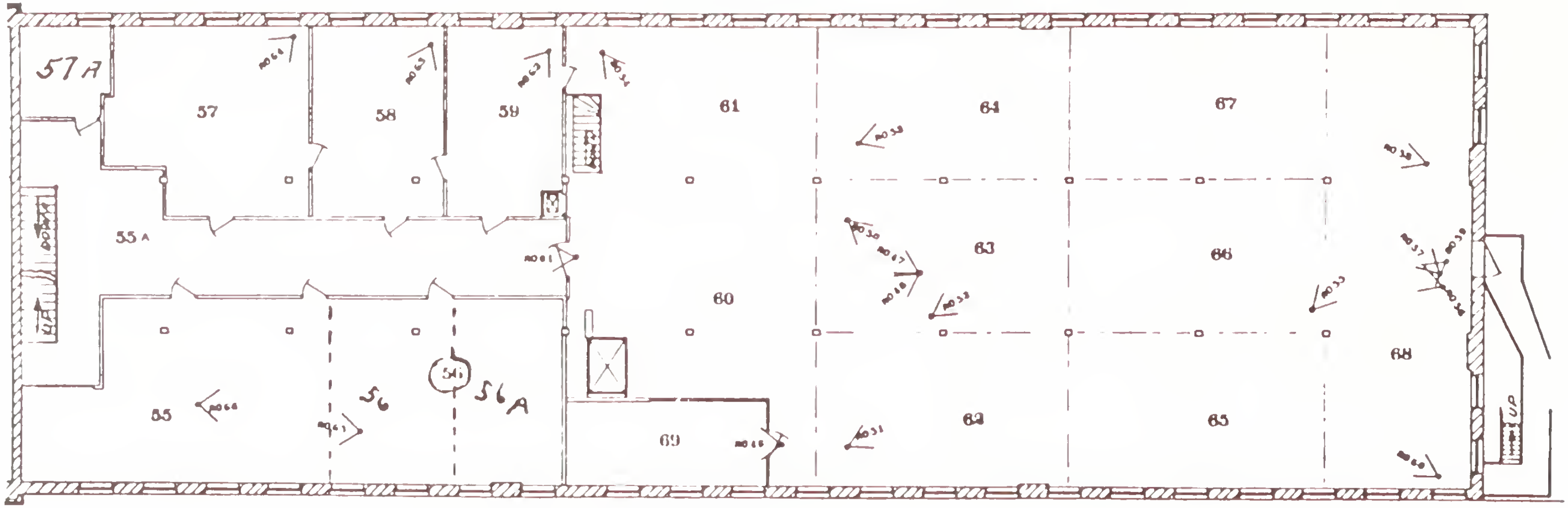
Eleven machines, recorded in 1914 photographs and the 1920 appraisal, disappeared by the time of the next inventory in 1939. They included two engine lathes, two drill presses, a milling machine, a table saw, a small rolling mill, and an engraving machine. Of these, the first emphasis should be placed on securing replacements for the engine lathes and milling machine; in part because they offer the best prospects for success, but more importantly because they will fill out and complete the furnishings of the north side of the shop.

As in the pattern shop, the first impediment to implementing this plan will be finding another home for National Park Service materials stored in the shop. These include racks of collections items such as diamond disks, trade catalogs, and drawings, miscellaneous semi-historical debris from Building 1, the photocopier, and audio-visual equipment.

[650] NB. We once seriously entertained the thought of proposing reconstruction of the partition that enclosed the entire row of experimental rooms on the south side of the shop. This offered the advantage of allowing us to ignore all the messy things that happened on that side of the room that we still don't understand. That proposal seems less realistic, now that we know that the walls were down and most of the machines were in place by October 1913.



