THE ARCHITECTURAL FORUM

DECEMBER 1927

LIBRARY AND MUSEUM REFERENCE NUMBER
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FROM AN ETCHING BY CHILDE HASSAM
LIBRARIES are not exempt from the operation of the universal law of evolution, under which organisms develop from the simple to the complex. Fifty years ago a library was a book dormitory, where the librarian slept with his tomes, seldom disturbed by the public; today it is a center of multifarious activities. In earlier days a person would go miles for a book; today it must be within effortless reach. The modern librarian advertises his wares like a merchant and strives to excel other libraries in the registration of readers and in book circulation. The degree of service depends largely upon location, the size of the community, and upon the ability of those in control to see the need of a properly arranged building, planned to accommodate readers and books economically and yet attractively.

Site. To facilitate such service the library should be easily accessible to the expected clientele. In a small town, where one building suffices, it may well be placed on a side street near the shopping center. A large city requires branch libraries to bring the books within reach of every home. The lot should admit of having ample light and air. A site sloping from front to rear benefits the basement and facilitates service. Many factors control the choice of a site, but the matter of cost usually dominates. The bibliophile or dilettante might prefer a shaded and bourned park, but business men, on the average library board, visualize the world through their pocket-books, and the economical site generally wins!

Determination of Size. The site determined, it is necessary to calculate the dimensions and proportions of the building. The architect should study the librarian’s requirements and convert the data furnished into a proper solution of the problem, to do which requires time and experience. He should estimate the size of building possible for the appropriation or, Vice versa, compute the amount of money necessary to construct and equip a suitable building, a structure appropriate to its surroundings.

The design of a library involves the hygienic accommodation of the greatest number of readers; the housing of the maximum number of books; and the architectural expression of the building’s purpose. With a given appropriation, it is necessary first to estimate the size and quality of the structure before developing the plans. Building costs vary in different sections of the country, but an average, which will include all items, may be struck on this basis:

- General construction, exclusive of metal stacks: 57 per cent
- Plumbing, heating, electric wiring and fixtures: 13 per cent
- Metal stacks, wood shelving and equipment: 20 per cent
- Architect’s fees and allowance for contingencies: 10 per cent

Assuming an appropriation of $300,000, 20 per cent would be $60,000. Dividing this by cubic foot cost of say 50 cents, gives 420,000 as the cubic foot limitation. The height of the building, to include basement and two stories, would approximate 42 feet, which divided into 420,000 yields 10,000 square feet as the ground area of the structure. With the appropriation of $300,000 we should endeavor to house 300,000 volumes and to accommodate 300 readers simultaneously seated, allowing 20 square feet per chair, which would require 9,000 square feet total floor area in the various reading, reference, children’s periodical, club and similar rooms. The 300,000 volumes may be apportioned 250,000 to the stacks and 50,000 to shelving throughout the various reading rooms. Five stories (each of 7½ feet) of stacks may be contained in the height of the building, allotting to each story one-third of the 250,000 volumes or 50,000, which divided by 20, the average number of volumes per square foot, leaves 2,500 square feet as the ground area probably necessary for the stacks.

Rather than carry the stacks vertically through the building, it is better, where possible, to arrange two or three tiers of stacks below the first floor. For two such stories the 250,000 volumes would require 6,250 square feet, and for three stories, 4,160 square feet. This arrangement has given satisfaction in the libraries at Wilmington, Del., and Highland Park, Detroit; (Plates 105 and 98) in the Knight Memorial at Providence (page 501), and elsewhere. Such
stacks can be kept in the darker central part of the basement (which is better for books than sunlight), thus giving the lighter portions of the basement to work rooms, for which good lighting is necessary.

Properly constructed stack spaces are readily warmed and ventilated, owing to the vertical slits at the bottom of each tier, whereby air circulation is engendered. In a large building, whose cost exceeds a million, it is possible to combine both arrangements of stacks, by extending them vertically through the central portion of the building so that the periphery of the structure on each story may be allotted to readers or workers. An economical library plan devotes minimum spaces to lobbies, corridors, stairways and such "circulation," and the maximum area to the library proper. In some monumental library buildings one-half of the ground area is used for walls, halls, stairs, etc., but it should be possible to limit them to 20 per cent of the area, and yet do justice to their functions.

