THE INFLUENCE OF WILLIAM LE BARON JENNEY
ON THE DEVELOPMENT OF THE SKYSCRAPER

by

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I. INTRODUCTION

Only in recent years has the significance of the "Chicago School" of modern architecture been recognized, and even today, although there have been some attempts to cover this period in its entirety (Thomas Tallmadge's Architecture in Old Chicago; Frank Randall's History of Chicago Buildings; and Carl Condit's The Rise of the Skyscraper), there is no comprehensive architectural source book of these years. Specific and individual phases have, of course, been delineated from time to time. Of the leading architects of the "Chicago School", only one, Louis Sullivan, has been the subject of a thorough-going biography; it was written by Hugh Morrison. (Sullivan himself was one of the first architects to gain recognition for his creative and prophetic writing.)

This thesis primarily concerns one of Chicago's post-fire architects--William LeBaron Jenney; it will attempt to correlate the series of incidents and discoveries in Chicago which led to the development of the skyscraper, with events of the same nature throughout the world, and with the particular contributions of William LeBaron Jenney.

The terms "skyscraper" and "skeleton construction" are used interchangeably to refer to a system of construction in which a metal frame (composed of girders, beams, and columns) supports both internal and external loads, transmitting the loads directly to the foundations.

II. METHOD OF PROCEDURE

Research for this thesis was begun in September, 1951, at which time the writer was appointed to the staff of the Department of Architecture at the University of Illinois as Research Associate, and assigned as Executive Associate to the Burnham Library-University of Illinois Architectural Microfilming Project at the Art Institute of Chicago.

During the academic year 1951-52, various architectural documents (including working drawings, renderings, specifications, photographs, writings, and related papers) were collected from most of the long-established architectural offices in Chicago and recorded on microfilm. Because of the scope of the project, and because of the large number of drawings in danger of imminent loss or destruction, research was directed solely to the selection and recording of this material.

In October and November, 1951, the writer had the privilege of selecting for microfilming, from available drawings, the typical and the outstanding works of William LeBaron Jenney. The complete files of Jenney's successors, the architectural firm of Mundie, Jensen, and McClurg, were placed at his disposal.

Until the fall of 1953, the vast amount of collected material had remained practically undisturbed in the files of the Burnham Library of Architecture at the Art Institute, and of the Ricker Library of Architecture at the University of Illinois. Some of the material had been used for papers, articles, and lectures, but no exhaustive research had been undertaken.

Since that time, the Burnham Library has had positive films made from the Jenney material for the writer; these films have been the basis of research for this thesis. Reading or reviewing important works on related phases of the "Chicago School" has necessarily played a considerable role in the preparation of the material.

III. EARLY CHICAGO, AND CONCURRENT ARCHITECTURAL TRENDS

In this study of skeleton construction, it has been necessary to evaluate not only the settlement and expansion of Chicago, which is the setting of its invention, but structural and technical discoveries both in the United States and in Europe, and the evolution of iron and clay as building materials. The Great Fire of 1871 formed a natural division between the old and new in Chicago architecture because of the obvious need to replace buildings in the reconstruction of the city.

A. Pre-Fire Chicago and Transitional Developments

Although the early settlers of the Middle West could not have been called a band of chosen men (for they were men of almost every station and nationality), the land itself might well have been thought of as a promised land. To the rich earth, severed by rivers and punctuated by a chain of lakes, belonged unimaginable potential wealth in oil, coal, and iron, plus the immediate natural means of distributing these resources. From this fertility and abundance men brought forth a new culture, tentative but curiously virile, which was to penetrate this new country and culminate in its new cities.

Chicago's incomprehensible growth was in large measure dependent upon its strategic location: between iron mines to the northwest, and coal mines and oil to the south and southwest; between the St. Lawrence Waterway to the east, and the Mississippi Waterway to the west and south, leading to the great ports of the new nation. The limitless bounty of the surrounding plains poured into Chicago, the focal point of the territory.

Although endowed with these elements of greatness, Chicago struggled to life at the swampy mouth of a recalcitrant stream, which trusted to the rain and the level of Lake Michigan to determine the direction of its flow. From this river, given the Indian title of "She-kag-ong" (place of the wild onions), Chicago took its name.[1]

This area was first visited by Joliet and Marquette in 1673, and later by LaSalle and others. Meanwhile a trapping post was developed here, along an existing portage route of some importance, used by the French in their passage to lower Illinois country. In 1779, when the first cast-iron structure was built (the 100 foot bridge across the Severn River at Coalbrookdale, England), Jean Point du Saible, a negro, became the first settler on the lower western rim of Lake Michigan. Here at the mouth of the Chicago River, he

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[1] Encyclopaedia britannica. 17th ed. Chicago, Published by the University of Chicago. 1949. Vol. 5, p. 454.

built a crude structure of logs, purchased twenty-five years later by John Kinzie, who thus became the first permanent white settler of Chicago. The same year, the log-constructed Fort Dearborn was built nearby by Captain John Whistler of the United States Army.[1]

Within the next thirty years, William Strutt designed the first iron-framed fireproof mill at Derby, England. This was a period in which the chaste elegance found in the architecture of Robert Adam was disappearing, in favor of what Nicholaus Pevsner called the "fancy-dress ball of architecture". Recent archaeological discoveries were leading to an unprecedented "Battle of Styles", as Greek, Italian Renaissance, English Perpendicular, Jacobean, Egyptian and even Moorish items were juxtaposed within a single city block. England was living through an era influenced not only by historic eclecticism, but also by the new products of the industrial revolution. As Thomas Telford was leading the way towards large-scale structural operations by erecting a chain suspension bridge over the Menai Straits, Augustus Welby Pugin successfully re-introduced a combination of twelfth-century French Gothicism and Christianity into England.[2] A new interest in city planning was evinced by

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[1]Federal Writers Project. Illinois, a descriptive and historical guide. Chicago, A. C. McClurg & Co. 1939. p. 193.

[2]Pevsner, Nicholaus V. An outline of European architecture. 2nd rev. ed. London, William Clowes & Sons, Ltd. 1951. pp. 248-251.

the model community, built by Robert Owen in conjunction with the spinning mills of New Lanark.

In this interim, the garrison and settlers near Fort Dearborn were attacked and overpowered during the Indian War of Tecumseh in 1812. The fort was burned and rebuilt. In 1830 the area was surveyed, and the Sauganash Hotel became the first frame building in the village. In 1833, Chicago was a town of about 200 inhabitants, its total area was seven-eighths of a square mile.[1] During this year, the first newspaper (Chicago Democrat) was published, and plans were made for three churches and another new hotel. In 1837 the city was incorporated, and its future was assured when the Federal Government improved the harbor and established a land office; lake trade increased, and a stage coach ran regularly between Chicago and Galena.[2] The influence of the vigorous Greek-Revival architecture of William Strickland had reached as far west as Springfield, in the Illinois Capitol Building, and was being felt in Chicago. By 1840, Chicago had grown to a city of approximately 5,000 inhabitants.

In Paris in 1843, Henri LaBrouste daringly supported lofty tile vaults over the reading room of his Bibliotheque

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[1]Industrial Chicago, the building interests of Chicago. Chicago, The Goodspeed Publishing Company. 1891. p. 23.

[2]Chicago, pictorial--historical. Chicago, Rand McNally & Co. 1902. pp. 22-24.

Ste. Genevieve in Paris upon slender iron arches and columns. Interior partitions were minimized by the use of iron for all structural members except the thick outer walls, which were of masonry. Before this library had been completed, one Hector Horeau was submitting courageous plans for a glass-and-iron frame to cover a projected market place in Paris. These proposals for the "Grandes Halles" were rejected because of impracticability, for his ideas had progressed beyond mathematical theory.[1]

At this time in England, under Queen Victoria, Joseph Paxton built the marvel of the century--the cast-iron-and-glass Crystal Palace for the Exhibition of 1851. New materials were being used with foresightedness as the potentialities of iron became evident. This same thinking carried across the ocean to New York where James Bogardus, after using cast iron for building facades, submitted an idea for a prefabricated cast-iron-and-glass arena for the World's Fair of 1853. His plan was rejected in favor of an absurd imitation of the Crystal Palace in London. The most significant outgrowth of this fair has been the passenger elevator![2]

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[1]Giedion, Sigfried. Space, time and architecture. Cambridge, The Harvard University Press. 1947. pp. 153-167.

[2]Fitch, James M. American building. Boston, Houghton Mifflin Company. 1948. pp. 80-88.

When their publishing house burned down in New York the same year, the Harper Brothers (to protect themselves against a similar disaster in the future), insisted upon complete fireproofing for their new building, in which the first wrought-iron beams ever rolled in this country were to replace wood as a structural material. Brick floor arches, a Bogardus iron front, and interior fire walls were used to make the building incombustible.[1]

Meanwhile, as the inhabitants of Chicago increased to nearly 30,000, there was evidence of architectural promise in the "balloon framing" used by George Washington Snow. To save building materials, Snow set "two-by-fours" on end for the entire height of a frame building, and supported intermediate floor joists on a thin "one-by-six" set into the sides of the studs. Before the advent of the railroads (the Galena and Chicago Union, 1848, and the Illinois Central, 1855),[2] materials were scarce and expensive. Wood was not readily available, and brick was used only for heavy walls and fireplaces. Snow's invention catalyzed building activities, which were increasing in proportion to population trends.

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[1]Bannister, Turpin C. Architectural development of the northeastern states. Architectural Record. Vol. 51, No. 6. June, 1941. p. 73.

[2]Chicago, Pictorial--historical. Chicago, Rand McNally & Co. 1902. pp. 24-26.

As buildings multiplied, the problem of drainage and sewer control became critical. Following the appointment of a board of sewage commissioners, and the establishment of a positive plane from which grades were to be measured, street levels were raised as the entire city was lifted out of the marsh between 1855 and 1857.[1] The use of cast-iron fronts, which had already been established in New York, Philadelphia, and St. Louis, was being adopted in Chicago about this time. As the population reached 100,000, the city expanded to cover an area of almost eighteen square miles.

These same years in Europe produced similar significant progress, leading to the ultimate development of the sky-scraper. In England, Henry Bessemer invented the converter which produced a superior grade of wrought iron, called "steel". In the United States, beginning in 1856, Thomas Ustick Walter covered the Capitol in Washington with a carefully calculated, cast-iron dome. The first public elevator of Elisha Graves Otis was manufactured and installed in a New York department store in 1857.[2] Two years later the next passenger elevator was used in a new Fifth Avenue hotel; the cab was set on a screw shaft, and was propelled upward by a steam engine revolving the shaft. The descent was checked hydraulically.

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[1] Randall, Frank A. History of Chicago building. Urbana, The University of Illinois Press. 1949. p. 4.

[2] Giedion, op. cit., p. 144.

In 1862 in Germany, Siemens invented the open-hearth process for producing steel; this was not introduced into the United States until 1873, when Andrew Carnegie rolled his first steel rails.[1]

In 1865 (when the Italian Gothicism of John Ruskin was replacing the French Gothicism of Pugin, and William Morris' Red House marked the introduction of the Arts and Crafts Movement in England), Napoleon III and Baron Haussmann were transforming Paris with broad green-belted boulevards lined with buildings of the Second Empire Style. In the same city, the architect-engineer Prefontaine designed an important transitional building for the St. Ouen Railroad and Docks Company.[2] This new structure, called the St. Ouen Docks, was built to connect a group of railroads with the navigable channels of the Seine. Prefontaine used an iron framework within walls of brick and cast-iron-and-brick, to support a series of superimposed columns, which were united by cast-iron arches and iron window frames. He used wrought-iron girders to support brick arches, which in turn supported an asphalt floor, thus producing one of the most modern buildings in Europe.

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[1]Included in a chronological list prepared by Philip Johnson for an exhibit at the Museum of Modern Art. New York. 1933.

[2]Newton, Robert H. New evidence on the evolution of the skyscraper. The Art Quarterly. Vol. 4, No. 1. Winter, 1941. pp. 57-70.

Seven years later, John Roebling opened the eyes of the world to the new possibilities of using tensile (instead of compressive) stresses, by supporting the Brooklyn Bridge on tension cables. Balthaser Kreischer, a New York manufacturer of fire bricks, had found the solution to the problems of dead weight and fire protection when he patented his flat hollow tile arch in 1871.

The influence of Ruskin's Seven Lamps of Architecture, of Charles Garnier's Paris Opera, and of the research of Viollet-le-Duc soon reached the eastern seaboard of the United States; there it affected the ideas of such eclectic designers as Robert Ware, Richard Morris Hunt, and James Renwick, and then this influence found its way to Chicago.

The buildings in Chicago during this era resulted from a combination of all earlier influences, plus the need for expediency. The result was confusion. Cast-iron fronts were further popularized by John Mills Van Osdel, Chicago's first architect, whose buildings were usually not over four or five stories in height. Heights increased to six or seven stories after the advent of the elevator, but this process was slow.

By 1870, Chicago was almost as large as Des Moines is today, and was growing steadily. Only traces of the Greek Revival remained in new buildings. Dubious structural progress was being forced upon the city by newly-created capitalism. Utility, speed of construction, and a large investment return were fundamental architectural considerations. Minor efforts were made to fireproof the buildings, but were not sufficient to resist the impending conflagration.

B. The Great Fire

During the fall of 1871, the extremely dry weather and the combustible properties of most Chicago buildings had caused many fires to break out. A small group of city firemen had been able to extinguish them successfully until Saturday, October 7, 1871, when one of these fires grew to such proportions that it destroyed the four blocks enclosed by Adams, Van Buren, and South Clinton Streets and the Chicago River.

At 9:00 p.m. on the following day, another blaze started in a cow shed on De Koven Street near the canal. It could not have happened at a more critical time, since the fire department had exhausted itself fighting the fire of October 7, and since almost all of the buildings in the vicinity were of frame construction and were in immediate proximity to each other. By midnight, the Great Fire had crossed the Chicago River, and at 3:20 a.m. on Monday, October 10, it had crossed the north branch of the river and had consumed the northside area all the way to the waterworks on Chicago Avenue, two and one-fourth miles from its origin. This conflagration destroyed almost 18,000 buildings, and made one-third of Chicago's 300,000 inhabitants homeless.[1]

C. The Reconstruction

Reconstruction began immediately after the fire and progressed with amazing rapidity until the Panic of 1874, when the process slackened noticeably. Between 1872 and 1879, approximately 10,000 building permits were issued; since fireproof construction had assumed a vital and personal new aspect for the people of Chicago, brick was suddenly replacing wood as a principal building material, and new uses were being found for stone, concrete, and iron.

Most of the buildings erected during 1872 and 1873 were not much taller than those which had been destroyed. In 1874, the first steam-driven elevator was installed in the Farewell Building, which was subsequently called an "elevator building". In the succeeding years, the number of "elevator buildings" kept pace with elevator production. These buildings were simply constructed: interior cast-iron columns were connected to cast- or wrought-iron floor beams, which supported most of the floor loads; exterior walls were

[1] Randall, op. cit., p. 8.

generally of solid masonry, either brick or cut stone, and were strong enough to support themselves and the floor loads.