N MACHINE SHOP



BLDG. Nº 5 SECOND FLOOR

Building 5, Precision Machine Shop, Second Floor

Object and Location	Evidence	Recommendation
LINESHAFT, 92' long, 1-15/16" diameter. Supported by thirteen 16" adjustable double-brace drop hangers with capillary oiling (section 61-68, ceiling, north side)	Figures 116, 120, 121, 123, and 124; 1920 Appraisal, pp. 21-23. Installed 1887.	Use EDIS 248/E-961 (original).
LINESHAFT, 72 ft. long, 1-15/16" diameter. Supported by ten 14" adjustable double-brace drop hangers with capillary oiling (section 60-68, south side)	Figure 122; 1920 Appraisal, pp. 21-23.	Use E-968 (original).
BENCH, 84' long, 27" wide; runs the entire length of the second floor shop on the courtyard [north] side, supported by 16 cast iron legs, 16 wood tool drawers (section 61-68, north wall)	Figure 116 and 121.	Use EDIS 684/E-933 (original).
FITTINGS on bench above: Bench Vise, Prentiss Bull Dog 52-92, Bench Vise, Parker Semi-Steel Solid Bar 239 Bench Vise, Parker 21X Bench Vise, Parker 22 Bench Vise, Prentiss Bulldog 52-92 Bench Vise, Parker 22X Bench Vise, Parker 22 Bench Vise, Parker 22 Bench Vise, Parker 203-3-1/2 Bench Vise, Parker 203 Bench Vise, Rock Island 4 Bench Vise, Parker 22 Angle Plate, iron, 4" x 6" x 6"	Figures 116 and 121. 1913 Inventory lists 22 vises in the second floor shop; 21 are in place today, including 12 on this bench.	Use E-1001 through E-1012 (various bench vises); use E-1998 (angle plate).

COUNTER, has two shelves, 20' long, 18" deep (section 61)	Figures 121 and 124.	Use E-942 (original).
STOOLS, 30, wood (under benches throughout the shop) [At least nine were listed as broken and thrown out in 1939. E-1861 was loaned to Plant Service 5/9/1944.]	Figures 116, 119, 121, 122, 123, and 124. At least 20 can be counted in the 1914 photographs.	Use E-1030 through E-1064 (originals).
Universal Cylindrical GRINDER, #1, 41" x 7" table, 10" swing, 24" work capacity, 10" diameter wheel; by Brown & Sharpe, Providence, RI. Last patent: 1903 (section 61)	Figure 121; 1913 Inventory no. 30; 1920 Appraisal no. 2-44.	Use EDIS 247/E-902 (original).
ENGINE LATHE, 12" swing, 5' bed, with taper attachment; by Prentiss Tool Supply (section 61)	Figures 121 and 124; 1913 Inventory no. 3; 1920 Appraisal no. 2-45. Removed between 1920 and 1939.	Acquire.
ENGINE LATHE, 16" swing, 8' bed; by Monarch Co. (section 61)	Figures 121 and 124; 1920 Appraisal no. 2-46. Removed between 1920-1939.	Acquire.
SURFACE PLATE, 48" x 24" x 4" (section 61, on desk, not original stand)	Figures 121 and 124; 1920 Appraisal no. 2-47.	Use E-938 (original plate); locate or reproduce stand.
Power PRESS, #10, open back inclinable fly-wheel press on cast iron stand; by Stiles & Parker, Middletown, CT (section 61)	Figures 121 and 124; 1913 Inventory no. 29; 1920 Appraisal no. 2-48. Moved from area behind counter (section 61) to tool crib (section 69) between 1920 and 1939.	Return EDIS 737/E-984 to 1914 location.
Power HACK-SAW, Star #90 (section 61)	Figure 124; 1920 Appraisal no. 2-49. Removed between 1920 and 1939.	Acquire.
Precision BENCH LATHE, no. 5-1/2; 7" swing, 34" bed; by Sloane & Chase Mfg. Co. Newark, NJ (section 61, on bench E-933)	Figures 121 and 124; 1920 Appraisal no. 2-50. One of five Sloane and Chase 7" bench lathes listed on 1913 inventory. Moved from bench E-933 (section 61) to present location between 1920-1939.	Return EDIS 730/E-994 to 1914 location on bench.