In the example under discussion, deducting 20 per cent from the 10,000 square feet, will leave 8,000 square feet, net area, in the basement and first story and (allowing for possible light wells) 6,500 square feet in the second story, or a grand total of 22,500 square feet. These areas may be apportioned among the library's departments, possibly on this basis:

<table>
<thead>
<tr>
<th>Department</th>
<th>Space (sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charging and delivery</td>
<td>1,000</td>
</tr>
<tr>
<td>Stack (area of two tiers in basement)</td>
<td>6,250</td>
</tr>
<tr>
<td>The various reading rooms</td>
<td>9,000</td>
</tr>
<tr>
<td>Catalog, work rooms and toilets</td>
<td>2,750</td>
</tr>
<tr>
<td>Librarian and staff rooms</td>
<td>2,000</td>
</tr>
<tr>
<td>Lecture room</td>
<td>1,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22,500</strong></td>
</tr>
</tbody>
</table>

The boiler and coal room might be below basement level, where in many instances they actually are.

Provision for Expansion. The size of a library building bears a natural relation to the population it is to serve. During the pre-war years, the Carnegie Corporation's donations were figured on a basis of $2 per capita, but with the increased costs of construction, $3 scarcely suffices, except for the simplest types. Where a new building replaces an older, there is usually an immediate increase in the patronage and within 10 to 15 years it becomes congested and requires expansion for both readers and books. It is well, therefore, to design the building so that it may be enlarged. Where such expansion has not been originally considered, it very frequently requires considerable ingenuity to secure a good result. The plan of the Saginaw Library accomplishes the purpose by changing location of the main entrance, which the corner lot made possible.

Admission, General Control, and Delivery Room. "Entrance at grade level" is a slogan with some libraries. It precludes, however, having a well-lighted basement. This presents the alternative,—less exertion for the readers or more light for the workers. If the lot slopes sharply, both are attained. A library building is a "free for all" club house with no social barriers. Casual pedestrians are allowed by electrically lighted bulletin and by book exhibits in the front window designed like shop fronts. In a small library the adult public should enter and leave by one main doorway, admitting them through a vestibule, to delivery room. A separate entrance for children may be desirable. The delivery counter, in a small library, should be near the entrance,—single space behind being more serviceable than excessive area in front; people enter singly or in small groups,
but congregate beyond the counter. The delivery room is the heart of a small library; its activities vitalize every part. To minimize the personnel required, the control must be centralized by locating the delivery (or charging) counter where it commands readers, book shelves, and entrances. Where crowds are served, it is advisable to have a restraining rail to keep the people in line by the counter.

In large libraries auxiliary desks in the different reading rooms are centers of information and control. A formation that radiates from the central counter, like staff officers surrounding their emperor, is ideal for control and for economy of administration. The size and components of every delivery counter depend upon the librarian’s requirements and vary too much to be detailed here. There are three main elements—registration; charging or loaning; and receiving. In large libraries three separate counters may be necessary. The delivery space is the center of movement and commotion; it should be so disposed as to offer the least annoyance to those using the reading rooms. An adjacent room wherein to shunt garrulous gossips is a desideratum.

The delivery room should be well lighted, and its location may necessitate skylighting, in which case "actinic" glass in the ceiling sash will exclude the heat without interfering with the light rays. In cool climates diffusing glass of various kinds may be used. Ample artificial illumination, well distributed, is essential. The room should appeal by appropriate decoration in form and color. It should contain display racks for new acquisitions and informing bulletin boards. Settles are not out of place, and from the room may extend "open" fiction shelves, forming alcoves where the public may browse, and take the selected books to the charging counter to be recorded.

Circulation Department. In a small library this department is combined with the delivery room. In a large library it may be segregated from the reading rooms and be provided with a special street entrance, as in the New York Public Library. The importance of a library is based largely on the number of books circulated annually. Librarians of different localities vie with one another in enlarging their respective "circulations,"—sometimes at a sacrifice of the quality of books distributed. The workers in this department have opportunities of encouraging the use of edifying books. Bacon said: "Books can never teach the use of books," so the librarian’s knowledge may happily aid in directing the ignorant or uncertain readers to higher ideals.

Reading Rooms. The comfort, convenience, and seclusion of the public are enhanced by the proper location, arrangement and design of the reading rooms. The collaboration of librarian and architect is here vitally necessary. The size and shape of any reading room can best be determined by plotting out the furniture. The tables should be spaced about 5 feet apart and the same distance from the walls of the room. The details are too varied to enlarge upon here, since the individual preference of the librarian and the requirements differ with every locality. But a fundamental condition, applicable to every case, is that of maintaining a reasonable pro-rata cost per reader accommodated. In our unsophisticated problem we have allowed 9,000 square feet for reading and auxiliary rooms, to accommodate 300 readers at 30 square feet for each. The appropriation being $300,000 makes each of the 300 seating rooms $1,000 outlay, which is less than a third of the cost of the reader’s seat in many large city libraries, built at considerable expense.