After 1873, the year that Frederick Baumann published his treatise, "Method of Isolated Piers" (which is generally considered the first rational attempt in this country for the proportioning of footings), stepped foundations became common, and were designed in accordance with individual column loading.[1] Baumann believed that the areas of the base of a column should be in proportion with superincumbant loads, and that loads should be concentrically placed on this base. He carried this idea further by saying that the footings should be pre-loaded with pig iron so that all foundations could settle at the same rate, and that these footings should be designed in accordance with the bearing quality of the soil.[2] Baumann's theories resulted from his

[1]The full importance of Baumann's work was not felt until nine years after the publication when Burnham & Root introduced a reinforcement of iron rail grillage into the isolated footings of the Montauk Building.

[2]". . . On the surface a thin layer of black muck is generally found resting on a bed of sand, ranging from seven to fourteen feet in depth, which in turn rests on a compact blue-clay bed of from three to seven feet in depth. Below this dry blue clay, is the great, compact damp deposit of blue clay, sometimes exceeding fifty feet in depth and always resting on the limestone. The dry blue clay strata, or the dividing line between the saturated sand and the saturated blue clay must be considered the true basis of solidity above bed rock." (Industrial Chicago, the building interests of Chicago. Chicago, The Goodspeed Publishing Company. 1891. p. 15.)

observance of the uneven settlement, distortion, and cracking of structures in the Loop area of Chicago, and from experimentation with possible improvements in his own architectural practice. His pamphlet was the first statement made in the United States for the design of foundations.[1]

A major innovation after the fire was the widespread use of Balthaser Kreischer's flat hollow-tile arches for fireproofing. They were first used in the floor construction of the Kendall Building.[2] Soon, tile was widely used for partitions, and to enclose columns and other exposed iron members. It was practical because the hollow space within the tile served as insulation, and because the tile remained in place when subjected to very high temperatures.

The elevator made higher buildings feasible; Baumann's theory made them practical for Chicago's marshy soil; fireproof construction made them safe; and Chicago's increasing real-estate values made them imperative.[3] The years that

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[1] Peck, Ralph B. History of building foundations in Chicago. Urbana, The University of Illinois Press. 1948. pp. 14-17.

[2] Randall, op. cit., p. 10.

[3] "Population growth and land values continued to follow their logarithmic curves. By 1880, the price of land was $130,000 per quarter acre. By 1890, it had risen to $900,000 per quarter acre. The population in 1870 was almost 300,000. By 1880 it had risen to over 500,000 and in 1890 it passed the million mark." (Condit, Carl W. The rise of the skyscraper. Chicago, The University of Chicago Press. 1951. p. 17.)

followed brought revolutionary developments in form and structure as technical factors became the basis of a new trend in building and a new architecture.

IV. WILLIAM LE BARON JENNEY

The life of William LeBaron Jenney has been particularly difficult for the writer to chronicle because of the paucity of specific information in the reference material available to him on this subject, and because of various inconsistencies noted from time to time. However, a clearer picture might have been composed had the writer had access to the excellent collection of concurrent architectural periodicals and original manuscripts reposing in the stacks of the Burnham Library of Architecture in Chicago. At the present time he feels that this material, while relative, would have added little to the premise of this thesis. Therefore the emphasis has been placed on Jenney's architectural contributions, manifested by four buildings, each of which represented a distinct step in the development of the skyscraper.

A. His Youth

William LeBaron Jenney was born at New Bedford (formerly called Fairhaven), Massachusetts on September 25, 1832. His father was William Jenney, head of the firm of Jenney and Gibbs, an important whale-oil house and shipping company.

His mother was Eliza Gibbs, daughter of Captain Ansel Gibbs of New Bedford and Lucy LeBaron of Plymouth.[1]

Little is known of Jenney's childhood except that he was enrolled in the Scientific and Military Academy at Unity, New Hampshire, and then at Phillips Academy at Andover, Massachusetts.

On February 1, 1954, the writer obtained some of the following information in an interview with Mr. Elmer C. Jensen, sole survivor of the firm of Jenney, Mundie and Jensen. At age seventeen, William Jenney made a trip around Cape Horn in one of his father's whaling ships. After the boat had dropped anchor in San Francisco Bay, he was able to see, during the three months he remained in California, the effects of the gold rush and of the second of San Francisco's seven disastrous fires. The ship later sailed for the Phillipines with the boy again aboard.

For Jenney, the crude bamboo huts of the Phillipines had an intense fascination; their skeletal simplicity perhaps formed the nucleus of his eventual conception of skeleton construction. The vast potentialities of Luzon impressed the young Jenney so strongly that he resolved to take up engineering in order to be able some day to build a railroad

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[1]Microfilm Roll No. 23: The Mundie Manuscript and Henry Penn Papers. Burnham Library-University of Illinois Architectural Microfilming Project. August, 1952. (Mundie Manuscript, p. 163.)

across the island.

To prepare himself for this new ambition, Jenney enrolled in the Lawrence Scientific School of Harvard University late in 1850, and remained there for two and one-half years. In June, 1853, to complete his education, he sailed for Europe and enrolled in the Ecole Centrale des Arts et Manufactures, in Paris.[1] After studying under Alphonse Lavelle, who had founded the school and was its first director, Jenney was awarded his diploma in 1856.[2] (According to Sigfried Giedion, in Space, Time and Architecture, Jenney also studied at the Ecole Polytechnique.)

The years immediately after his graduation are uncertain. William B. Mundie, in his unpublished manuscript on skeleton construction, located Jenney in three different places in the year of 1858: first in Europe, where he was supposed to have spent another year and a half; in America; and later in the year, on the Isthmus of Tehauntepec, an engineer employed on the construction of the Panama Railroad across the Isthmus.

Mr. Mundie placed considerable emphasis on the time spent in Europe, making mention of Jenney's association with George Du Maurier and James McNeill Whistler, and describing

[1]Mundie, op. cit., p. 163.

[2]Microfilm Roll No. 11: The Jenney Scrapbook. Burnham Library-University of Illinois Architectural Microfilming Project. November, 1951. (Not numbered.)

the fabulous dinners of Mme. Busque at her restaurant on the Rue de St. Pierre, where Jenney and Whistler were said to have introduced the pumpkin pie to Paris. Very little further reference was made to his return to America or his stay in Panama.

After the completion of the railroad, Jenney returned to the United States where he was appointed an engineer for the Bureau of American Securities, which was under the direction of William Tecumseh Sherman. The exact nature of this work is unknown.

When the Civil War began, Jenney applied for a commission in the Union Army and was appointed a captain, and assigned to duty at Cairo, Illinois. After supervising the construction of a fort there, he was transferred to Fort Henry and then to Fort Donaldson as Engineer Officer, and later devised the defenses at Shiloh, Corinth and Vicksburg.[1] He was next ordered to report to his former employer as Chief Engineer of the Fifteenth Army Corps of the Army of Tennessee, with the rank of Brevet Major. He served with General Sherman throughout the war and was with him on his famous march from Atlanta to the sea. Mr. Jensen said that Jenney's bridges had made the march and the ultimate victory possible.

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[1]Mundie, op. cit., p. 164.

On July 24, 1865, after service at Goldsboro, North Carolina, and a thirty-day leave authorized by General Grant, Jenney was assigned to the army post at Jefferson Barracks, near St. Louis; here he worked for almost a year making topographical maps of the various important campaigns and movements of troops during the war. In January, 1866, while General Sherman was still his commanding officer, Jenney was made a special courier to Washington to deliver to General Grant a series of manuscripts written by General Sherman.[1]

In December, 1865, following a recommendation by General Sherman, Jenney was offered a position on the faculty of the New Jersey State School for Agriculture and Industrial Arts at New Brunswick, a division of Rutgers University. This he declined. In March of the following year, while still in the army and stationed at St. Louis, Jenney accepted the position of Vice-President of the McKean County Bituminous Coal Company in New York at a salary of $1,000 per year; in April he was also appointed Vice-President of the Humbolt Mining and Refining Company, in the same city.[2]

Jenney had been given a leave of absence from the army

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[1]Microfilm Roll No. 11: The Jenney Scrapbook.

[2]Ibid.

in order to accept the McKean position, and General Sherman had extended his leave of absence from thirty to ninety days; on May 19, 1866, Jenney was officially mustered out of the army.[1]

B. Early Practice

According to Mr. Mundie's manuscript on skeleton construction, Jenney came to Chicago in the fall of 1868 to begin a career as an architect. His reasons for leaving New York were not enumerated, although he must have heard of the concentrated opportunities offered by Chicago's unprecedented growth and development, its accelerated building program, and its need for architects and engineers.

For a short time, Jenney was in partnership with two landscape architects, a Mr. Schermerhorn and a Mr. Bogart. Although this firm planned and executed various minor architectural projects, their major contribution was made in the field of landscape architecture. An example in point was their planning for the new town of Riverside, Illinois. Parks on Chicago's west side have also been attributed to this firm.

Jenney's enthusiasm for architecture and engineering made itself apparent when he decided to abandon this

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[1]Ibid.

established practice in order to form a new partnership with Sanford D. Loring, architect. Their first work of architectural importance was the Grace Episcopal Church on Wabash Avenue near Sixteenth Street in Chicago. In this building, the influence of Pugin, Ruskin and Viollet-le-Duc was apparent, an indication that Jenney had accepted the neo-Gothic tradition as a basis for designing.

The partnership with Loring was short-lived, however; after Jenney had written a book (his only published book), Principles and Practice of Architecture,[1] he established an office in his own name. (Again the writer has found no reasons for this change, but assumes that the Chicago Fire might have given impetus to this decision.)

Jenney's first large building after the fire was the Portland Block. This then-impressive seven-story building was erected on the southeast corner of Dearborn and Washington Streets in 1872, replacing an original five-story building of the same name which was destroyed by the fire.[2] The Portland Block was not significant structurally because it embodied only the accepted methods of fireproof construction made mandatory by the fire. Its exterior treatment was similar to that of the Grace Church. The only innovations

[1]This was a profusely illustrated folio of details of ornament, fenestration, etc. Sanford Loring was co-author.

[2]Randall, op. cit., p. 62.

were the facades, for which pressed brick was used instead of the accustomed stone. Jenney was among the first tenants of the Portland Block after its completion. Another building of the same type was his Second Lakeside Building erected on the southwest corner of Clark and Adams Streets in 1873.

C. The First Leiter Building

About 1875, a Mr. L. Z. Leiter, who was to become one of Jenney's most important clients, bought a small lot on the northwest corner of Monroe and Wells Street (then Fifth Avenue). Jenney received the commission from him to design a building to house a firm of clothing manufacturers, which had acquired a long-term lease for the proposed building from Mr. Leiter.[1] To meet the firm's demands for space, a five-story building with a full basement was indicated.

Mr. Leiter proved to be an ideal client, eager to accept new and practical ideas. Jenney, with his innate talent, his classic education, and his years of experience in engineering and building, was waiting for such an opportunity. Sigfried Giedion says, "Jenney's hand first showed

[1]Microfilm Roll No. 9: William LeBaron Jenney. Burnham Library-University of Illinois Architectural Microfilming Project. November, 1951. (Original First Leiter Building drawings. Frame Nos. 1-21.)

itself clearly in a warehouse he built at 280 West Monroe Street for Leiter in 1879."[1]

To meet the challenge, Jenney devised a system by which the live loads were no longer entirely dependent upon heavy masonry walls for support. To carry a design live load of 250 pounds per square foot, he placed 8" x 12" cast-iron columns against the east (Wells Street) and west (alley) walls (Figure 2). These, plus three rows of cast-iron interior columns (placed 13'-2" by 24'-8" on centers), supported heavy timber girders running east and west.[2] A heavy wooden floor was in turn supported by 3" x 12" wooden joists running north and south. These joists were carried by a heavy-masonry party wall on the north and 7" wrought-iron beams, which were partially supported by triple-window mullions, and which were embedded in masonry piers on the south (Monroe Street Elevation). In this way, the floor loads (except for those at the north party wall) were carried by columns to isolated footings. The weight of the masonry walls was carried on continuous footings (Figure 1). Jenney kept the interior free and open by eliminating practically all partitions.

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[1]Giedion, Sigfried. Space, time and architecture. Cambridge, The Harvard University Press. 1947. p. 293.

[2]Microfilm Roll No. 9: William LeBaron Jenney. (Original First Leiter Building drawings, Frame Nos. 1-21.)

Figure 1.

First Leiter Building, Basement Plan and Footings[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 1.