Precision BENCH LATHE, no. 5-1/2; 7" swing, 33" bed; by Sloane & Chase Mfg. Co. Newark, NJ (section 61, on bench E-933)	Figure 121; 1920 Appraisal no. 2-51. One of five Sloane and Chase 7 in. bench lathes listed on 1913 inventory. Moved from bench E-933 (section 61) to present location between 1920-1939.	Return EDIS 731/E-995 to 1914 location.
Precision BENCH LATHE, no. 5-1/2; 7" swing, 34" bed; by Sloane & Chase Mfg. Co. Newark, NJ (section 61, on bench E-933)	Figure 121; 1920 Appraisal no. 2-52. One of five Sloane and Chase 7 in. bench lathes listed on 1913 inventory. Moved from bench E-933 (section 61) to present location between 1920 and 1939.	Return EDIS 728/E-913 to 1914 location.
CABINET, wood, with four shelves, 18" x 20" x 34" (section 61)	Typical early twentieth century machine shop furnishing.	Use E-939.
CABINET, wood, with five drawers, 28" x 32" x 40" (section 61)	Typical early twentieth century machine shop furnishing.	Use E-940.
Precision BENCH LATHE, no. 5-1/2 O.S.; 7" swing, 34" bed; by Sloane & Chase Mfg. Co. Newark, NJ. Originally (1914-1920) mounted on small bench or table adjacent to column (section 64)	1920 Appraisal no. 2-12. Not visible at 1920 location in figure 122 (1914). Moved to present position between 1920 and 1939.	Use EDIS 729/E-914.
CUTTER GRINDER, no. 2, O.S.; by S.W. Putnam & Sons, Worcester, MA (section 64)	1913 Inventory no. 2; 1920 Appraisal no. 2-36. Purchased from Prentiss Tool & Supply Co. Removed between 1920 and 1939.	This may be the cutter grinder now located in the first floor stock room.
GRINDER, double emery grinder on iron base (sect. 64)	1920 Appraisal no. 2-37.	Use E-909 (original).
GRINDSTONE and FRAME, 24" x 4" stone (section 64)	Figures 120 and 123; 1920 Appraisal no. 2-38. Removed between 1920 and 1939.	Acquire.

ENGINE LATHE, 14" swing, 6' 6" bed, single back-geared, quick-change geared, on leg base; by R.K. LeBlond, Cincinnati, OH Accessories: Chuck, 12" Face Plates, 2 Steady Rest; (section 64)	Figures 120 and 123; 1913 Inventory no. 5; 1920 Appraisal no. 2-39. Moved from north aisle (section 64) to east end of south aisle (section 65) between 1920 and 1939.	Return EDIS 260/E-992 to 1914 location.
ENGINE LATHE, 12" swing, 5' bed, single back-geared, quick-change gears, on pan and leg base; by Hendey Machine Co., Torrington, CT (section 64)	Figure 121; 1913 Inventory no. 4; 1920 Appraisal no. 2-41.	Use EDIS 257/E-905 (original).
ENGINE LATHE, 14" swing, 6" bed, single back-geared, quick-change gears; by Hendey Machine Co., Torrington, CT (section 64)	Figure 121; 1920 Appraisal no. 2-42.	Use EDIS 256/E-904 (original).
Universal MILLING MACHINE, 39" x 8-3/8" table, quick-change gears on feed and spindle; by Brown & Sharpe, Providence, RI (section 64)	Figure 121; 1920 Appraisal no. 2-43.	Use EDIS 255/E-903 (original).
CABINET, wood, 5 ft. x 2 ft. x 3 ft. 4 in. (section 64)	Typical early twentieth century machine shop furnishing.	Use E-934.
CABINET, wood, with plank door, 24" x 13" x 60" (section 64)	Typical early twentieth century machine shop furnishing.	Use E-935.
ROLLING MILL, 5" face x 3" diameter; by Bement Miles & Co., Philadelphia, PA (section 63)	Figure 123; 1913 Inventory no. 27; 1920 Appraisal no. 2-16. Card for E-868 notes that it was removed to Ediphone Division, 12/19/38.	Acquire.