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Delivery Room, Knight Memorial Library, Providence
Edward L. Titus, Architect
The selection of reading room chairs may make necessary a choice between beauty and strength—two qualities that do not always combine. The “Windsor” type is attractive, but it seldom withstands hard usage; the most enduring seems to be a chair without arms, with wood saddle seat, and with back, seat and legs thoroughly framed together and reinforced. The chair should be built up “free and easy,” with softwood cores veneered with the hard-wood selected for the finish of the room—preferably oak for service and for excellence of appearance.

Shelving. The book shelving should have a fixed bottom shelf, 4 to 6 inches above the floor level, with the other shelves carried on pins which fit holes in the uprights bored every inch apart in height to permit of adjustment for different sized books; a basis for total height is 11-inch centers between shelves, which will give from 6 feet, 10 inches to 7 feet for a total height of seven shelves including base and cornice. A depth of 8 inches suffices for the shelves excepting those for the larger volumes, certain reference books, encyclopedias, and technical works. The wall shelving requires no wood backing, but may rest against the plaster, unless it conceals heating coils, in which case the shelving must be supplied with wood backs insulated with asbestos and sheet metal to shield any books from the heat. Shelving cannot be properly made by the ordinary mill but only by manufacturers accustomed to cabinet construction. This applies to the furniture and technical library equipment throughout. Other concomitants to the rooms under discussion are dictionary stands, atlas cases, filing cabinets for clippings and for photographs. For atlases and folio, tables with sloping tops are convenient. The floor covering of all readers' room should be resilient and quiet. Cork carpet or cork tile are used largely in many libraries.

Newspapers and Periodicals. Newspaper reading in libraries is generally discouraged. As much space is occupied by the reader of a two-cent paper as of a two-dollar book, and newspapers are cheap enough for everyone to buy his own. Such a room is likely to become a dormitory for vagrants who seek it for repose rather than for edification. Some of the large libraries, however, allot space to current newspapers and storage for the bound volumes, for the use of persons with legitimate motives. For such rooms high stand-up desks with bread, sloping sides discourage lolling. Small libraries may subscribe to their local daily—half a dozen of them can be piled in a section of wall shelving in which the shelves have been replaced with cleats attached to the sides and sloping from top-center to bottom-front, with hooks or relays to hold the files.

Periodical space is indispensable. In college libraries, periodicals are cognate to the reference books and frequently impart more recent information. They may be variously cared for—slopeing shelves for the current periodicals with horizontal shelves beneath each, to hold the previous issues until ready to bind; or horizontal shelves, 4 inches apart, properly labeled for the current numbers with cupboards below for back numbers. In either case the shelves for displaying the magazines should be within eye range of a standing person to be entirely practical.

Catalogs. The catalog cases should be accessible to the public, the delivery counter, the reference room, and the cataloging workroom. It is difficult to locate them contiguously with all four elements enumerated, so the cataloging room is likely to be sacrificed. One solution is shown in the Knight Memorial Library, where the catalog trays are planned to slide both ways. The writer invented this system 25 years ago for Juniata College. It would not suffice for large libraries, where conflicts would arise too frequently between users on opposite sides of the cases. Such libraries must incur the expense of duplicate catalogs; the children's department, fur-
thencemore, will need its own in most instances. The standard tray holds 1,000 cards, or a possible 1,200 of thinner paper. Averaging five cards to a title, there would be required, for our imaginary 300,000 volumes, 1,500,000 cards, which would require 1,250 to 1,500 trays. It is desirable to limit the case height to 15 trays (13 are better), which would necessitate 64 to 100 trays horizontally. The width of trays approximates 6½ inches center to center. Therefore the frontal extent would be 45½ to 54½ feet, unless in double rows. Some standard cases have sliding shelves to rest the trays upon while consulting the cards, but this is objectionable, since one person obstructs the access to many other trays. It is better to have small "stand-up" tables, approximately 40 inches high, upon which to set the trays, the tables covered with a cork or similar surface. Separate catalog cases may be required for special collections, such as those devoted to music.

Special Departments. The sub-division of departments under special heads depends upon the demands made upon the library. In manufacturing towns it is necessary to have collections of genuine technical works. Books on patents and patent law are closely allied to the technological. Differing from these in appeal are the art and music collections. Each art folio should be laid flat on roller shelves. Broad tables with sloping tops are desirable for consulting the folders. Valuable books should be in cases with locked doors whose panels may be of wire mesh or glass. Thin music scores, if shelved upright, require racks with partitions not over 12 inches apart or with adjustable supports on the shelves. Large maps in frequent demand may be hung on spring rollers from a "canopy" at the ceiling. The average-sized maps should be pasted on muslin and folded to the dimensions necessary to fit shallow drawers designed for them. Photographs and clippings should be mounted and filed vertically in cabinets whose deep drawers are provided with cloth separators that slide along small rods. Very large photographs and pictures can be kept in portfolios placed vertically in cupboards with doors hinged at the bottom, to afford ease of access.