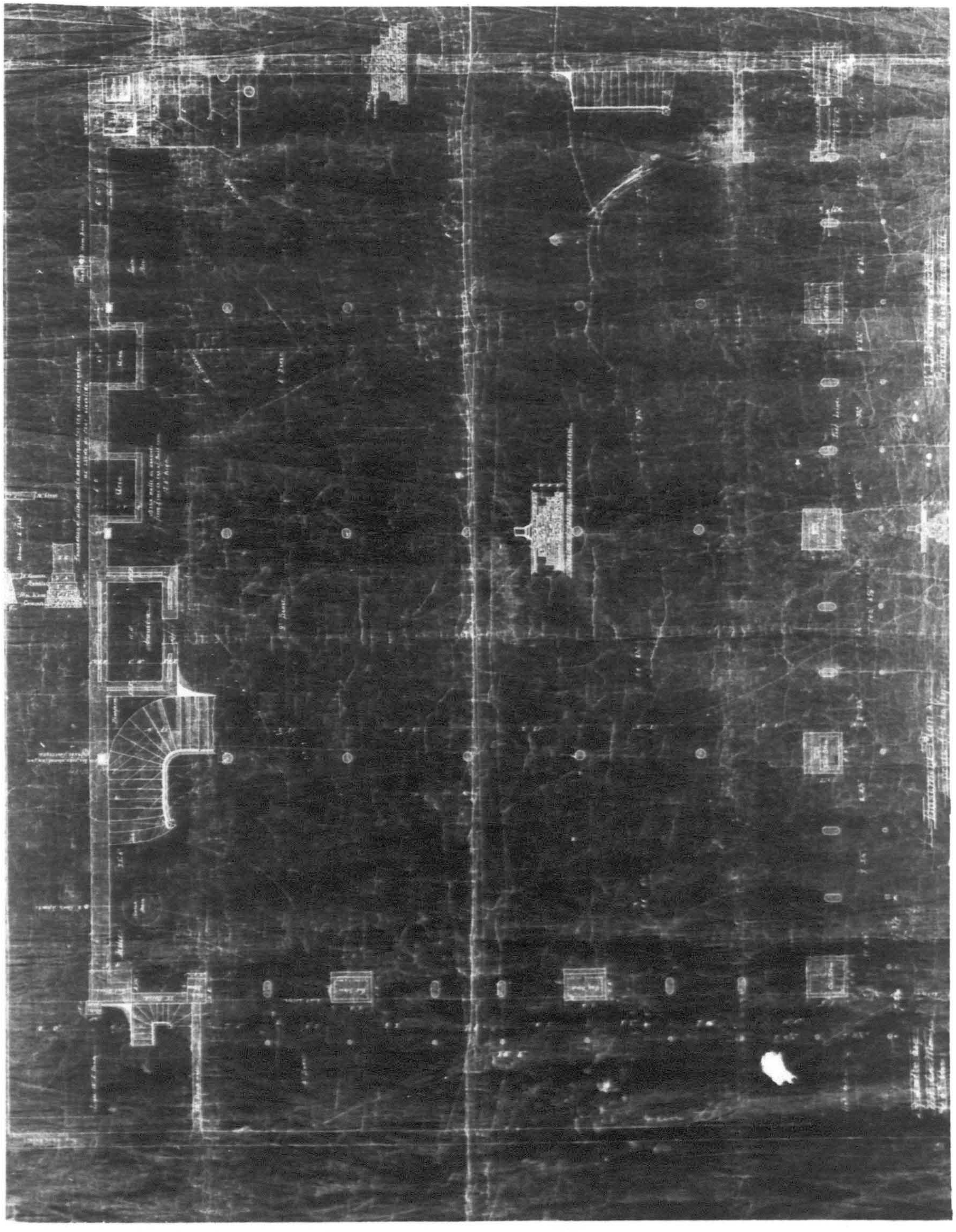
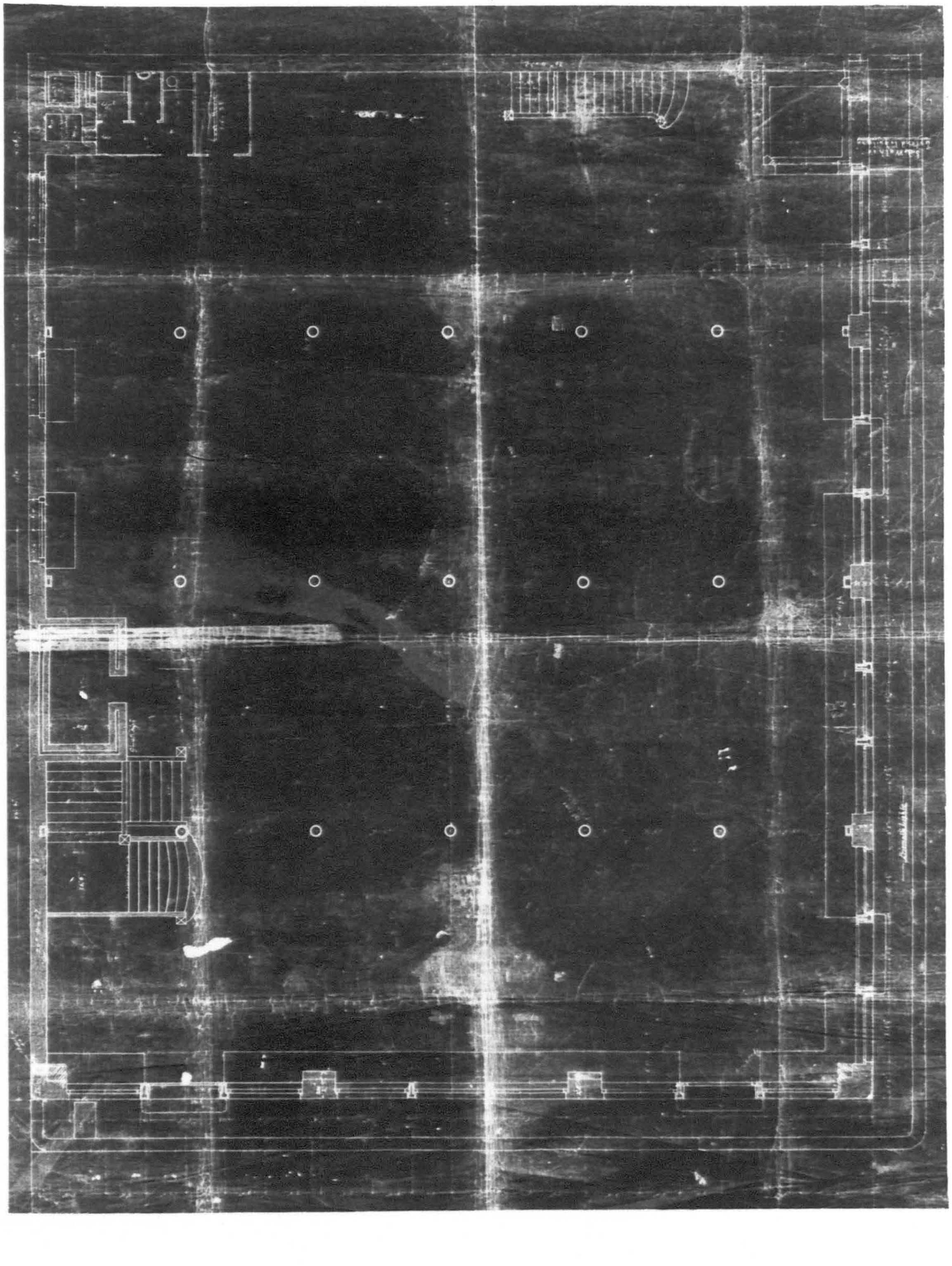


Figure 2

First Leiter Building, First Floor Plan[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 2.



The same "open" feeling was even more obvious in the simple exterior facades. Five 3'-8" brick piers, evenly spaced across the 102'-7" Monroe Street front, and the 6" lintels formed a simple geometric pattern from the base of the building to the unobtrusive cornice (Figure 3). Each bay was further broken into three separate glass areas by window mullions (10" wide in the first story and 8" wide in all floors above), which were continuous columns from the foundations to the cornice (Figure 4). In this manner, the piers were reduced to a minimum, making possible the unprecedentedly wide use of glass common to the skyscrapers of today.

Here, for the first time in his career, Jenney had created a building with no excessive ornamentation. The intersection of the spandrels and columns of each bay were accented with a stylized rosette in carved stone courses. The cornice of the building was clean and shallow, and added to the refined simplicity of the building. The strength of the First Leiter Building lies in its prophetic tendency to reveal, not disguise, its structural system.

The First Leiter Building stands today[1]--partially obscured by the "L", painted an incongruous mauve, and marred by attempts of recent tenants to modernize their

[1]Two additional floors were added in 1888..

Figure 3

First Leiter Building, Wells Street Elevation[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 7. This drawing is incorrectly labeled "Monroe St. Elevation".

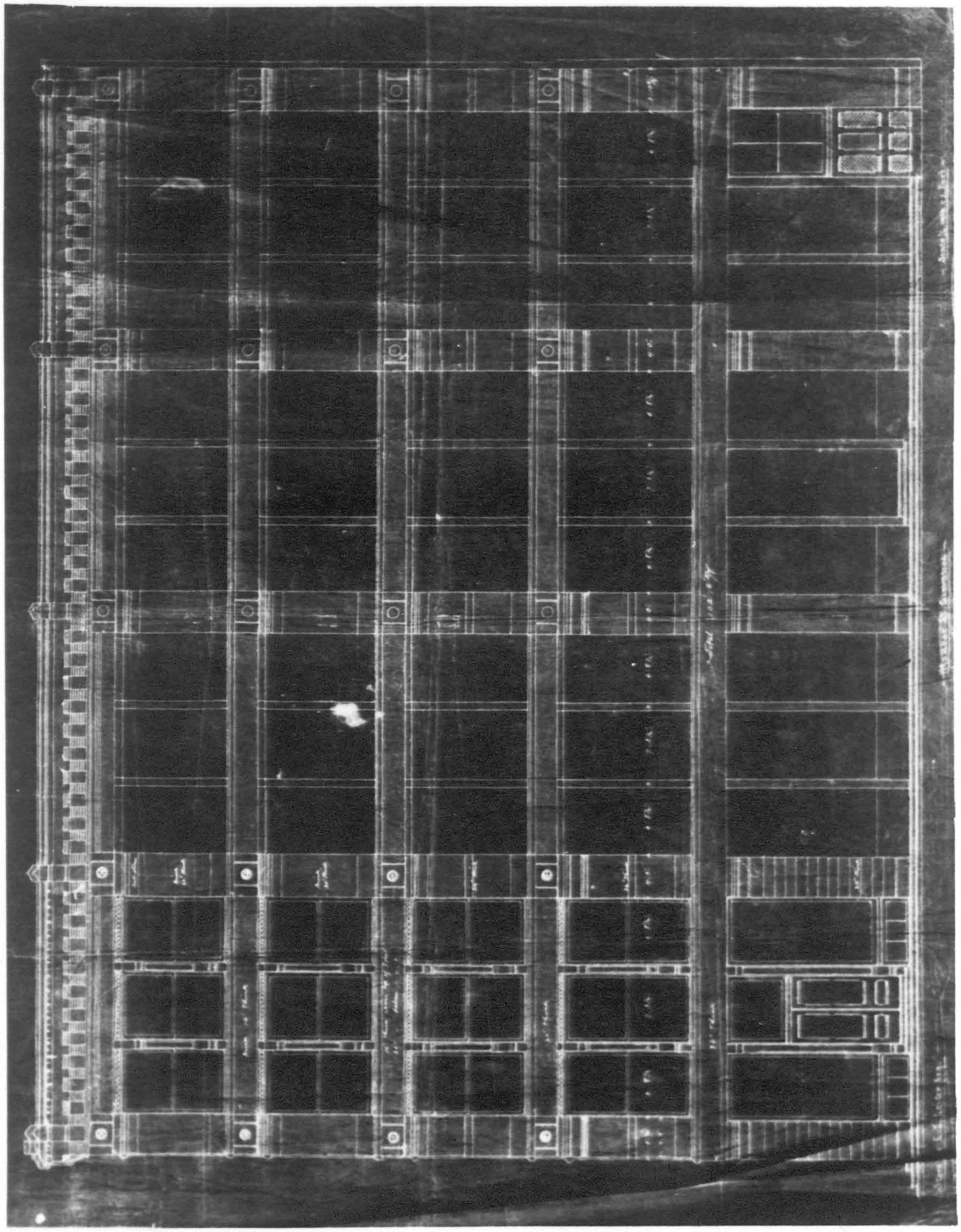
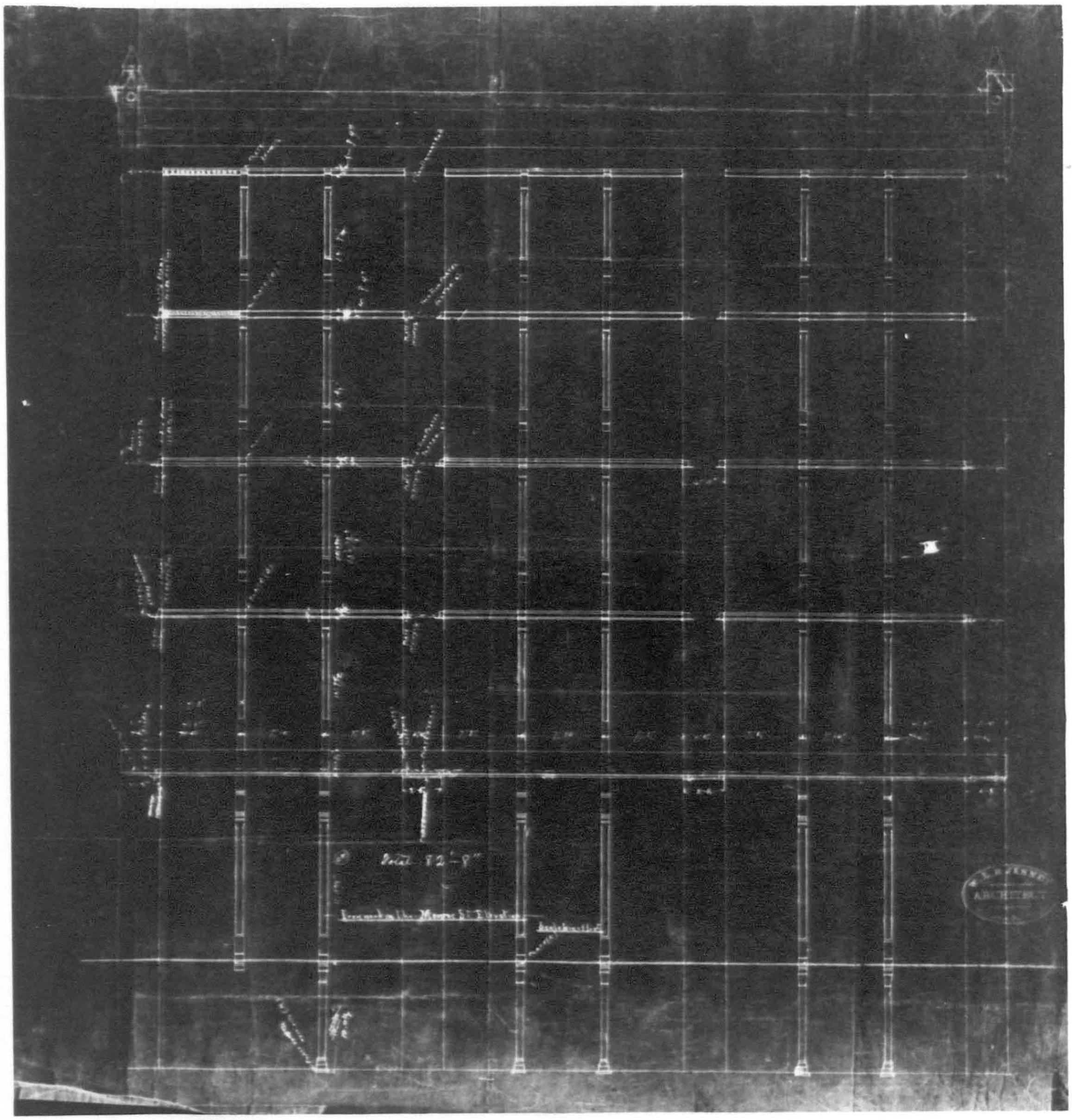


Figure 4

First Leiter Building, Iron Details, Monroe Street Elevation[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 11.


Total 82'-8"
ARCHITECT

store fronts--and yet it stands today possessed of much of its original strength and dignity, justified by a prophecy fulfilled. Carl Condit says that the First Leiter Building "marks the important intermediate step between Bogardus' invention of 1848[1] and Jenney's achievement of full framing of 1883-1885".[2]

D. The Home Insurance Building

Sometime late in 1883, the Home Insurance Company of New York decided to erect a new building for its branch office in Chicago. A competition was held to select an architect. Prizes of $500, $300, and $200 were to be awarded to the architects whose designs were considered best by the insurance building committee; the winner was also to receive the commission to design the building, subject to the approval and recommendations of the committee.

Early the following year, the designs were submitted and winners selected. No public announcement was made until April 2, 1884, when, after a series of meetings with the various competitors, the building committee awarded first prize and the commission to William LeBaron Jenney, second

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[1]Condit refers to the invention of a structural system in which the interior of a building and its walls were reduced to a framework of cast-iron.