Burr TABLE SAW, circular saw for cutting metal; 12" diameter blade, 15" x 10" table (section 63)	Figure 123; 1920 Appraisal no. 2-18. Listed as #129 on the first floor in the 1913 Inventory. Moved from first floor to second between October 1913 and April 1914. Removed from second floor between 1920 and 1939.	Do not install; leave space vacant.
Double-spindle DRILL PRESS, 12" x 19" table; by Fox Machine Co. (section 63)	Figure 123; 1913 Inventory no. 18; 1920 Appraisal no. 2-19. Removed between 1920 and 1939.	Leave EDIS 723/E-2996 in place until more appropriate replacement can be acquired. See below for description of EDIS 723.
DRILL PRESS, 14" swing, single spindle, slide head, 11" square guttered table; by Charles G. Allen Co. Barre, MA (section 62)	Moved from Building 1 section 4, October 9, 1943. Stands in location occupied by Fox Machine Co. double spindle drill press in 1920.	Use EDIS 723/E-2296.
DRILL PRESS, 20" swing, single spindle, power feed; Silver Mfg. Co. (section 63)	Figure 122; 1920 Appraisal no. 2-20. Removed between 1920 and 1939.	Do not install; leave space vacant.
DC MOTOR, 15 HP at 800 RPM 230 volts, 56 amps; by Crocker- Wheeler Electric Co. (section 63)	Figures 121 and 124; 1920 Appraisal no. 2-27. Installed after first floor shop was electrified in 1910. Figure 124 shows another motor mounted on a suspended platform at the northwest corner of the shop. That one is belted to the north lineshaft; this one is not. [It is possible that a change-over was taking place in April 1914.]	Use EDIS 234/E-900 (original).
Universal MILLING MACHINE, 45" x 10" table, all power feeds; by Hendey-Norton, Torrington, CT (section 67)	Figures 116 and 119. 1920 Appraisal no. 2-32.	Use EDIS 264/E-912 (original).

GAP-BED LATHE, 16" and 32" swing, 6' bed, double pedestal base, back-geared with change gears; by Pratt & Whitney, Hartford, CT Accessories: Chuck, 15" Chuck, 36" Face plates (section 67)	Figure 119. 1913 Inventory no. 8; 1920 Appraisal no. 2-33.	Use EDIS 263/E-911 (original).
Universal MILLING MACHINE, no. 3, belt feed; by Brown & Sharpe, Hartford, CT (section 67)	Figure 119; 1920 Appraisal no. 2-34. Removed between 1920 and 1939.	Acquire.
SPEED LATHE, on leg base, 4' bed, plain tailstock, plain tool rest, with chuck and polishing disk; by Hendey Machine Co. Torrington, CT (section 67)	Figure 120; 1913 Inventory no. 10; 1920 Appraisal no. 2-35. Used for buffing.	Use EDIS 262/E-910 (original).
ENGINE LATHE, 14" swing, 6' bed, single back-geared, quick-change gear, on pan and leg base; by Hendey Machine Co., Torrington, CT (section 67)	Figure 121; 1913 Inventory no. 7; 1920 Appraisal no. 2-40.	Use EDIS 261/E-908 (original).
CABINET, wood, 48" x 18" x 40", with tool rack (on west end, section 67)	Figures 120 and 123.	Use E-929 (original).
GAS FURNACE, for soldering copper (section 68)	1920 Appraisal no. 2-10.	Use existing furnace on bench E-941.
GAS BLOWER, high pressure, mounted on bracket attached to column; by American Gas Furnace Co. (section 68)	Figure 119; 1920 Appraisal no. 2-24. Similar blower, mounted on a skid with an electric motor, is on the first floor, section 52. This unit may have been moved between 1920 and 1939.	Use blower from first floor.