Children's Department. Ever-increasing thought and effort are being expended upon this department to cooperate with the schools in developing good citizenship. Branch school work has grown to large proportions. Publishers are specializing in juvenile books issued in such numbers that shell room needs frequent expansion. After school hours the children crowd to the library, and it is noteworthy that the parents of the majority are of foreign birth. In Cleveland's libraries the children must wash their hands before handling books, a useful lesson in cleanliness, which results in many improved homes.

Children are restless, and in a library they must be segregated from the adults either on the opposite side of the building under supervision of the main desk, or in another story. If in the basement, especial care should be taken to make the rooms damp-proof, airy and light. This position permits of direct entrance from the outside. If placed in an upper story the children should not enter the adult sections of the building. The problem has been solved at the Mount Pleasant Branch, Washington, where an outside stair admits the children to their department, divided into separate spaces for the "little folks," the grammar, and the high school grades (Plate 102). The heights of chairs and tables for children are proportioned to the users. The standard table top for children is 30 inches, for adults' 36 inches by 60 inches, dimensions practically standard.

Chub rooms in town libraries and seminar rooms in college libraries are essential adjoints. Advance notice to the librarian gives opportunity to prepare the books on the given subject, ready at the time.

Staff Offices and Work Rooms. Comfortable
quarters for the staff, including rest room, locker room, toilet room, possibly with shower, and kitchenette, will yield better results in efficiency and library results than those obtained from a disproportionate lecture room. A good librarian and an efficient staff are as essential to a library as a competent president and faculty are to a college, and it is equally important to maintain esprit de corps in a library.

In a small library it is usually necessary to locate the librarian’s office within easy reach of the delivery counter, but in larger libraries the librarian should be more secluded, where he can work with less chance of interruption. It is well for his room to be large enough to hold a table where the trustees may assemble for occasional board meetings, for which a separate room is an unnecessary luxury except in metropolitan libraries where it may be excusable. Combining the librarian’s and trustees’ rooms gives space to the former to conduct his work in unhurried quarters and to have his documents at hand when the trustees require his reports. A secretary’s room adjacent, where the callers may be received and their business analyzed without unnecessarily interrupting the librarian, is desirable. The working space and rooms should be ample to insure the proper running of the machinery of administration. The order and cataloguing rooms should be near the librarian’s office, for convenience of supervision, and should be within easy reach of the stacks either on the same level or by lifts. They are equipped with typewriters, shelf list cases, shelving, and work tables. Good light and air are vital to ensure the health of the occupants and to enable them to prosecute their arduous work effectively. A floor covered with cork carpet or good mastic is usually satisfactory, noiseless, and easy to walk upon.

A bindery is not necessary except in very large libraries, since it is usually cheaper to send books out for rebinding; but a room or space for ordinary repairs is desirable, and means should be supplied for warming the glue pots. Lavatories and sinks are requisites in all work or repair rooms. A receiving and unpacking room in basement or at grade level should communicate by lift with the work rooms just mentioned. The lift should be large enough to accommodate a book truck and one or two people. An electric push-button lift is the most useful. Passenger lifts for the public are expensive to install and to operate and are unnecessary except in buildings of several stories, where upper floors may be devoted to exhibition or lecture rooms much used.

Galleries for Exhibits. Exhibits of paintings and historical or other collections have educational value, but the cost of space required usually overbalances their value in a library. Collections increase by donations, often of questionable merit, and with the constant growth of the library, a state of mutual crowding is engendered which embarrasses both. It is better to devote the building to library work and to house collections in a separate structure. If a delivery room runs through two stories with a gallery around the upper level, it is profitable at times to utilize such space with museum cases for the exhibiting of small objects germane to the library work. Appropriate paintings, pictures and illustrations in the children’s room are always desirable and are not to be excluded elsewhere on the library walls if hung where they do not attract gazers to the detriment of readers. Statues and plaster casts of artistic value are likewise desirable when properly placed in relation to the architecture of the building.