[2]Condit, Carl. The rise of the skyscraper. Chicago, The University of Chicago Press. 1951. p. 112.

prize to John Addison, and third prize to Frederick Baumann, author and originator of the isolated-pier theory.[1]

In order to make sure of renting the offices in their new building, the Home Insurance Company insisted on offering the prospective lessees better accommodations than had been available heretofore. Inadequate natural light had been a serious problem in other contemporary office buildings because windows at that time were little more than a series of inadequate slots. As land values had increased, buildings had become taller, with the result that outer bearing walls had had to be made disproportionately thick, reducing not only the total glass area possible, but also the valuable rental area on the lower floors. Because of this, the building committee had required that all designs submitted take this difficult question into consideration. The committee had asked also that there be the maximum number of well-lighted offices above the first or banking floor.

Before the commission had been finally awarded to Jenney, he met with a Mr. J. J. Martin, the president of the company, and the building committee, to discuss his solution to their problem. They were aware, as was Jenney, that large window areas would tend to reduce the size of the piers between the windows to a minimum, and make them too small to

[1] Jensen, Elmer C. Skyscraper construction. Read before the Chicago Chapter of the Newcomen Society. November 9, 1944. p. 12.

support the building. In Jenney's scheme, the masonry had been reduced beyond this point. To support the additional weight, Jenney had inserted iron columns into the piers above the banking floor.[1] To increase the rigidity of the proposed structure, he had extended the wrought-iron lintels above the window areas to the cast-iron columns within the masonry piers, where they were supported on brackets and bolted to the columns.

The building committee was unwilling at first to accept Jenney's solution, and was reluctant to spend more than a half-million dollars on an experiment. Jenney then explained his solution in terms of an iron bridge set on end, and to satisfy the prospective clients, he suggested that his solution be checked by any bridge designer with an established reputation. General Arthur C. Ducat, a former engineer who was managing the company's western offices, and who was a member of the building committee, checked the drawings and calculations. He recommended that Jenney's solution be accepted and that the building should be commenced at the earliest practical date.[2] This was on April 2, 1884, the day he was actually given the commission and awarded the $500 prize.

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[1] In an earlier study, Jenney carried the wrought-iron columns directly on the base of its footing.

[2] Mundie, op. cit., p. 19.

The site selected for the Home Insurance Building was on the northeast corner of LaSalle and Adams Street. The building permit had been issued on March 1, 1884,[1] a month before the commission was finally awarded to Jenney.[2]

According to the original plans (Figure 5), the building was essentially a rectangle, 138' (on LaSalle Street) by 98' (on Adams Street). Attached to this was another rectangle 50' by 26' extending north from the northeast corner of the building. A light well, 49' by 33', almost centrally located, was situated on the east lot line. There were party walls to the north and east.

Before calculating the footings, Jenney made a series of test borings at some twenty spots on the site. Analysis indicated the following information:

> . . . the thickness of the hard pan (approx. 12'-6") was found sufficiently uniform to allow a uniform weight of two tons per square foot to be used as the permanent load of the foundations.[3]

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[1]Randall, op. cit., p. 105.

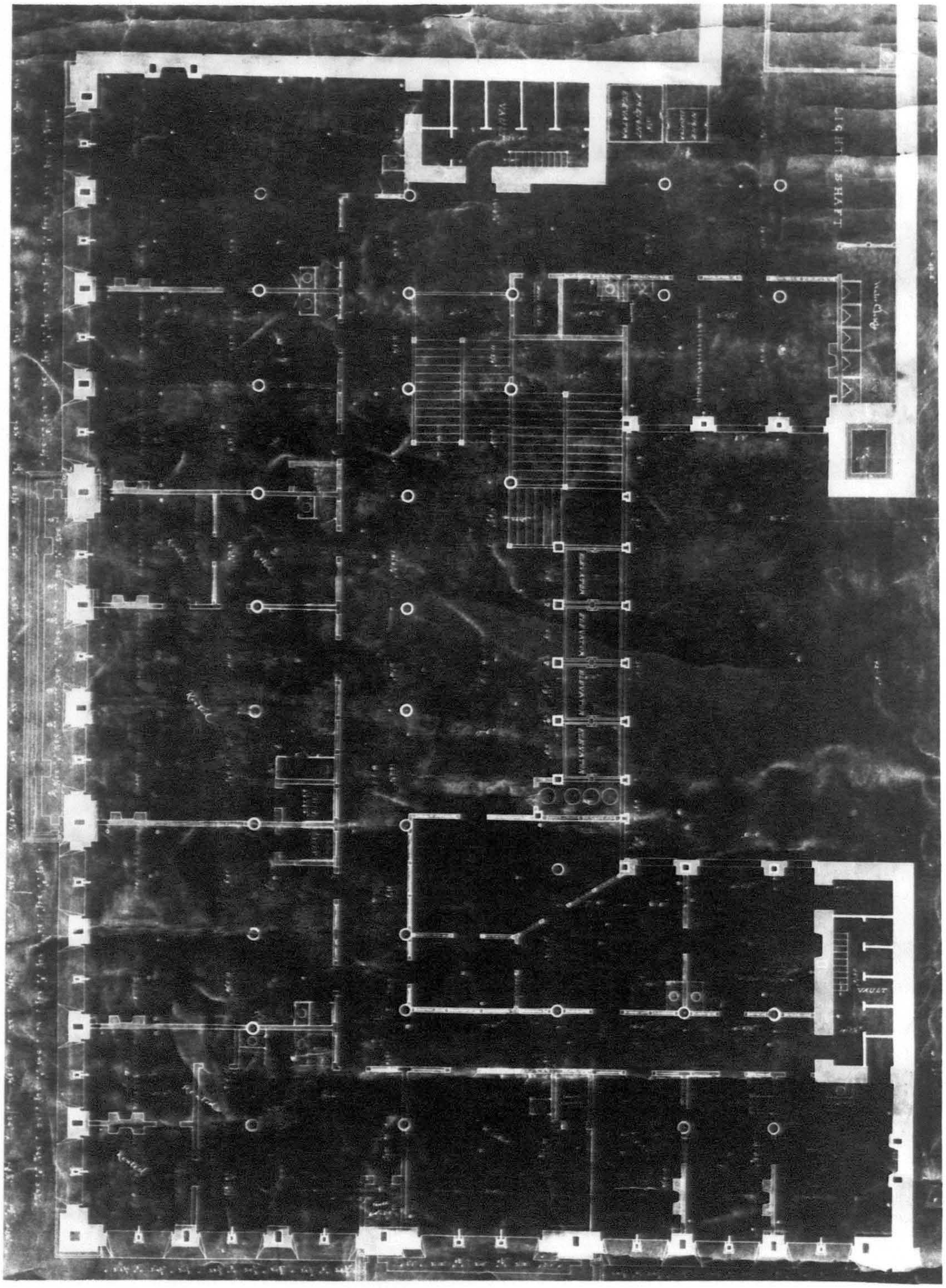
[2]Prior to this, Jenney's project had been submitted to the building authorities and had been rejected in part, because of its unique structural system; therefore, Jenney removed columns from within the party walls to comply with regulations. The building commissioner did allow an open iron stairway provided that an iron frame would support the four hydraulic elevators in the building.

[3]Jenney, William LeBaron. The construction of a heavy fire-proof building on a compressible soil. Read before the Nineteenth Annual Convention of the American Institute of Architects, Nashville, Tennessee. October 1, 1885. p. 4.

Figure 5

Home Insurance Building, Second Floor Plan[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 27.


LIGHT SHAFT
VAULT

The foundations for the party walls on the north and east sides of the building, the solid vault walls, and the west wall of the rectangular projecting wing, were continuous spread footings.[1] All interior columns extended down through the basement to isolated spread footings, while the exterior columns within the two street walls were supported by granite piers at the second floor window line. The footings were composed of alternate layers of dimension- and rubble-stone, set on a 21" bed of concrete reinforced with rails. Where loads were excessive, cut stone alone was used for the footings.

Jenney spared no effort to make sure that the size of each footing was directly proportioned to the exact load it carried. In this way settling was controlled. According to his calculations, the building should settle a total of 2½". To allow for this, the entire building was planned 4" higher than would have been usual. At a reading after the building had been accepted and occupied, the total settlement had been but 2¼", and nowhere was the variation in settlement greater than 11/16".[2]

Because of the shallow depth of the hard-pan, Jenney was extremely careful during the supervision to make sure

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[1]Microfilm Roll No. 9: William LeBaron Jenney. (Original Home Insurance Building drawings, Frame Nos. 22-53.)

[2]Jensen, Elmer C. Skyscraper construction. November 9, 1944.

that none of the hard-pan was removed. Mortimer & Toppen accepted the contract for the foundations and excavations on a cost-plus-10 per cent basis.[1]

The structural system of the Home Insurance Building was simple and straight-forward (Figures 7-12). Elmer C. Jensen, first an apprentice and later a partner of Jenney, says that here Jenney was faced with a new engineering problem and proceeded to solve it. No new structural materials were used by Jenney in his original design. The framing plans (Figures 7-10) and details, relatively few in comparison with those demanded by today's standards, called for a post-and-lintel frame made up of round or rectangular cast-iron columns, and wrought-iron beams and girders.[2]

The girders, either 12" or 15", and usually in pairs, carried I-beams, rested on and were bolted to the cast-in-place brackets of the columns. In the interior, cast-iron columns, varying from 15" in diameter in the basement to 8" in diameter at the top floor, were non-symmetrically located in plan. Each column was filled with sand, sealed with mortar, and fire-proofed with hollow clay tile. Exposed, square cast-iron columns were used in the light well. These girders were also supported by heavy,

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[1]Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 416.

[2]Ibid. Frame Nos. 22-53.

rectangular cast-iron columns built into thick brick piers of the exterior street walls. Party walls were anchored by round rods, threaded at one end and secured by a nut drawn against the opposite face of the columns. The wall-end of the rod was flattened, turned down, and set into the top flange of the girder.

All iron work was protected from fire by masonry, except the square columns in the light court and the 15" columns in the banking room on the ground floor. The banking-room columns were originally covered with 3" of porous terra-cotta, which increased their diameter to 21". Since this increased size was not aesthetically successful, Jenney removed the terra-cotta and replaced it by ¼" iron rods which were placed vertically 2" on center around the columns, covered with wire mesh, and plastered first with Portland cement and finally with Keen's cement.

Wrought-iron spandrel I-beams rested on cast-in-place column brackets at only three floors. Bolted to column separators, four 7" beams were used at the third floor, three 15" beams at the fifth floor, and two 12" beams at the eighth floor. Directly below these beams (and above the windows on all floors) were 4" cast-iron lintels, shaped like a long pan, which varied in width according to the width of the outer walls, and extended to each exterior column. The molded lintels were carried freely on cast-in-place brackets, but instead of being bolted to the columns, they were bolted to each other, forming a continuous band of ornamental iron around the building. Exposed, vertical cast-iron mullions, rising from spandrel to spandrel, were bolted to the lintels at the intersections to complete the skeleton system.

Jenney took little advantage of his ingenius structural system in designing the exterior of the Home Insurance Building (Figure 6). The strong feeling of verticality was suppressed by a series of horizontal bands of sandstone which divided the facades of the building into five distinct parts. Heavy masonry piers were located at the corners of, and flanked the entrances of, the street elevations. Between the large piers were smaller masonry piers, four on Adams Street, and six on LaSalle Street. The major piers of ashlar granite sloped evenly from 4'-3" in thickness at the sidewalk, to 3'-0" at the base of the horizontal stone course beneath the third-floor windows. At this point, the corner piers were 3'-0" wide, and the ones at the entrances were 3'-6" wide; all of them had been reduced to a thickness of 2'-4". They continued vertically until interrupted by another horizontal stone course beneath the fifth-story windows. The same process of decreasing dimensions was repeated again at the eighth and tenth floors, where Jenney had used spandrel beams, until the wall was 12" thick at the

Figure 6

Home Insurance Building, Adams Street Elevation[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 31.

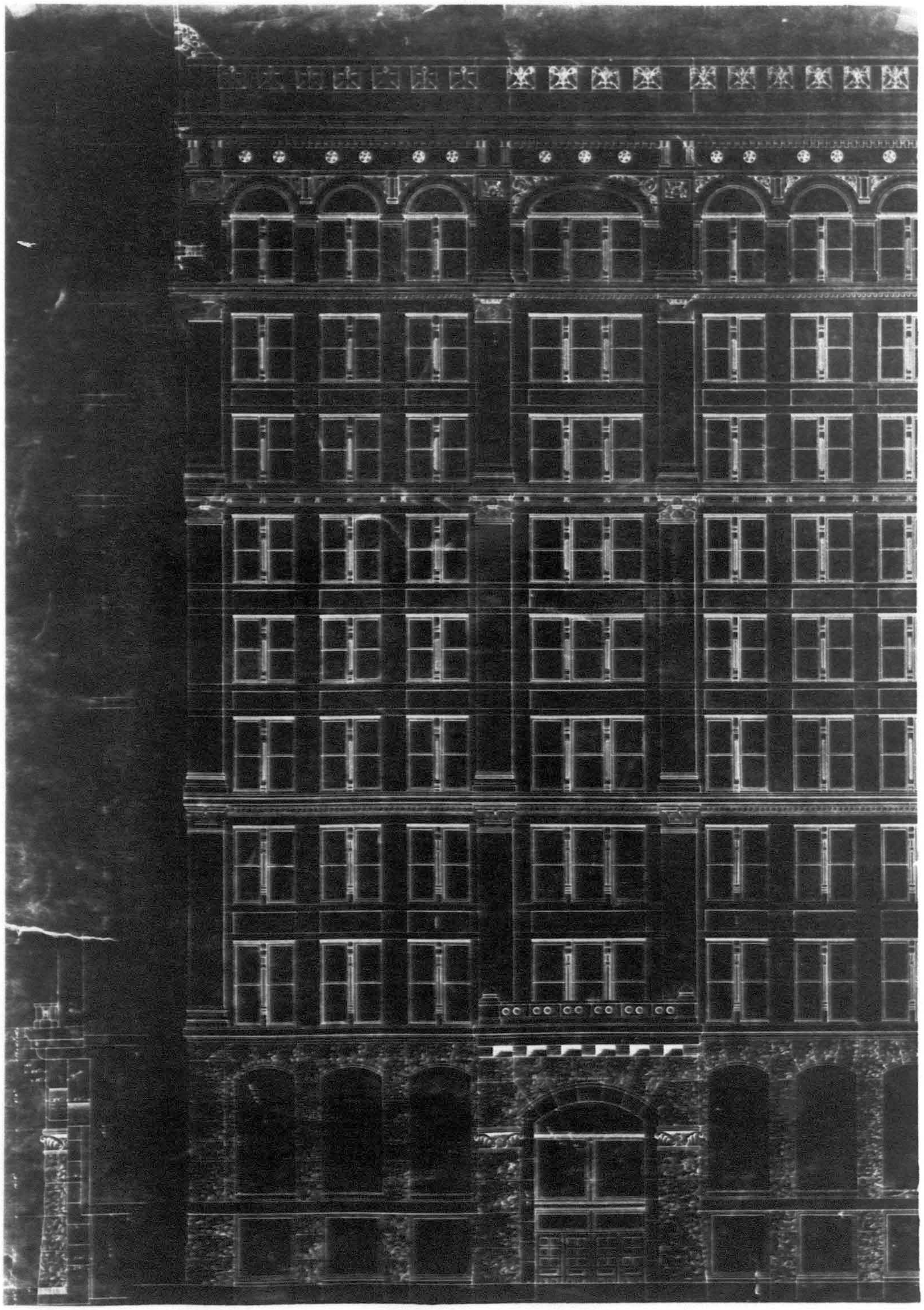


Figure 7

Home Insurance Building, Basement Girders and Floor Beams[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 36.