PLANER, metal, 42" stroke, 16" wide table, 16" throat; by Bridgeport Engine Co. Bridgeport, CT (section 68)	Figures 116 and 119; 1913 Inventory no. 32; 1920 Appraisal no. 2-28. Purchased from E.P. Bullard, February 1, 1888, voucher 233.	Use EDIS 266/E-916 (original).
MILLING MACHINE, horizontal plain; by Brown & Sharpe, Providence, RI (section 68)	Figures 116 and 119; 1920 Appraisal no. 2-29.	Use EDIS 265/E-915 (original).
Precision BENCH LATHE, no. 5-1/, 7" swing, 34" bed; by Sloane & Chase Mfg. Co. Newark, NJ (section 68)	1920 Appraisal no. 2-53. One of five Sloane and Chase 7 in. bench lathes listed on 1913 inventory. Moved from bench on north wall of section 68 between 1920 and 1939.	Return EDIS 733/E-996 to 1914 location.
COUNTERSHAFTS, for bench lathes, attached to riser on bench E-944 (section 68)	Figures 116 and 121 show countershafts in their original locations. Removed from north wall and installed on bench built between 1920 and 1939.	Dismantle bench and return countershafts to original locations along north wall.
Tinsmiths' BENCH, 30" wide x 9' long (section 66-68) Beading machine (E-922), slip rolls (E-921), and Pexto circle cutter (E-920) are attached.	Figures 120 and 123.	Move E-925 to southeast corner of shop.
BEADING MACHINE, by Peck, Stowe, & Wilcox, Southington, CT (section 66, on bench E-925)	Figure 119; 1920 Appraisal no. 2-01.	Use E-922 (original).
ROLL FORMING MACHINE, Tinsmith's hand roller, with three 30" long x 2" diameter rollers; by Niagara Machine & Tool Works, Buffalo, NY (section 66, on bench E-925)	Figure 119; 1920 Appraisal no. 2-02.	Use EDIS 692/E-921 (original).
Miscellaneous MACHINES and small MOTORS, 3, on bench (section 68)	1920 Appraisal no. 2-23 indicates the cluttered nature of experimental activity.	Select suitable specimens from basement of Building 5.

Tinsmiths' BENCH, 3' x 8-1/2' x 31" high, has sheet iron top (section 68)	Figure 123. Located on opposite (south) side of center aisle in 1914.	Use E-941 (original).
BENCH VISE, Parker 272 Tinsmiths' and BENCH ANVIL (section 68, attached to tinsmith's bench above, E-941)	Typical early twentieth century machine shop furnishing.	Use E-1022 (original bench vise) and E-1023 (bench anvil).
BLOWER, no. 1, noiseless; by B.F. Sturdevant Co., Boston, MA (section 68, under bench E-941)	Typical early twentieth century machine shop furnishing. Provides blast air for furnaces on bench E-941.	Use EDIS 698/E-999 (original)
BENCH, oak plank top on wood frame, 16' long x 30" deep x 36" high (section 65-68)	Typical early twentieth century machine shop furnishing. Similar in design and construction to other early benches.	Use E-945.
FITTINGS on bench above, E-945: Bench Vise, Parker 203 Bench Vise, Prentiss 10 Bending Horn, iron, 24" long	These are two of the 22 vises listed on 1913 Inventory.	Use E-1013 (Parker #203 bench vise), E-1014 (Prentiss #10 bench vise), and E-1997 (bending horn).
BENCH, supported by 15 cast iron legs, 12 wood drawers, 64' long x 30" wide x 36" high (section 62-68, along south wall)	May have been installed after experimental rooms were dismantled, although the legs are the same design as those of benches installed in 1887.	Use E-955 (original).
FITTINGS on bench E-955: Bench Vises, 3, Parker 22 Bench Vise, Parker 22X Bench Vises, 3, Parker 203 Surface Plate, 14.5" x 15"	These are seven of the 22 vises listed on 1913 Inventory. There were small surface plates on benches throughout the shop; see figure 121.	Use E-1000, E-1016, E-1017, E-1018, E-1019, E-1020/EDIS 26404, and E-1021 (bench vises); use E-1862 (surface plate).
BENCH, 13-1/2' long x 2' deep x 3' high (section 68, southeast corner)	Typical early twentieth century machine shop furnishing.	Use E-943.
BENCH, wood, 7' long x 30" deep x 36" high (section 68)	Typical early twentieth century machine shop furnishing.	Use E-946.
BENCH, galvanized sheet iron top, 5' long x 2' deep x 32" high (section 68)	Typical early twentieth century machine shop furnishing.	Use E-936.