Lecture Rooms. The lecture room, unless usable

An Interior, Knight Memorial Library, Providence
Edward H. Tilton, Architect
for other purposes, is likely to make the least return and should not, therefore, be too large nor occupy valuable space on the main floor. For this building the lecture room need not accommodate more than 125 to 150 seats, for which 8 to 10 square feet per seat are necessary to allow for aisles and platform space. The cubic foot content of such a room, with a 12-foot ceiling, would be 18,000, and at 50 cents (the cubic foot cost of our building) would represent $9,000 as the amount invested in the lecture room. Interest at 6 per cent would be $540, to which must be added the expenses of light, heat and janitor’s labor. It is usually better economy to hire a hall in the neighborhood for lectures and entertainments and to omit such a room from a library building, or at least to reduce it to very small dimensions.

In a Philadelphia branch the children’s room is converted on occasion into a lecture room, a large table becoming the platform. The combination works well, since the hours of use do not generally conflict.

Furniture. The furniture will consist of delivery or charging counter, catalog cases, bulletin boards, tables, chairs, shelving, and the various items of equipment for the rooms devoted to periodicals, newspapers, fine arts and special collections, as well as the suite for the librarian and staff, for the cataloging and work rooms, and for the lecture room. Our building, as before said, is intended to accommodate 300 readers, and for convenience we can assume that the tables will be the standard 3 feet by 5 feet size for four persons, making a total of 75 tables and 300 chairs. The 30,000 volumes to be distributed throughout the rooms will need about 1,000 feet of bookcases, five shelves high in the children’s room, and seven shelves high elsewhere, and will cost about $7500, if made properly. Metal shelving can be installed for nearly the same price, but it is usually not so attractive in its appearance.

Stacks. As before indicated, the amount of stack required may be calculated by multiplying the square foot area of the stack room by 20 volumes, if but one tier of shelves be required; by 40, if two tiers be required, and so on. Conversely, if we wish to know the size of stack room necessary to house 300,000 volumes in one tier, seven shelves high, divide by 20, giving 15,000 square feet; for two tiers, divide by 40, giving 7,500 square feet; for three tiers, divide by 60, giving 5,000 square feet, and so on. Metal stack construction is an invention of recent years, and its rapid development has kept pace with modern library demands. There are several makes of metal stacks upon the market, each claiming to have special features of superiority. A few systems are suitable where the conditions impose heavy loadings of superimposed tiers, and where compactness and strength are desirable. The weight of each tier of stacks, with its complement of books, may be figured at 125 pounds to the square foot. The cost may be roughly computed at 50 cents per cubic foot of stack, including floors.

There are two general types of metal stacks, the so-called “standard type” and the “bracket type.” There are radical differences in the construction of the various makes of stacks and in the use of cast iron, steel, and pressed or sheet iron. Before selecting one, a careful consideration should be given to the different types and makes, from full-sized models or, when possible, from working actually installed. Space will not permit of an analytical description of the different makes, but general points may be indicated, which might aid in selecting a type.

(a) Narrow upright supports between shelves

Photo: George B. King
Catalog Cabinets; Pasadena Public Library
Meyer Hunt and H. C. Chambers, Architects
make for economy. The space of a half-volume gained means 15 to 2 per cent increased volume capacity; that is, 1,500 to 2,000 volumes additional in every 100,000. This gain should be considered when the comparative prices of different makes and types of stacks are being judged before choosing.

(a) The provision for electric wires and switch plates on the stack ends is a point to be observed.

(b) The method of support for the electric conduits along the stack ceiling is important. They should not be wired to small beams, but holes should be drilled through the beams to support conduits.

(c) Many stacks are finished green, the color baked on. It is possible, however, to have the stacks finished in cheerful, light tones, though they will remain more easily with the constant use they receive.

(d) If several superimposed stack stories are required, some makes of stacks are to be preferred.

(e) The usual length of shelves is 3 feet, but there is an alternate length of 3 feet, 6 inches, which permits an appreciable increase in volume capacity.

(f) The shelves are usually made of solid steel, but there is also a shelf consisting of a parallel series of inverted U-shaped sections, connected with separators, which is stiffer than the plate shelf and which is often used.

(h) The ventilating slit below the bottom shelf, at the floor, should be vertical, not horizontal, as it is in older stack types.

(i) The shelves should be adjustable, every inch in height. The story height from floor to floor of each tier should be approximately 7 feet, 6 inches; in some cases it can be 7 feet. Less than that allows insufficient headroom for the ceiling lights in the gangways. The heights given admit of seven shelves with an average spacing of 11 inches and permit the lowest shelf to be raised above the floor with a vertical ventilating slit, and allow for thickness of supporting struts and flooring of the tier above, which are important details.