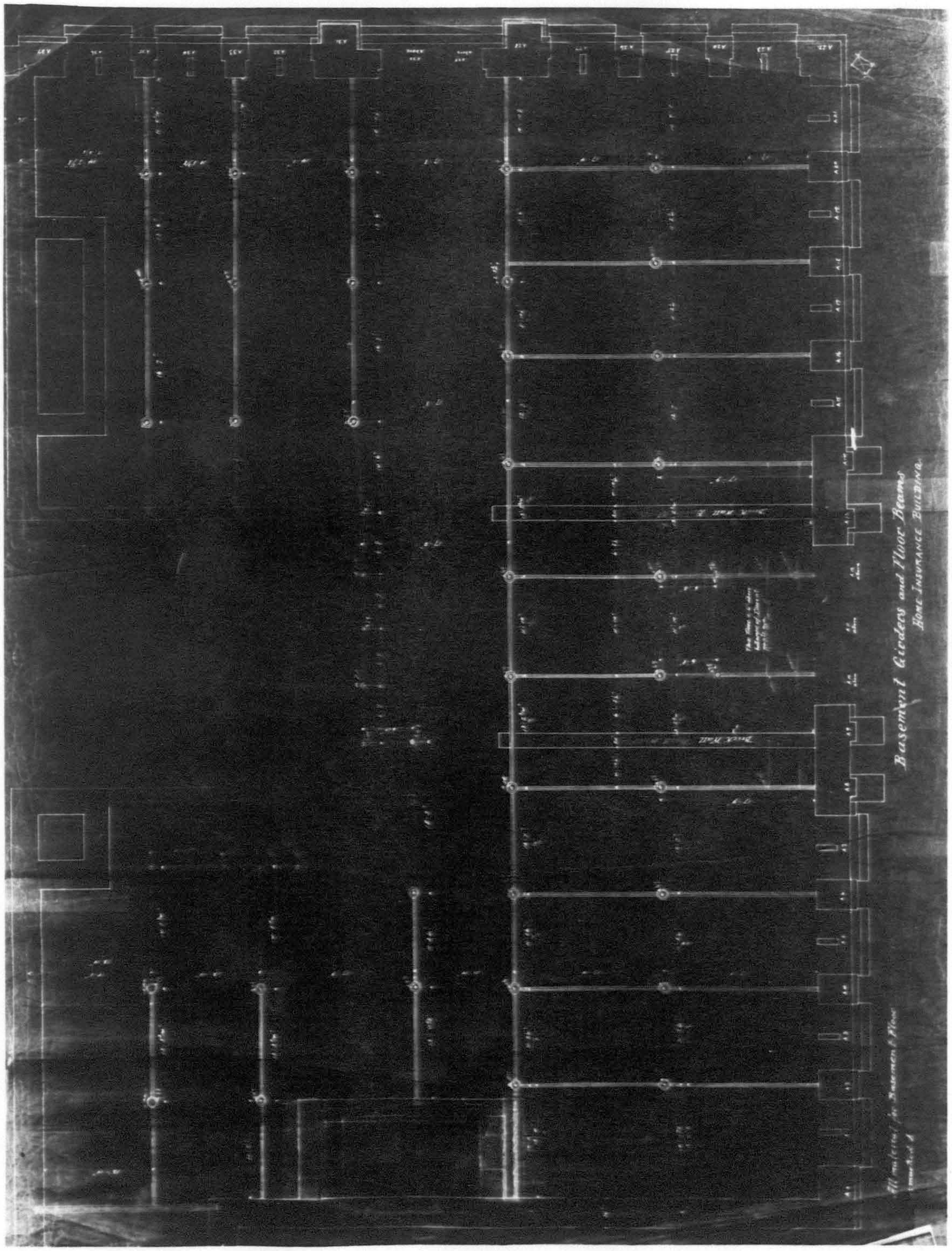

Basement Girders and Floor Beams
Home Insurance Building

Figure 8

Home Insurance Building, First Floor Beams and Girders[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 37.

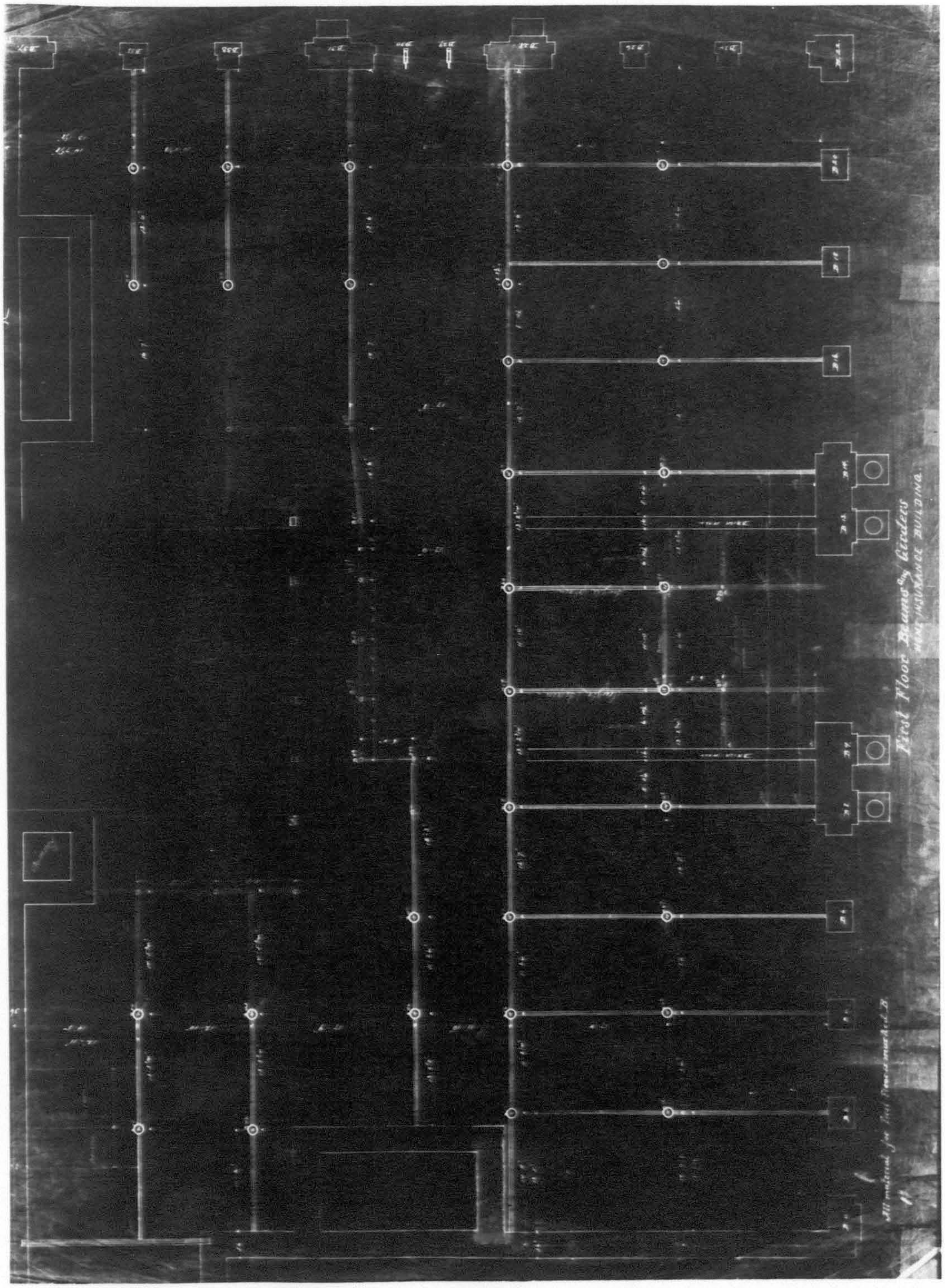

First Floor Beams and Girders
HOME INSURANCE BUILDING

Figure 9

Home Insurance Building, Second Floor Beams and Girders[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 39.

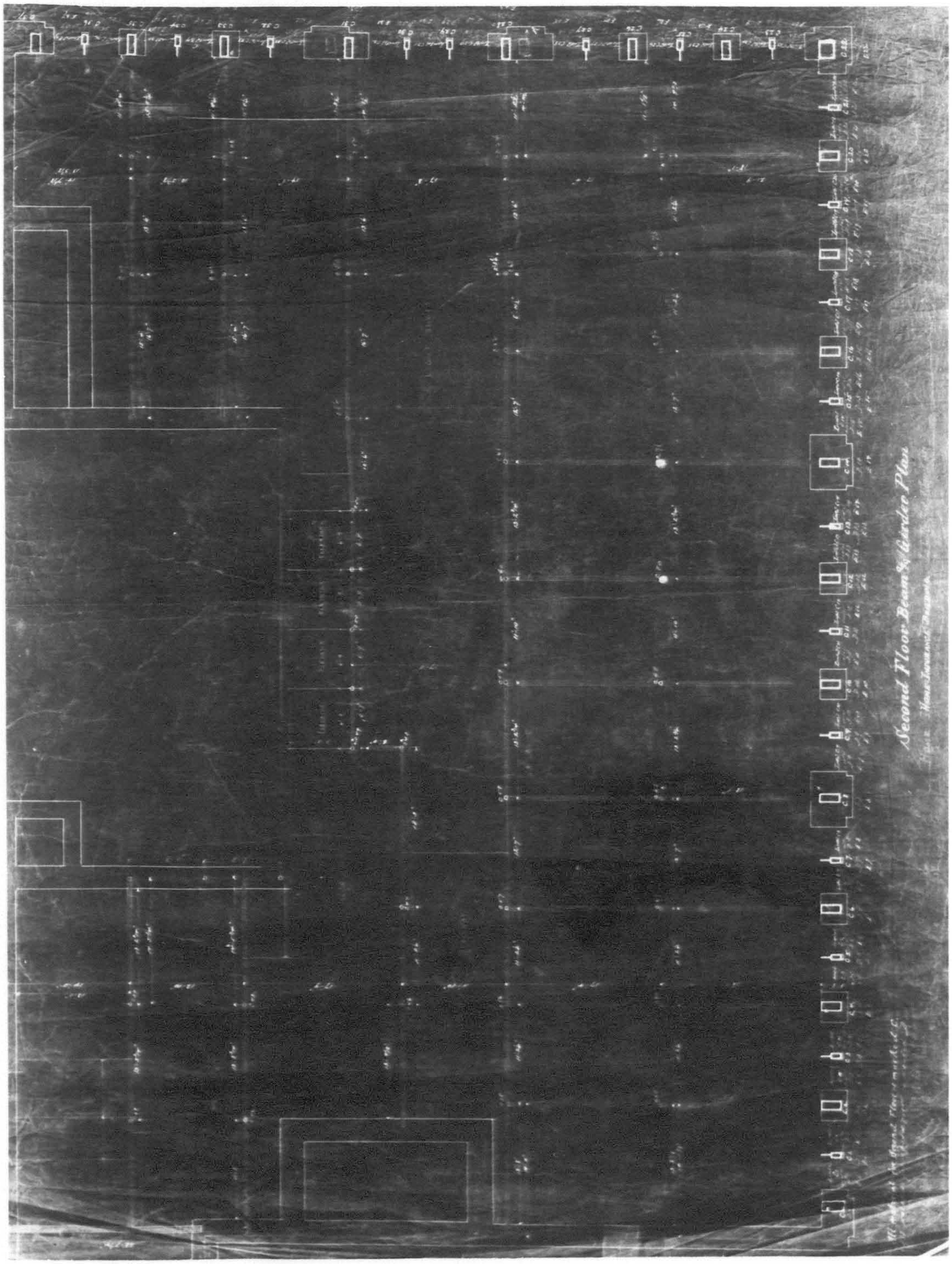

Second Floor Beam & Girder Plan

Figure 10

Home Insurance Building, Ninth Floor Beams and Girders[1]

[1] Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 40.

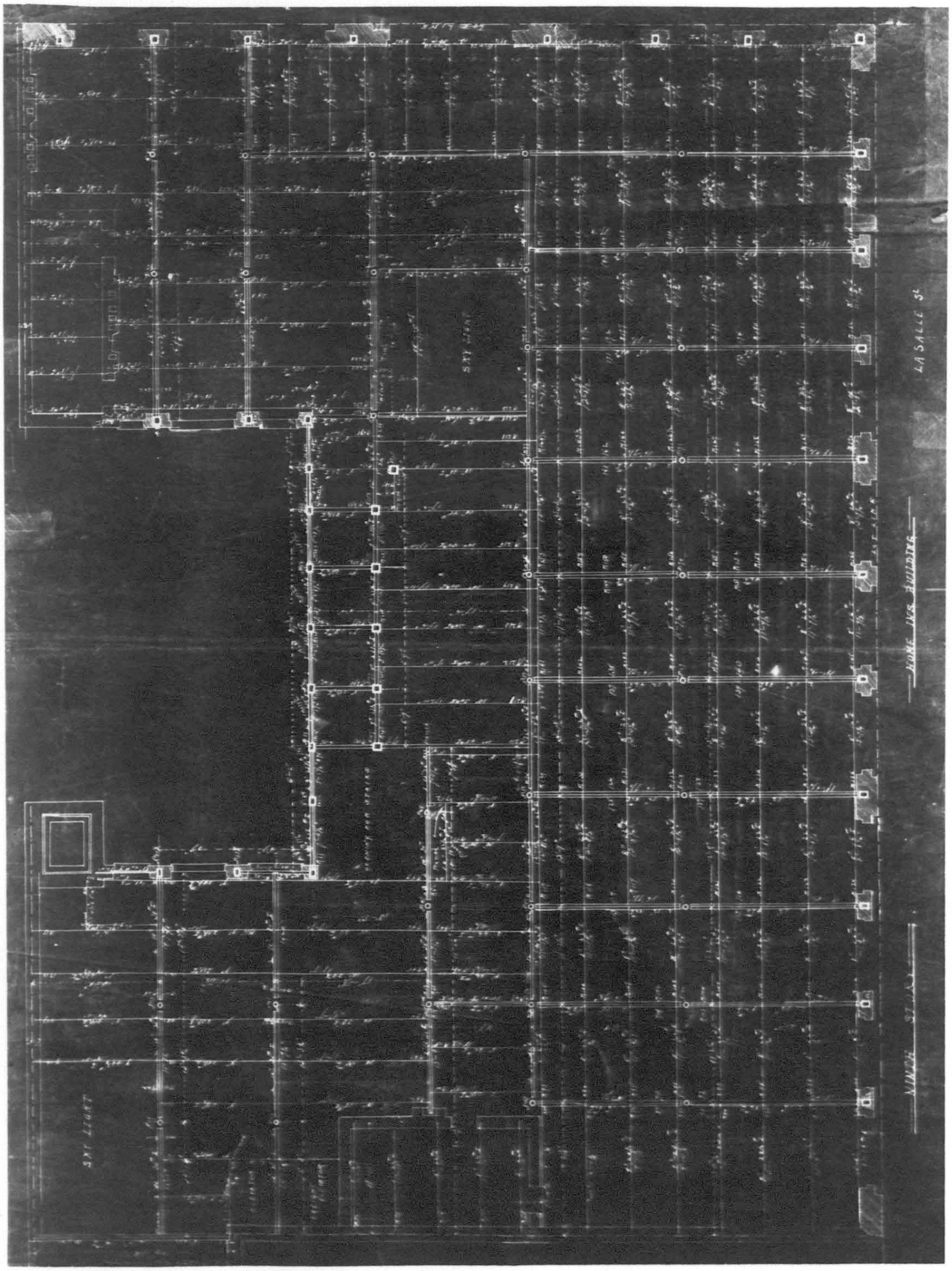

LA SALLE St
HOME INS BUILDING

Figure 11

Home Insurance Building, Structural Details[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 42.