SCREW ARBOR PRESS, 11" diameter table, 24-3/4" throat; by W.F. & John Barnes, Rockford, IL (section 66)	Figure 123; 1920 Appraisal no. 2-13.	Use EDIS 691/E-989 (original).
DRILL PRESS, 10" swing, single spindle, fixed head, 13" x 9 1/2" table; by Sigourney Tool Co. Hartford, CT (section 66)	Figures 121 and 122; 1920 Appraisal no. 2-14.	Use EDIS 732/E-987 (original).
Double-spindle DRILL PRESS, by Charles G. Allen, Barre, MA (section 66)	Figure 122; 1920 Appraisal no. 2-15. Card for E-870 notes that it was removed to Storage Battery Works, fourth floor plating room, October 23, 1939, IPO [inter-plant order?] 1814.	Acquire.
Tinsmiths' BENCH, 42" x 20' (section 66)	Figure 119.	Use E-926 (original).
HAND-BEADING MACHINE, by Peck, Stowe, & Wilcox, Southington, CT (section 66, on bench E-926)	Figure 119. Moved to first floor by May 8, 1956.	Retrieve E-923 (original) from first floor shop.
ARBOR PRESS, Greenerd no. 3 (section 66, on bench E-926)	Figure 123; 1913 Inventory no. 47; 1920 Appraisal no. 2-25. Moved to section 64 between 1920 and 1939.	Use E-906 (original).
BENCH, 3' x 5' (section 66)	Figure 119.	Use EDIS collection or acquire.
DRILL PRESS, 10" swing, slide head, 10" x 10-3/4" table, circular base (section 66)	May be 1913 Inventory no. 16; figures 116 and 119; 1920 Appraisal no. 2-31. Moved a few feet southwest between 1920 and 1939.	Use EDIS 724/E-988 (original).
SURFACE PLATE, ex. cement house mold, 2' x 4' x 4' (section 66)		Use E-949.
CABINET, wood, with one four panel door, 42" x 20" x 84" (section 66, against column)	Figures 119 and 123.	Use E-927 (original).

SINK (section 66)	Figure 123.	Acquire.
CABINET, wood, 36" x 15" x 30" high, with one shelf (section 66)	Typical early twentieth century machine shop furnishing.	Use E-950.
CABINET, wood, 21" x 7" x 36" (section 66)	Typical early twentieth century machine shop furnishing.	Use E-951.
CABINET, wood, 20" x 14" x 32" high (section 66)	Typical early twentieth century machine shop furnishing.	Use E-952.
ENGINE LATHE, 10" swing, 5' bed, single back-geared, change gear, with leg base, rise and fall rest; by Pratt & Whitney, Hartford, CT (section 65)	1920 Appraisal no. 2-03. Not clearly visible in 1914 photos, may have been installed between April 1914 and March 1920.	Use EDIS 259/E-991.