(i) For the stack flooring avoid glass, once much used from a fallacious idea that it admitted light to the upper shelves of the tier beneath. The light reflected from white marble, painted concrete or similar flooring is better.

In colleges where the upper stories and the honor men are allowed access to the stacks, it is well to provide small study alcoves, which will be much used. These suggestions do not exhaust details to be considered in weighting the relative prices and qualities of the different makes and types of stacks. To repeat, the lowest bid is not always the most economical; the number of volumes shelved and the quality of workmanship and service should be considered as highly important factors.

Lighting: The lighting of the library is of paramount importance, and to accomplish a satisfactory result it is well to follow the school house requirements and make the total glass area of reading rooms equal to 20 per cent of their floor area. The light from the windows will be effective in the room for a distance equal to about one and one-half times the height of the top of window from the floor. Ceiling lighting will be advisable for spaces not properly lighted by windows. The spacing of the bays or window openings is controlled, practically, by the ceiling heights and, aesthetically, by the effect to be produced. The classic proportions of a window are, height twice the width, or in some cases, one and one-half times the width. The height is limited in a reading room by the distance between the top of the wall shelving and the ceiling.
15-foot ceiling and 7-foot high shelving, there will be only 8 feet above the shelving or, allowing one foot for a cornice, but 7 feet left for height of window, which should be either 3 feet, 6 inches or 4 feet, 3 inches wide. The spacing between window axes will need to approach 8 feet in order to assure sufficient light.

Here are two hypothetical developments of these suggestions:

(A) Reading Room, 61 feet long by 25 feet wide, area 1,525 sq. ft.
Net glass area, one-sixth of 1,525, equals 253 sq. ft.
Ceiling of room, 15 feet high.
Windows 7 feet high by 4 feet, 8 inches wide, equals 32% sq. ft.
10 windows required, six on the side and two at each end.
Windows spaced approximately 8 feet, center to center.

(B) Reading Room, 141 feet by 32 feet, area 4,535 sq. ft.
Net glass area, 987 sq. ft.
Ceiling of room, 20 ft. high.
Windows 12 ft. high by 6 ft. wide.
15 windows required, 11 at the side and two at each of the ends.
Windows spaced at distances approximately 12 ft. on centers.

Note that Room A will accommodate 14 tables, 3 ft. x 5 ft., in two rows of seven each, and that each table will seat four readers; a total of 56 in a room of 1,525 sq. ft. or 27 sq. ft. per reader. Similarly, Room B will accommodate 51 tables in three rows of 17 each, and 204 readers in an area of 4,535 sq. ft., 24 sq. ft. per reader. It is preferable, however, to allow 30 sq. ft. per reader, since some of the tables will be omitted to allow room for a possible information desk, filing cabinets, dictionary stand, and similar items of equipment which the librarian may perhaps wish to install.

The objection is sometimes made to the “prison-like” aspect of a room lighted only by windows above the line of the 7-foot high wall shelving. To obviate this, it is possible to introduce occasional small “squeezed” windows framed in the shelving. If properly handled, these openings improve the exterior effect. Or, the window sills may be brought lower by sacrificing some small extent of the shelving.

Artificial illumination is produced by various types of electric lamps, of which the nitrogen is one of the more recent. The amount of light required may be roughly figured at a minimum of one watt for each square foot of floor area when a direct lighting system is used. Indirect or semi-indirect lighting will require more wattage per square foot. The net area inside the walls of approximately 9,500 square feet, that is, 10,000 less the walls, will require for proper direct illumination enough lamps to yield at least 9,500 watts. A number of small wattage lamps in a ceiling fixture is better for the eyes than fewer large wattage lamps. In general, the lighting should be arranged to produce an evenly distributed illumination and to avoid bright spots. illumination by fixtures depending on the ceiling yields good practical results. Table lamps for readers are expensive, and the necessary floor receptacles prevent the ready shifting of tables. In a browsing room stand lamps with easy chairs make for comfort, but the combination is expensive. Candelabra or torches may be used effectively in the delivery room. In the catalog, work, and librarian’s rooms, base receptacles must be conveniently distributed. The panel boards for the lighting circuits are well located when on or near the delivery desk, within easy reach.