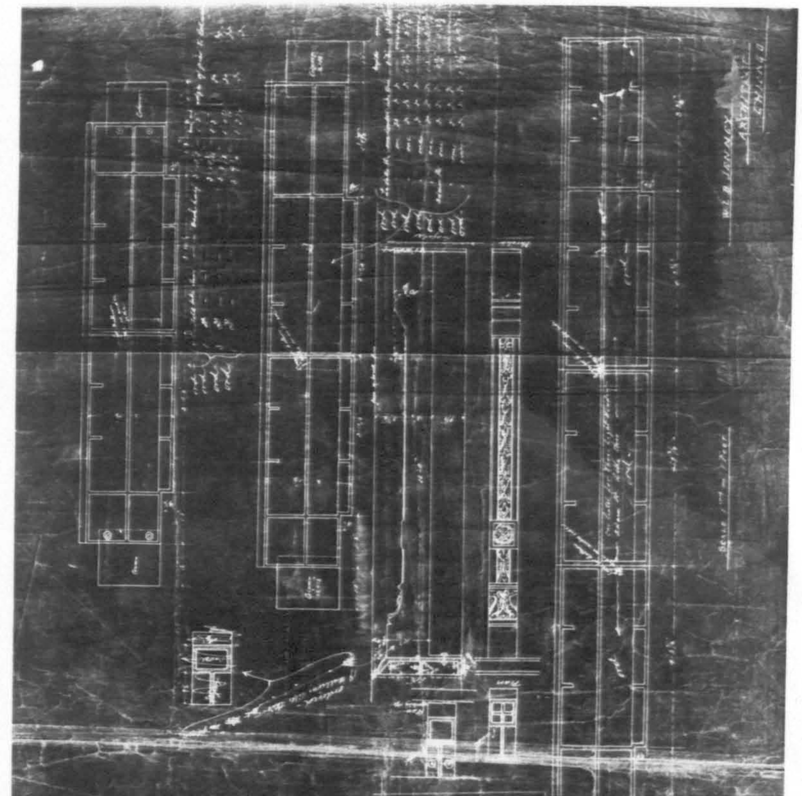
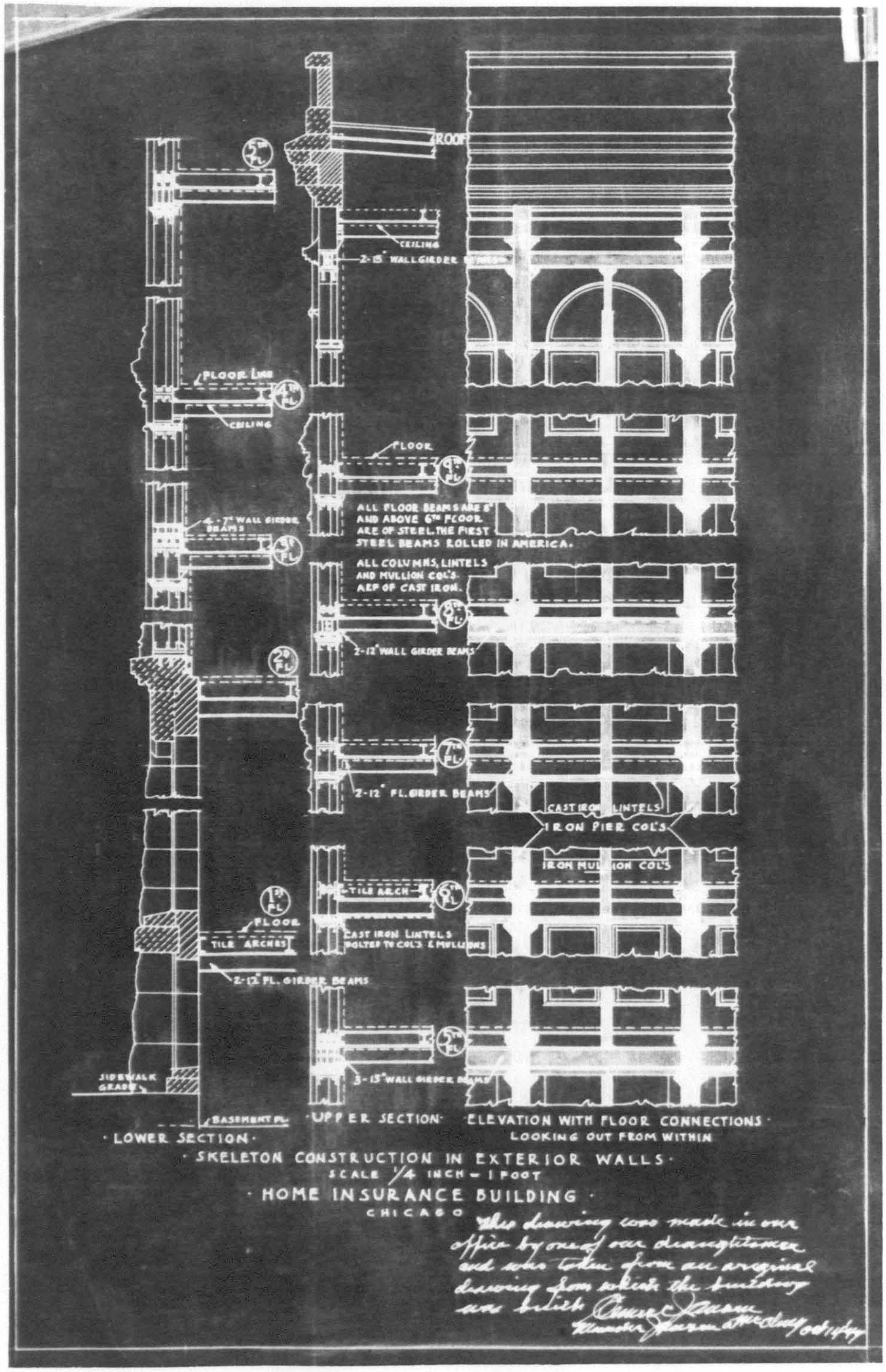

HOME INSURANCE BUILDING
DIAGRAM OF IRON WORK - EXTERIOR WALLS. 2ND STORY
No 20

Figure 12

Home Insurance Building, Skeleton Construction in Exterior Walls[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 46.



ROOF
CEILING
2-15" WALL GIRDER BEAMS
FLOOR LINE
CEILING
FLOOR
ALL FLOOR BEAMS ARE 8" AND ABOVE 6TH FLOOR ARE OF STEEL. THE FIRST STEEL BEAMS ROLLED IN AMERICA.
ALL COLUMNS, LINTELS AND MULLION COL'S. ARE OF CAST IRON.
2-12" WALL GIRDER BEAMS
2-12" FL. GIRDER BEAMS
CAST IRON LINTELS
IRON PIER COL'S
IRON MULLION COL'S
TILE ARCH
CAST IRON LINTELS BOLTED TO COL'S & MULLIONS
FLOOR
TILE ARCHES
2-12" FL. GIRDER BEAMS
3-15" WALL GIRDER BEAMS
SIDEWALK GRADE
BASEMENT FL.
· LOWER SECTION ·
· UPPER SECTION ·
· ELEVATION WITH FLOOR CONNECTIONS ·
LOOKING OUT FROM WITHIN
· SKELETON CONSTRUCTION IN EXTERIOR WALLS ·
SCALE 1/4 INCH – 1 FOOT
· HOME INSURANCE BUILDING ·
CHICAGO
This drawing was made in our office by one of our draughtsmen and was taken from an original drawing from which the building was built

top floor. Continuous stone sill- and lintel-courses confined spandrels of brick and terra-cotta at each floor, increasing the quality of horizontality. Thus the structural expression lacked authority; it suggested several low buildings placed one on top of another. This "layer-cake" effect was further emphasized within each horizontal division, by pilasters which were treated as units, each with a stone base, a brick shaft, and a terra-cotta capital (Figure 6). The plane cornice was mild and unobtrusive. The remaining space was glass.

Hard-burned brick was used throughout the building; it was laid in mortar to which 30 per cent of "good" cement was added at the time of using. Every brick was rubbed into place to prevent voids, after which each joint was filled with mortar.[1] According to Jenney's calculations, this masonry could safely carry eight to ten tons per square foot, depending upon the hardness of the brick and the care taken in placement. Every stone course was anchored to minimize displacement.[2]

Clay tile was used for fireproofing throughout the building except as noted. Plastered interior partitions were built up of 6" tile, and the floor arches were of flat

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[1] Jenney, William LeBaron. The construction of a heavy fireproof building on a compressible soil. October 1, 1885. p. 3.

[2] Ibid.

hollow tile. When the partitions ran with the arches, T-iron was laid from beam to beam across the tile arch to prevent movement and settlement in the partitions.[1] All tile was laid by the Wight Fireproofing Company.[2] Marble was used generously throughout the building, particularly in the lower stories, for flooring and wainscoting.

Jenney used the invention of a Mr. C. N. Pay[3] for his electrical system; picture molding enclosing the conduit channels ran around each room and along the corridors. The wiring was distributed to these channels from the elevator cylinder shaft, and lead pipes carried it through partitions and from one molding to the next.

When the construction of the Home Insurance Building had reached to the sixth floor, Jenney was faced with a very unusual problem. A story was being circulated that the expansion and contraction of the building would crack the walls and endanger the lives of pedestrians. This and similar rumors reached the office of the Home Insurance Company in New York, and the officials seriously considered roofing the building at the sixth floor. Jenney again suggested an investigation by a competent engineer. The building

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[1] Jenney, William LeBaron. Some other particulars of the Home Insurance Building. (ca. 1900.) p. 2.

[2] Mundie, op. cit., p. 20.

[3] Jenney, William LeBaron. Some other particulars of the Home Insurance Building. (ca. 1900.) p. 2.

committee hired a Mr. Norman S. Patton, who then spent several weeks examining the building, the working drawings and calculations. The officers of the company came to Chicago in order to discuss Mr. Patton's report. Daniel H. Burnham, who had formerly worked for Jenney but had by now established his own practice with John Welborn Root, was called in to testify; after his testimony, the investigation was ended and the work carried on.[1]

Shortly after this,

> When the framework had reached the sixth floor, a letter came to Mr. Jenney from the Carnegie-Phipps Steel Company of Pittsburgh. It stated that they now were rolling Bessemer steel beams and asked permission to substitute these for wrought-iron beams on the remaining floors. Jenney agreed, and the resultant shipment was the first ever made of structural steel. The columns continued to be cast-iron however, since plates and angles of steel, of which the later steel columns were built up, had not yet been rolled.[2]

The Home Insurance Building was completed early in 1885, the year that Henry Hobson Richardson completed work on his famous wall-bearing warehouse and wholesale store for Marshall Field. Late in the same year, tenants had filled the well-lighted offices, and the branch office of the insurance company was occupying the ninth and tenth floors; Jenney, by this time, had moved from his office in the Portland Block into a suite of offices on the second floor.

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[1]Ibid. p. 2.

[2]Starrett, W. A. Skyscrapers, and the men who build them. New York, Charles Scribner's Sons. 1928. p. 27.

Carl Condit said, "The utilitarian advantages of steel framing were enormous and immediately obvious to architects, builders and owners",[1] but this was not entirely true. The new flexibility of planning and the potentialities of larger glass areas (both of which had been made possible by new materials and new uses for old materials) were obvious, but many Chicago architects continued to design in the vernacular. This reluctance to accept a new form was due in part to the depression and series of strikes and riots which occurred in 1885-86.[2]

During the next three years, Jenney's office force was cut to a minimum, and a number of architects were forced to close their offices. This deflationary trend was reflected in the smaller number and the decreased size of new buildings erected during this period. In spite of the fact that steel beams had been used in the Home Insurance Building, few beams and almost no other steel sections were available to the average architect or engineer. Mr. Jensen stated in an interview that he himself had had to go work on a farm in Indiana in order to find employment during this period.

By late 1887, the trend had changed, and Chicago prospered once more. During the next five years, the volume of building in Chicago reached new proportions. It was in

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[1] Condit, C. W., op. cit. p. 116.

[2] Dedmon, Emmett. Fabulous Chicago. New York, Random House. 1953. pp. 149-162.

this period that the architectural firm of William Holabird and Martin Roche received the commission to design their Tacoma Building, which was to mark another step in the evolution of the skyscraper. In this building, as in the Home Insurance Building, the curtain-wall principle was used, but Holabird and Roche carried it to a more advanced stage of development. Here, for the first time, rivets were used to fasten the skeleton together. Cast iron, wrought iron, steel, and glass were the materials used. Because of this new method of fabrication, labor costs were materially reduced and construction efficiency increased. Holabird and Roche had not realized the full potential of skeleton construction, however, for two heavy bearing walls had been used within the building. The Tacoma Building, completed in 1888, for many years claimed the distinction of being the world's first skyscraper.[1]

At this time, Leroy S. Buffington, an architect in Minneapolis, designed and patented an idea. Buffington's Project (Figure 13), which he referred to as a "Cloudscraper", was unique in its conception. His plan included twenty-seven floors within an 80' x 80' area.[2] The building was to

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[1]Tallmadge, Thomas E. Architecture in old Chicago. Chicago, The University of Chicago Press. 1941. p. 194.

[2]Microfilm Roll No. 21: Leroy S. Buffington. Burnham Library-University of Illinois Architectural Microfilming Project. June, 1952. (Original "Cloudscraper" drawings. Frame Nos. 142-162.)