Building 5, Drafting Room

Two photographs, figures 130 and 131, depict the drafting room in 1914 and 1915. Dyer and Martin also mention a "draughting room," along with the experimental rooms on the second floor of Building 5. Early in the 1910-1920 period of interpretation this room became the site of a new engineering and experimental department which seems to have had responsibilities similar to those of the drafting department. Essentially, the work taking place in this room included designing and measuring new parts and products and distributing blueprints and specifications to the appropriate production departments at the Phonograph Works.[651]

In 1910 there were nine draftsmen on the payroll, and the plan reflects this by recommending the room be furnished with nine drafting tables in addition to a supervisor's desk. The tables are furnished with typical drafting supplies such as scales, blue prints, T-squares, triangles and dusting brushes.

When this room is open to the public, visitors will enter the drafting room through the center doorway, and exit through the westernmost doorway in the north wall. A waist-high barrier bordering the doorway area will be installed. The water cooler should be placed far enough from the barrier area so that it will not be touched by visitors.

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[651] C. Wilson memo, June 24, 1910 (in DF 1910, Phonograph).

CABINET, wood, with one four panel door, 42" x 20" x 84" (section 66, against column)	Figures 119 and 123.	Use E-927 (original).
SINK (section 66)	Figure 123.	Acquire.
CABINET, wood, 36" x 15" x 30" high, with one shelf (section 66)	Typical early twentieth century machine shop furnishing.	Use E-950.
CABINET, wood, 21" x 7" x 36" (section 66)	Typical early twentieth century machine shop furnishing.	Use E-951.
CABINET, wood, 20" x 14" x 32" high (section 66)	Typical early twentieth century machine shop furnishing.	Use E-952.
ENGINE LATHE, 10" swing, 5' bed, single back-geared, change gear, with leg base, rise and fall rest; by Pratt & Whitney, Hartford, CT (section 65)	1920 Appraisal no. 2-03. Not clearly visible in 1914 photos, may have been installed between April 1914 and March 1920.	Use EDIS 259/E-991.

Building 5, Drafting Room

Object and Location	Evidence	Recommendation
SHELVES (east wall)	Figure 130.	EDIS collection or reproduce.
BOOKS and FILING BOXES (in shelves)	Figure 130.	EDIS collection or reproduce.
NOTICES (pinned to east wall beneath shelf)	Figure 130.	Reproduce.
FILING CABINET (perpendicular to north wall of alcove)	Figure 130.	EDIS collection.
FILING CABINETS, 6, wood (against east wall of alcove)	Figure 130.	EDIS collection or acquire.
STATEMENT DISTRIBUTORS, for filing (three rows of shelving installed above five of the filing cabinets above)	Figure 130.	EDIS collection or acquire.
FILING BOXES (stacked in two rows on top of statement distributors)	Figure 130.	EDIS collection or acquire.
ROLLED DOCUMENTS, 20 (stacked on top of filing cabinet in southeast corner)	Figure 130.	Reproduce.
HAT, man's, fedora style in winter/straw boater in summer (on top of documents)	Figure 130.	Acquire or reproduce.
ROLLER SHADES, 8, cream or buff (in windows)	Figures 130 and 131.	Reproduce.
DRAFTING TABLES, 9 (perpendicular to south wall)	Figures 130 and 131.	Use EDIS 2661 and EDIS collection or acquire eight others.
LAMPS, 9, metal cone-shaped shades, on metal supports (attached to tables)	Figures 130 and 131.	Acquire or reproduce.