To illustrate a method of computing the outlets, wattage and circuits required, we can refer to Room B, just described, with an area of 4,935 square feet.
Since we cannot foresee whether other than direct lighting may be demanded, it will be best to allow 1½ to 1¾ watts per square foot. There are 11 windows on the side of the room and two at ends; therefore the ceiling outlets can be located on the window axes, making two rows of 11 each,—22 outlets at 300 equals 6,600 watts. If properly wired, these outlets may be included in five circuits (1,320 watts each) controlled by switches conveniently placed; although another determining factor is the number of lamps on each outlet. If we use 25-watt lamps, 12 will be required for each outlet to give a total wattage of 300, and local underwriters' regulations may require a separate circuit to each outlet. The stacks would be lighted by conduit boxes, 6 feet on centers, in the aisles between stacks controlled by switches at the ends of the stacks tiers. In addition to the light wiring, allowances should be made for an interior telephone system, for public telephone connections, for call bells, clock system, vacuum cleaner, electric elevator and book lift, and, questionably, a pneumatic tube system.

Hearing. Libraries are usually steam-heated, for which the square feet of radiation may be roughly calculated by the Mill's formula of 2-20-200, the sum of the glass area divided by 2; the solid wall area by 20, and the cubic feet content of the room, by 200. For example, our building, we assume, has a net area within the walls of 9,500 square feet by a height of approximately 40 feet under the roof, which gives 380,000 cubic feet. The glass area equals 1,500 square feet (or 20 per cent of floor area); the wall area equals the periphery of the building (150 plus 70 plus 150 plus 70) 440 lineal feet, by 40 feet height or 17,600 square feet less the 1,900 feet of glass, or 15,700 square feet. This formula will apply:

\[
\text{feet of radiation required} = \frac{200}{2 + 20 + 200} \quad \text{in which} \quad x \text{evaluates the square feet of radiation required; } a \text{ equals glass area of windows and ceiling lights; } b \text{ equals solid wall area; } c \text{ equals cubic contents. Applying this formula, we obtain the results:}
\]

<table>
<thead>
<tr>
<th>Area</th>
<th>1900</th>
<th>15,700</th>
<th>380,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>2</td>
<td>20</td>
<td>200</td>
</tr>
</tbody>
</table>

\[
\frac{1900}{2} + \frac{15,700}{20} + \frac{380,000}{200} = 3,625 \text{ square feet of radiation. If the radiation is concealed behind shelving or seats, it should be increased by about one-third or say, 1,200 square feet, giving, say 4,800 square feet, to which add 50 per cent for piping and for reserve power on boilers; or 2,500 added to 4,800 yields 7,300, which indicates the requisite boiler rating. The cost of the installation may approximate $4 per square foot of the radiation, 4,800, or say $19,200. An additional percentage of radiation should be allowed for exposed walls on north sides and for ceilings under flat roofs.}
\]

Ventilation. The mechanical ventilation in an ordinary library may be limited to the lecture room and a possible small amount in the shape of "mixed" or "direct-indirect" for certain of the reading or work rooms. A "plenium" system for the entire building is expensive to operate, and experience shows that the use of the fan is likely to be discontinued. The writer has arranged a simple system, first tried in Cleveland and since installed in many buildings, by which the radiators or coils are concealed back of insulating shelving with openings at floors and at tops of cases to permit the circulation of air. When the shelving runs beneath windows, either high or low, there is an opportunity to arrange an effective method of ventilation by opening the window slightly and inserting a deflector. Even with closed windows there is a continual circulation of the room air engendered by the spaces containing radiators between the walls and the back of shelving which act like flues. Chilled by the windows, the air is kept moving, which is the secret of ventilation.

Construction. Statistics have indicated that but few modern libraries have been destroyed by fire. Therefore, in districts where fireproof construction is not compulsory and the most question arises between more space if non-fireproof, or less, if fireproof, it is likely to be decided in favor of the former. The use of non-fireproof construction has increased, however, with the upward trend of prices, so that the difference between it and fireproof construction is much less than during pre-war years. Reinforced concrete with pan or slab system is suitable for library buildings and usually costs less than steel beams and terra cotta blocks.

Decoration. Planning is for the mathematician, practical mind that unifies the heterogeneous elements into a systematic whole. Designing is for the artistic spirit that produces an exterior of beauty, symmetry and proportion. The architect should combine the ability to plan and to design, in order to produce an appealing result. Artistic decoration and mural painting enhance greatly the spiritual elevation which a library should propagate, like music, to the hungry soul; but mediocre work is worse than plain walls. Appropriate planting enhances the beauty of the whole. Statues conceal the hard lines where the base of the building meets the ground. The construction resembles the human skeleton, similar in white, blue and red man, child and adult, while the flesh covering of some may be beautiful and of others the reverse. The style may be Classic, Gothic or Renaissance, the materials may be marble or brick, but it is the spirit shining through that appeals.
The Librarian's Ideas of Library Design