Figure 13

Proposed "Cloudscraper", Perspective[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 21: Leroy S. Buffington. Frame No. 145.

have had slight indentations on each side, and rounded corners. The plan above the first floor was symmetrical. A central core housed four skip-stop elevators located in each corner of a double stair arrangement which had the shape of a Greek cross. A corridor around this square core led to offices located at the perimeter of the building. Frederick Baumann's system of isolated footings was to have been used to carry the weight of the iron skeleton. The proposed frame consisted of a series of laminated and riveted iron posts, which were braced diagonally, as were latticed bridge girders of the period. The exterior was to have been of random ashlar masonry in the style of Henry Hobson Richardson.

Buffington received his patent, No. 383,170, "Iron Building Construction", on May 22, 1888. Soon after the patent had been issued, he was in New York filing a suit against the owners of a new building at 60 Wall Street, for infringement of rights.[1] The claim was defeated. Sixteen years later in 1904, Buffington claimed he had not been properly represented in the original suit and re-opened it. Almost simultaneously he filed a second suit against the First National Bank and the Chicago and Northwestern Rail-Road jointly, in Chicago.[2] The New York suit failed. After

[1]Mundie, op. cit., p. 91.
[2]Ibid. p. 92.

William LeBaron Jenney had been a principal witness for the defendants in Chicago, the Home Insurance Building was recognized as having been prior to Buffington's patent; therefore, the Chicago suit was thrown out of court. During this time, Jenney and Buffington frequently corresponded; these letters and a copy of Buffington's original patent are recorded on microfilm in the Burnham Library of Architecture.

In both lawsuits, Buffington claimed to have conceived the "Cloudscraper" as early as 1882, and this date appeared on several of the original drawings.[1] Professor Turpin C. Bannister, in a lecture at the University of Illinois in 1950, said that the 1882 date had since been proved fraudulent.

Associated with Buffington during the 1880's was Mr. Harvey Ellis, a brilliant draftsman and delineator. There is on file at the University of Minnesota an original perspective of the "Cloudscraper", dated 1888 (Figure 13). It is curious to note that Buffington's best architecture was done at the time Harvey Ellis was employed by him, and that very little good work was done by Buffington before Ellis had arrived or after he left. Buffington died in 1929, still claiming that he should have received royalties on every skyscraper ever erected.

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[1]Microfilm Roll No. 21: Leroy S. Buffington. Frame Nos. 142-162.

William B. Mundie in his manuscript on skeleton construction said,

> All he (Buffington) patented was the use of . . . his laminated steel plate column. . . . This column was so extravagant that no one ever had the desire to use it. . . . No architect or engineer of any scientific knowledge would be guilty of using it; in skeleton construction it was worthless.[1]

In 1931, after the Estate of Marshall Field had purchased the Home Insurance Building and the adjacent land to the north, a committee was established by the Marshall Field Estate, another by the Western Society of Engineers, and a third jointly by the Chicago Chapter of the American Institute of Architects and the Illinois Society of Architects; these committees had as their purpose the investigation of the demolition of the Home Insurance Building. Although for the most part they substantiated the original theories and explanations of William LeBaron Jenney and his associates, these three groups did not always arrive at the same conclusions. The Field Committee, headed by Thomas E. Tallmadge, was composed of such outstanding authorities as William B. Mundie; Earl H. Reed, architect and Superintendent of the Historic American Building Survey in Illinois; Richard E. Schmidt, Ernest R. Graham, Andrew N. Rebori, Trent E. Sandford and Alfred Shaw, architects; Charles B. Pike, President

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[1] Mundie, op. cit., p. 92.

of the Chicago Historical Society; George Richardson, Trustee for the Field Estate; and Mark Levy, President of the Chicago Real Estate Board. They concluded:

> As in the case of every great invention, skeleton construction in its completeness was not nor could it have been discovered by any one man nor expressed in any one building. The early buildings for this reason are all more or less transitional and experimental. Each learned from the experience of the preceding and added its contribution in the development of the idea. It is, however, entirely possible, from a consideration of the evidence, to appraise the relative importance of each in terms of its originality and its influence on the work which followed. Acting on this conviction we have no hesitation in stating that the Home Insurance Building was the first high building to utilize as the "basic" principle of its design the method known as skeleton construction, and that there is convincing evidence that Major Jenney, in solving the particular problems of light and loads appearing in this building, discovered the true application of skeleton construction to the building of high structures and invented and here utilized for the first time its special form.[1]
>
> We are also of the opinion that owing to its priority and its immediate success and renown the Home Insurance Building was in fact the primal influence in the acceptance of skeleton construction; and hence, is the true father of the skyscraper.[2]

The Committee of the Western Society of Engineers, consisting of J. C. Sanderson, J. L. McConnell and F. J. Thielbar, came to this conclusion:

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[1]Report of the Committee appointed by the trustees of the Estate of Marshall Field for the examination of the structure of the Home Insurance Building. Chicago, The Alderbrink Press. 1939. p. 17.

[2]Ibid.

> The steel skeleton was self supporting.
>
> The wind load was carried by the masonry as the steelwork was not designed to take wind bending.
>
> The masonry work could not be started at an upper floor without providing temporary support for the eight inches of masonry in front of the cast iron columns.[1]
>
> The walls were not of the curtain type but were as previously described of the ordinary bearing type. It is apparent that the designer of this building was reluctant to give up the known strength and security of heavy masonry walls and piers of the untried curtain walls and steel wind bracing of the modern skeleton building.
>
> The Home Insurance Building as previously stated was erected during the development period of the skeleton type of building and is a notable example of its type; while it does not fulfill all the requirements of a skeleton type, it was well along in this development and was principally lacking in not having curtain walls, no provision in the framing for wind loads, and not having made full provision for starting the masonry above the first floor.[2]

The committee representing the Illinois Society of Architects and the Chicago Chapter of the American Institute of Architects summarized as follows:

> In summarizing our findings, it must be kept in mind that this building was constructed during a transitional period and represented real pioneering in the adaption of metal framing to tall structures. It contained the essential elements of true skyscraper construction - there was a complete skeleton framework, floor loads were carried by both exterior and interior columns, wall loads were transferred to columns and columns

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[1]Demolition photographs disproved this conclusion.

[2]Mundie, op. cit., p. 153.

> were supported on independent footings. The fact that some of these elements existed in a rather primitive manner, and that the framework did not conform to our modern ideas of rigidity, should not be allowed to cloud our judgement of a courageous and creditable undertaking.[1]

During the demolition of the Home Insurance Building, and subsequent to the reports of the various committees, Mr. Henry Penn, a district engineer for the American Institute of Steel Construction, recovered two of the original beams from the upper floors of the building.[2] In a letter to Earl H. Reed dated December 10, 1951, Mr. Penn said,

> In regard to the Bessemer steel of 1884. I have laid aside at the junk yard a 7 in. and a 9 in. beam, pieces of which will be available for museum or other uses. The photomicrographs of the steel of 1884 differs from the photomicrographs of 1890 and indicates that the steel of 1890 was rolled with many more passes through the rolls than that of 1884. Also please note the difference in carbon content between these two steels.

On December 26, 1931, the Chicago Evening Post carried an article about the Home Insurance Building's demolition, Mr. Penn's research, and the information in Table 1.

Before the Field Report was printed in 1939, Mr. Tallmadge had received word of Mr. Penn's analyses and to the Field Report had made an addendum which supported this statement by Jenney:

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[1]Ibid. p. 149.

[2]Mr. Penn recovered beams from the original building and also from the 1890 addition.

Table 1

Properties of the Bessemer Steel Used in the Home Insurance Building in Comparison with Cast and Wrought Iron of 1884 and Silicon Steel of 1931[1]

	1884			1890	1931
	Cast	Wrought	Bessemer	Bessemer	Silicon
Carbon	3.29	0.02	0.08	0.15	0.40
Manganese	0.51	0.03	0.37	0.53	----
Silicon	2.27	0.20	0.02	0.02	0.20 min.
Sulphur	0.08	0.07	0.06	0.08	0.05
Phosphorus	0.51	0.45	0.14	0.22	0.04
Tensile Strength	--	50,250	60,820	63,310	80,000 min.
Yield Point	--	35,330	46,450	43,500	45,000
Elongation in 8 inches	--	10%	21%	28.5%	15.8%

[1]From an article in the Chicago Evening Post, December 26, 1931.

> In this building the first Bessemer steel beams were used, manufactured by the Carnegie Phipps Company, who stated at the time that the Home Insurance Building was the first in the United States to use steel beams in its construction.[1]

In an interview in August, 1952, Mr. Penn stated that the steel sections, when removed, were in excellent condition.

E. The Manhattan Building

In the spring of 1889, William LeBaron Jenney had received the commission for the Manhattan Building and was ready to start preliminary drawings; Dankmar Adler and Louis Sullivan were completing work on the Chicago Auditorium (theater, hotel, and office building). On June 7, 1889, a permit was issued for the Manhattan Building to be erected on a lot between Dearborn Street and Plymouth Court (then Third Avenue).[2]

Here Jenney was faced with a new problem, that of designing a very tall building with two party walls and with two primary elevations. About this Jenney said:

> The building has two facades, the site being about 150 feet long on each street and 68 feet in depth from street to street. On the north is a building occupied by printers, in the basement of which are three boilers against the party walls, furnishing power for the steam presses, and on the south a fine office building, the basement for rent as stores and shops.[3]

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[1]Jenney, William LeBaron. Some other particulars of the Home Insurance Building. (ca. 1900.) p. 1.

[2]Randall, op. cit. p. 120.

[3]Mundie, op. cit. p. 63.

Instead of using the party walls, thereby depriving the north building of its source of power, Jenney preferred to ignore both existing walls; he planned his new building without tie or bond to either adjoining building.

The 12" north and south walls of the Manhattan Building were built up of two layers of hollow tile,[1] and were carried independently, story by story, on a double set of cantilever beams; these beams were supported by the first row of interior columns and anchored to the second row of columns. At the tenth floor, the building was offset one complete column bay, and continued to rise vertically above the first row of interior columns.

The interior columns acted as a fulcrum for cantilever beams and supported columns for the walls which rose above the tenth floor; the beams also supported the two end wings. The interior columns were vertical truss members for a series of tie rods which crossed diagonally from the top of one column to the base of the next on each floor; here was formed the first careful system of windbracing ever used in any building.[2] After the diagonal tie rods had been bolted to the columns and tightened by turnbuckles, they were enclosed by partitions. Because of the extreme height of the building, Jenney felt that the building could not be

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[1]Microfilm Roll No. 9: William LeBaron Jenney. Frame Nos. 54-83.

[2]Randall, op. cit. p. 120.

structurally sound unless wind loads had been taken into account.

The Manhattan Building was designed with a complete skeleton frame. The curtain walls and all floor loads were carried by fireproofed wrought-iron beams and cast-iron columns. Working on a limited budget, Jenney was unable to use Bessemer steel beams since they were still much more expensive than wrought-iron beams. Nevertheless, the Manhattan Building at that time was one of the lightest buildings ever constructed and was the first sixteen-story building of its type in the world.[1]

Architecturally speaking, the Manhattan Building was severe in comparison with the Home Insurance Building, and somewhat reminiscent of Jenney's earlier Leiter Building. Gone were the many bands of horizontal stone which broke up the Home Insurance Building facades. Instead, the elevations were almost austere, and fenestration was unique. Planned to admit as much light as possible along narrow Dearborn Street, was a series of projecting trapezoidal and circular bay windows. Above this, in the unobstructed upper stories, conventional windows were paired beneath circular arches and filled the spaces between the smooth brick fireproofing that covered the exterior columns. On the top floor, smaller

[1] Giedion, op. cit. p. 295.

rectangular openings, similar to those in Louis Sullivan's Auditorium, were arranged in groups of three beneath a typical Jenney cornice. Another cornice, richer and heavier, was set above a series of alternating large and small capitals at the twelfth floor. Ashlar masonry was used on the three lower floors, and large uninterrupted areas of glass formed the shop fronts along the street.

Louis Sullivan, in describing his seventeen-story Schiller Building (now the Garrick Theater), said that the Manhattan Building not only was an important step forward in the development of skeleton construction, but gave him his idea for the set-back Schiller tower.[1]

F. The Second Leiter Building

By 1890, William LeBaron Jenney was approaching the climax of his career as an architect. At that time he was enjoying a prestige almost unparalleled in Chicago; his many buildings were acclaimed by all,--his clients, his colleagues, leading architects, and engineers.

During this time, while the Manhattan Building was under construction, Jenney was asked to design a department store for his old client, Mr. L. Z. Leiter.[2] This store was

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[1]Mundie, op. cit. p. 70.

[2]Microfilm Roll No. 9: William LeBaron Jenney. Frame Nos. 84-146.

to be erected on the east side of State Street, between Van Buren and Congress Streets, to house Siegel, Cooper and Company, Mr. Leiter's tenants.

The Second Leiter Building was a major triumph for Jenney; here, on the busiest street in Chicago, he erected a building which was practically void of the lingering aspects of styles which had unappropriately adorned his earlier work. The aura of eclecticism had all but vanished. If the Manhattan Building was austere in comparison with Jenney's earlier work, the Second Leiter Building was even more so, compared to the Manhattan; yet it recalled the flavor of the original Leiter Building.

The technical problems that confronted Jenney here were not new, and they were dealt with as a matter of routine. He had solved a more difficult foundation problem in the Home Insurance Building, and the question of wind bracing had been much more vital in the Manhattan Building. (At this time he was fortunate in respect to budget; Mr. Leiter had approved the use of more expensive steel beams and girders, although he was a man who would not tolerate extravagance in any form.)

Above the independent grillage footings used in the Second Leiter Building, Jenney used a complete iron-and-steel skeleton to enclose almost 60,000 square feet of floor space, and clothed this frame with smooth planes of white

Maine granite and sheets of glass. For the first time in his career, Jenney allowed the negative (glass) areas of a facade to surpass the positive (masonry). The granite defined and protected his columns and spandrel beams, as the heavier corner and intermediate piers rose to accept the chaste cornice (Figure 14).