MISCELLANEOUS: a variety of the following items are found on each of the nine drafting tables: Colunna Tracing Paper; Columbia Paper; Art Gum Erasers; Thumbtacks, stamped steel; Pencils, 4H and 3H; Memo Notebook; Black Ink; Blue Pencils; Blueprints; Triangle; T-square; Rolled Plans; Erasers; Books; Dusting Brush	See voucher 32, August 1910 for tracing paper, Columbia paper, art gum erasers, thumbtacks, and Koh-I-nor brand pencils. See voucher 1, June 1910 for Acme brand notebook. See voucher 53, December 1910 for Higgins brand black ink. See voucher 57, January 1911 for blue pencils. See figure 130 for blueprints, triangle, T-square, rolled plans, books, and dusting brush. See figure 131 for blueprints. See voucher 317, 1890 for Velvet brand erasers.	Reproduce blueprints and rolled plans; EDIS collection books; acquire remaining items.
DRAFTING STOOLS, 9 (one at each table)	Figures 130 and 131.	EDIS collection or acquire.
NOTICES and ca.1914 CALENDAR (pinned to south wall and to inside of various window frames)	Figure 130.	Reproduce or acquire.
Framed PICTURES, 2 (on south wall)	Figures 131.	EDIS collection or reproduce.
DUSTING BRUSH (hanging inside window frame)	Figure 130.	Acquire.
TRIANGLE (hanging on wall next to window)	Figure 130.	Acquire.
SHELVES, 3 (bracketed to south wall between windows)	Figures 130 and 131.	Reproduce.
DESK TRAYS, ROLLED PLANS, Shannon FILE (on shelves)	Figure 130.	Acquire and reproduce.
FAN (on one shelf in summer)	Common early twentieth century office equipment.	Acquire or reproduce.

SHELVES (attached to west wall of alcove)	Figure 131.	Reproduce.
BOOKS, JOURNALS (on shelves)	Figure 131.	EDIS collection or acquire.
MAP CASES, for storing large plans (beneath shelves, against west wall of alcove)	Figure 131.	EDIS collection or acquire.
HAT, fedora style in winter/straw boater in summer, and JACKET (hanging on west wall)	Figure 131.	Reproduce.
CALENDAR and NOTICE (hanging on west wall)	Figure 131.	Reproduce.
WORK TABLE (perpendicular to north wall, between two columns)	Figure 131.	EDIS collection or acquire.
PLANS (on work table)	Figure 131.	Reproduce.
WATER COOLER (north wall)	Figure 131.	Acquire.
NOTICES (hanging on north wall)	Figure 130.	Reproduce.
Columbia PAPER, 50-foot roll (on north wall)	Figure 130; Voucher 32, August 1910.	Acquire paper and roll.
CLOCK (on column, facing center of room)	Figure 130.	Acquire.
CALENDAR and NOTICE (on column, facing center of room)	Figure 130.	Reproduce.
DESK, with sliding shelf over drawers (facing drafting tables)	Figure 131.	EDIS collection or acquire.
DESK BASKET, wire (on desk)	Figure 131.	EDIS collection or acquire.
PLANS (on desk)	Figure 131.	Reproduce.
CATALOG or DIRECTORY (on desk)	Figure 131.	Acquire.
TELEPHONE, candlestick style (on top of catalog, on desk)	Figure 131.	Acquire.

CLIPBOARD (on desk)	Common twentieth century office supply; may be used in figure 131.	Acquire.
PAPER FASTENER (on desk)	Common early twentieth century office supply	Acquire.
Double INKWELL (on desk)	Voucher 428, 1890.	Acquire.
FOUNTAIN PENS, 2 (on desk)	Common early twentieth century office supply	Acquire.
PENCILS, 6, Eagle brand (on desk)	Voucher 428, 1890.	Acquire.
OFFICE CHAIR, wood, with arms, swivel style (at desk)	Figure 131.	EDIS collection or acquire.
WASTEBASKET, wire (beside desk)	Common early twentieth century office supply	Acquire.
SPITTOON (near desk)	Figure 130.	Acquire.
SHELVES (on north wall, east of visitor area)	Figure 130.	EDIS collection or acquire.
BOOKS, FILES, PLANS (stored on shelves)	Figure 130.	EDIS collection or acquire.
OUTLETS, 8 (hanging from cords, over drafting tables)	Figure 130.	Reinstall.
LIGHT FIXTURES, 6, metal shades, dark exterior, light interior, each with single, large globe	Figures 130 and 131.	Reproduce.