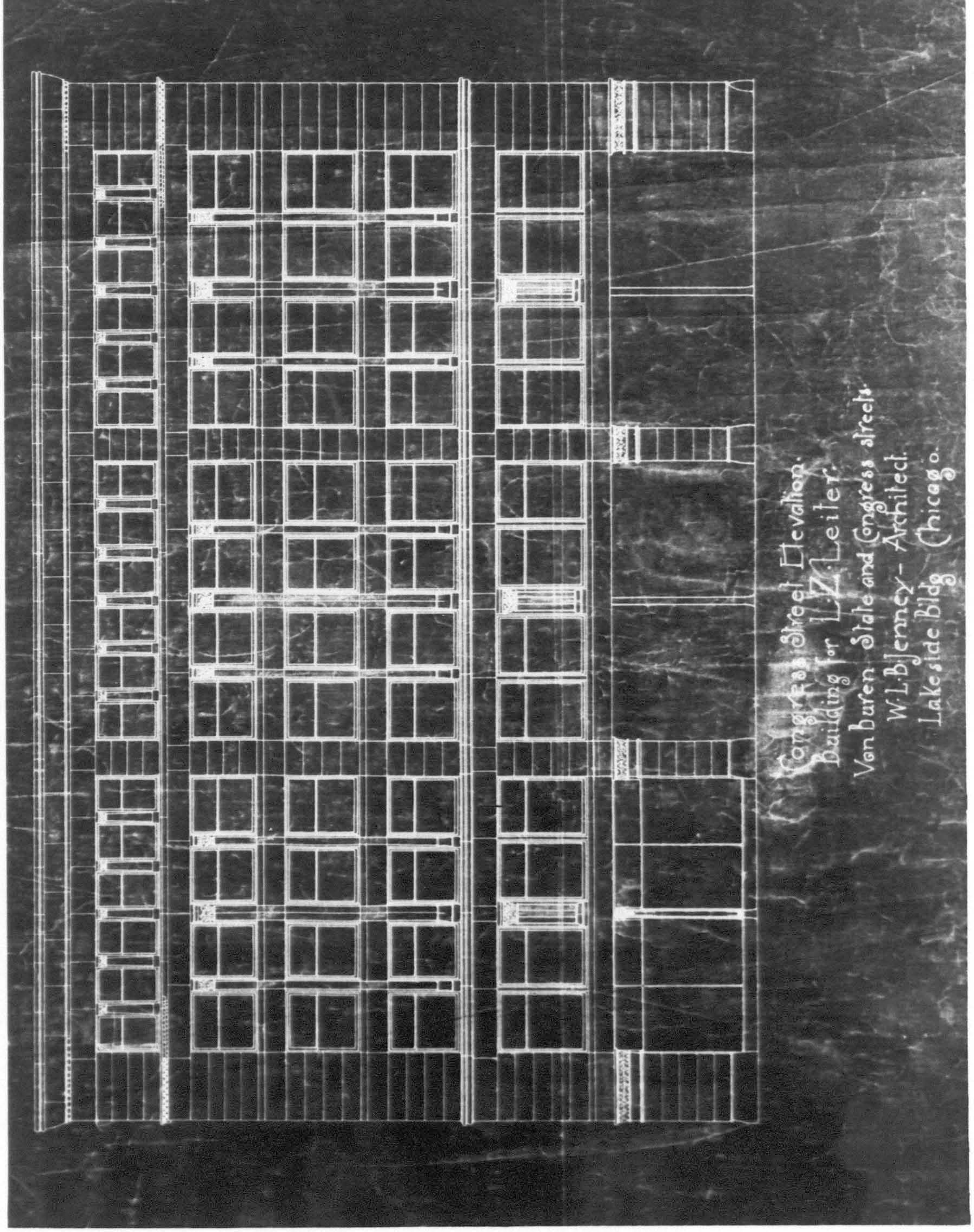
The Second Leiter Building became the dominant element on State Street, in spite of the fact that it was not significant for its eight-story height; here was the frank expression of structure which marked the beginning of a trend in the development of modern architecture. This period in Jenney's life was coincident with the change in direction of the architectural pendulum as it swung from over-ornamentation to austerity.

Today the Sears, Roebuck & Co. occupies this Leiter Building. In 1952, an arcade was cut through the first bay on Congress Street to allow for the widening of Congress Street into a superhighway. Jensen, McClurg and Halstead, successors to the original Jenney firm, were the architects.

Figure 14

Second Leiter Building, Congress Street Elevation[1]

[1]Burnham Library-University of Illinois Architectural Microfilming Project. Microfilm Roll No. 9: William LeBaron Jenney. Frame No. 98.


Congress Street Elevation.
Building for L.Z. Leiter.
Van Buren, State and Congress streets.
W.L.B. Jenney - Architect.
Lakeside Bldg Chicago.

G. His Late Practice and the Influence of the World's Columbian Exposition

While work was still progressing on the Manhattan and Second Leiter Buildings, William LeBaron Jenney continued to receive sizeable commissions; in 1891 he formed a partnership with William B. Mundie. Their Ludington Building, built during that year at 1104 South Wabash Street, was unusually clean in appearance, had an all steel frame, and marked a continuance of the firm's modern thinking.[1] The Fair Store was erected the same year on Adams Street between State and Dearborn Streets.[2] Here, as in the Leiter Building, the skeleton was expressed as an integral design feature, and glass was used more generously than ever before to create greater display areas in the lower two floors; Ionic capitals reappeared, however, marking the beginning of a return to the past.

During this time, Jenney was appointed to the Commission of Architects for the World's Columbian Exposition. He served under his former employee, Daniel H. Burnham, who had been elected Chief of Construction. John Welborn Root (designing partner in the firm of Burnham & Root), Louis

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[1] Randall, op. cit. p. 124.

[2] Ibid. p. 127.

Sullivan, William Holabird, and Martin Roche were a few of the leading Chicago architects on the commission.

The untimely death of Root in 1891 spelled disaster for American architecture; Burnham, without the leveling influence of his brilliant partner, used his own organizational ability and business acumen to persuade the commission to make the fair a neo-Renaissance paradise. Burnham imported such leading eastern eclectics as George B. Post, Richard M. Hunt, Charles F. McKim and Stanford White. (Everyone but Sullivan succumbed to this exploitation of classicism. At the fair, the vigor of the "Chicago School" and the genius of Sullivan lived in his Transportation Building; it stood proudly by itself in the fabulous "White City".) Jenney's engineering creativity was put to a test when he designed the dome for the fair's Horticulture Building, but the results were hidden by classic details. He considered the fair a tremendous success!

The years that followed brought new clients to Jenney but dubious laurels. He not only approved of the neo-classic trend but became engrossed in it. His sketches for the Illinois Memorial to the Civil War Dead at Vicksburg were prolific in detail. He further perpetuated and abetted the new trend, as did many of his contemporaries, by designing almost exclusively in this medium. At the turn of the century Jenney and Mundie won the competition for the

Chicago National Bank commission, after which they received a series of similar commissions all over the country.

Before his death in California in 1907, William LeBaron Jenney was admired and praised by practically everyone who knew him or his earlier work. He was a member of the best clubs, including the Union League which he designed in 1885, various architectural societies, the Military Order of the Loyal Legion, and many others. He was a prominent raconteur and gourmet, and attended all leading social functions. He served on reception committees for presidents and princes, learned Spanish to attend an international convention in Madrid, lectured at the Art Institute of Chicago, and published papers in leading periodicals.

Mr. Jensen, in a recent interview, spoke of Major Jenney with an almost religious respect for his architecture, his theories, and his person.[1]

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[1]Elmer C. Jensen became a partner in the firm of Jenney, Mundie and Jensen when William LeBaron Jenney retired from active practice in 1905.

V. CONCLUSIONS

Chicago's rise from an obscure town to the nation's second largest city has been phenomenal. The Great Fire of 1871 cleared the way for the development of large scale building ventures. By the 1880's, Chicago was on its way to being the most important rail center and inland port of the country. This fact was responsible for an enormous influx of financial power which was concentrated in the downtown section of the city, and gave rise to a sudden, desperate need to house numerous new businesses in the face of the soaring real estate values. The advent of the power elevator, the discovery of new materials, and the theories of Frederick Baumann opened the way to the fulfillment of this need. Thus Chicago became the logical place for the development of the first revolutionary form in architecture since the Gothic cathedral.

Skeleton construction was not the contribution of one man, but was the result of an evolutionary process occurring simultaneously in Europe and America, and culminating in Chicago. Paxton, Bessemer, Labrouste, Prefontaine, and many other men, had made significant contributions on the Continent before the issue became vital in Chicago. The elaboration of the theory of isolated piers was the necessary contribution of every Chicago architect who later designed a tall building; men like William LeBaron Jenney removed all guesswork and transformed a theory into an exact science.

Before 1879, masonry walls supported floor loads. In Jenney's First Leiter Building, cast-iron columns and a solid wall were juxtaposed, and a part of the floor loads was carried by the iron; the Leiter Building was the first of its type to deviate from accepted wall-bearing principles. Because of this and the architectonic treatment in the street elevations of the building, it became one of the most important transitional buildings in the world, the forerunner of Jenney's complete skeletal system of framing.

This he accomplished five years later in the Home Insurance Building, which became the most significant single building of the "Chicago School". Masonry and iron were still used in combination, but here for the first time, all iron members were imbedded in the masonry and bolted together to form the integrated skeleton framework which was to become standard for the skyscrapers of today.

Even so, the skeleton of the Home Insurance Building was not completely developed, in terms of today's construction, for Jenney himself was unsure of his invention. His metal framework almost surely would have carried the entire load of the exterior walls, if he had not constructed walls so thick (in the effort to give his masonry as much bearing value as possible) that they could probably have supported themselves without the iron. Several years later, William Holabird and Martin Roche improved upon Jenney's system, when they used thinner walls in their Tacoma Building of 1888.

After Jenney, too, had improved this system, and had invented a practical method of wind-bracing for the Manhattan Building, and after steel had become readily available and economical, the full potential of skeleton construction was enthusiastically accepted and carried forth by most of the Chicago architects. Perhaps never in the history of the world have architects and engineers produced, within a limited area and within the short span of thirty years, so great a concentration of outstanding architecture. (Some examples are: the Reliance Building, by Burnham and Root; the Schlesinger-Mayer Department Store (now Carson-Pirie-Scott & Co.), by Louis Sullivan; and the Marquette Building, by Holabird and Roche.) The collective work of this period is referred to as the "Chicago School" of modern architecture, and its primary contribution was the mastery of a new structural and aesthetic form, at first called "Chicago Construction"; from this school came a new word--the skyscraper!

The Second Leiter Building was Jenney's most mature and articulate work; it marked the beginning of an architectural trend which was later expressed by, and incorporated into, the theories of the Bauhaus movement in Germany. This architecture has been labeled the "International Style" by Henry Russel Hitchcock and Philip Johnson. If the Second Leiter Building was the zenith in Jenney's career, then the series of neo-classic buildings designed by Jenney after the World's Columbian Exposition, must have been its nadir.

Jenney played one more contributive role in the evolution of the skyscraper, that of educator. Most of the leading "Chicago School" architects received at least a part of their training in Jenney's office, and he took pride in this fact. Sigfried Giedion says that Jenney did much the same thing in Chicago as did Peter Behrens in Germany or August Perret in France. According to Mr. Jensen, Jenney personally supervised the education of the men who came to work for him, gave them many opportunities to learn, and saw to it that each man had a chance to do every kind of architectural work in the office. Such outstanding men as Daniel H. Burnham, William Holabird, Louis Sullivan, Louis Ritter, Martin Roche, William Mundie, Elmer Jensen, and others, were all, at some time or another, Jenney's pupils.

In William LeBaron Jenney, we see the designer with a flair for selection and a penchant for the flourish; but we see, moreover, the architect whose genius for integration made possible the Home Insurance Building. This man's name is known to few people outside of his profession, but skyscrapers everywhere are a tribute to his endeavors.

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VII. APPENDIX

APPENDIX A: SELECTED REFERENCES

The five rolls of microfilm supplied by the Burnham Library of Architecture, were used constantly as reference material because they contained the original drawings for the four principal buildings discussed in the text of this thesis, an unpublished manuscript on skeleton construction by William B. Mundie, and numerous papers written by and about William LeBaron Jenney. The Mundie manuscript was unusually helpful because of its first-hand account of Jenney's architectural practice after 1884.

Randall's History of Chicago Building is practically a catalog of buildings in the Loop area. It was used continually to check erection dates, locations and similar specific information.

Peck's pamphlet, History of Building Foundations in Chicago, is the best single reference for this basic phase of the "Chicago School"; however, the value of Industrial Chicago should not be discounted.

The Marshall Field Report on the demolition of the Home Insurance Building was invaluable in checking the original drawings against the completed unit.

APPENDIX B: THE BURNHAM LIBRARY-UNIVERSITY OF ILLINOIS ARCHITECTURAL MICROFILMING PROJECT

Chicago, because of the fire of 1871, of necessity became the center of architectural development in the United States. It was in Chicago that the dream of the skyscraper became a reality; there were more advances in techniques in the decade following the depression of 1873 than in the hundred years which preceded it. Today the influences of these developments are everywhere. John M. Van Osdel, William LeBaron Jenney, Louis Sullivan, Dankmar Adler, Daniel Burnham, John Root, William Holabird, Martin Roche and Frank Lloyd Wright are but a few of the leaders of this Chicago School of Architecture.

Generally, Chicago's technical and aesthetic contributions to modern architecture are recognized; however, a comprehensive history of the Chicago School remains to be written. This is because documents and data for such a volume are not readily available. Some sketches, working drawings, specifications, etc., have been destroyed, some lost and others scattered throughout the country. Each day may bring similar losses.

Viewing this situation, several Chicago architects and engineers, including Earl H. Reed, Elmer C. Jensen and the late Frank A. Randall, proposed that an architectural archives be established at the Burnham Library of Architecture of the Chicago Art Institute. Miss Ruth Schoneman, Librarian at the Art Institute, proposed a plan to microfilm working drawings and other material of significance in Chicago's development. Since the resources of the Burnham Library were inadequate, it was proposed to Professor Bannister, Head of the Department of Architecture at the University of Illinois, that the University cooperate in this project, and that in exchange for this cooperation, the Ricker Architectural Library at the University would become a depository for duplicates of all microfilms made during the course of the project. . . .

This cooperative plan was put into effect in September of 1950. Mr. Reed and Mr. Randall served as co-chairmen of the Advisory Committee, which was composed of Professor

Bannister, Miss Schoneman, Mr. Alfred E. Hamill, Trustee of the Art Institute, and Professor W. C. Huntington, Head of the Department of Civil Engineering at the University of Illinois. . . .[1]

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[1]Peterson, Charles E. American Notes. Journal of the Society of Architectural Historians. Vol. 11, No. 1. March, 1953. pp. 27-28.

APPENDIX C: SIDELIGHT

PHILIP JOHNSON'S ARCHITECTURAL SHOW PRESENTS THE CASE FULLY

Display at Museum of Modern Art Leaves Only Consolation That New York Has Done Job Better

By Henry McBride

Philip Johnson, I very much fear, is destined to die young. Some New Yorkers will probably massacre him--and shortly. Do you know what his latest is? He has arranged an exhibition in the Museum of Modern Art that tends to prove Chicago invented skyscrapers. He snatches the one aesthetic glory that we have left, snatches it in broad daylight with every one looking--and takes it to Chicago. Talk about gunmen!

It is true he only claims priority for the steel construction of office lofts. A man named Jenney did it, it seems, in 1884. Jenney was not an artist. He was a mere commercial architect. Jenney knew, of course, about the London Crystal Palace of thirty years previously, entirely of iron and glass, but Jenney did design the Chicago Home Insurance Building in 1884 in which steel beams were first used above the sixth floor. I, being a New Yorker at heart, am inclined to say, "Well, what of it?" but Philip Johnson, not being a New Yorker at heart, elevates this Jenney person to the heights.[1]

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[1] Portion of an article appearing in the New York Sun, January 21, 1933.