By ARTHUR E. BOSTWICK
Librarian, St. Louis Public Library

The architect is the only artist who has to consider utility. His function is to produce a result that will be satisfactory for its intended purpose and that will also be beautiful and fitting. Not all architects have lived up to this program, as no one knows better than the architects themselves. In many cases this is by no means the fault of the architect but of those whose business it has been to advise him regarding the uses of the building. Librarians and library boards, I am afraid, will have to take their share of condemnation for faults of this kind. In the cases of some very notable library buildings, no working librarian was consulted at all in connection with the plans, and the result was that the library boards and the architects were both deprived of knowledge necessary to make a workable structure. In one case, indeed, this method of procedure cost the library board the tidy sum of $50,000, which was the amount necessary to fit the building to its proper uses. Following one or two cases of this kind, librarians who had the requisite influence with their boards have sometimes prepared complete programs covering the sizes, number and relative positions of all the rooms in the libraries and required the architects to work to these programs, a procedure that is really as unfair to the architects as the reverse is to the administrators. Obviously, the logical method is for the administrator and architect to work together, being in close consultation at every stage of the planning, so that the result will be both useful and beautiful, the utilities not interfering with the artistic effect, and the latter not hampering the former; only thus can success be had.

It has been my good fortune to plan a large number of library buildings with some very eminent and competent architects, and in no case, I believe, did any of us have occasion to find fault with the method employed. If this is the way things are done, the librarian's idea of library design will certainly be incorporated therein, but I should dislike very much to feel that any architect would accept the personal views that I am about to put forward as being applicable in all cases. In fact, I believe that if two libraries in different towns are exactly alike, one of them is probably a bad library. Buildings should be as individual as people and are necessarily so if they
fit conditions, local, climatic, social and economic. It is astounding, for instance, how little climatic conditions were regarded by architects of the older generation. In my own city, St. Louis, the older type of fine residence, designed mostly by eastern architects, was almost uniformly designed with apparently not the least knowledge that comfort here in the summer months is largely dependent on exposure to a south breeze. Librarians in the southern states tell me that they have there many Carnegie buildings designed by northern architects who were unfamiliar with the necessities of a summer climate. Discomfort results for both the staff of the library and its users,—and both are important in its development.

Modern Library Purposes. I am sometimes sorry that we have not adopted a more distinctive name for what we call "public libraries." The word "library" connotes, in the minds of many, a mere storage place for books, and the modern public library, although it is this, is a great deal more. The book, to be sure, is just as important as ever, but its reader has become equally important, giving the librarian and the library two units that must be taken into account instead of one. A building intended to store books with safety and a reasonable degree of accessibility is one thing; to house the vast departments that are now necessary to bring about adequate contact between book and reader is quite another thing. The late Walter Cook of New York, one of the most human and appreciative architects that I have ever known, once said to me after I had described to him the uses that would probably be made of a branch library building that we were planning: "Why, this is not to be a library at all. It is to be a community reading club." He was perfectly right, of course. That is what all public libraries have become in these modern days. The club features have become prominent, and this fact must be given its full weight in future in planning either a central library or a branch building. A branch library building designed by one of the most eminent of American architects is a striking example of his total misconception of such a library's use and needs. Having his mind fixed on the day when all libraries were repositories of treasures which it was necessary to guard against theft, he fitted the front windows of this building with strong iron bars, such as one sees sometimes in a bank structure, while the rear windows were protected.

Plates. George R. Fox Arca

Larchmont Free Library, Larchmont, N. Y.
Frank A. Morris, Architect
by heavy steel shutters. For a community reading club, such as this branch library building was intended to be, these things were, of course, grotesquely out of place, and they were ultimately removed.

Attracting Readers. There are two basic features of the modern library which are related to this closeness of contact between book and reader. The librarian’s technical names for them are “free access” and “home use.” Free access means that all or most of the books are where they can be seen and handled by the reader as freely as if they were on his own shelves at home. The latter means that their use is not limited to the library but that they may be borrowed and kept for a specified time at his home. Both these plans met at first with great objection from librarians and were for many years unjustly looked down upon. There are still some persons who think that a library where the books are carefully stored in a place inaccessible to the general reader is necessarily superior to one where the reader may see and handle them. It ought not to be necessary to say that neither of these opinions has any sound basis in fact. The old plan had its advantages and must still be used in libraries where the books are curiosities or treasures rather than the tools of education and progress. But the open shelf and free access are now so much the rule that they have been the basis of most of the changes that differentiate the new community reading club from the old library, and they are becoming more important.

The difference between the two, in fact, begins at the outside. The old library forbade, or at least discouraged, use by the general public. It was distinctly a place for the scholar, and for him alone. The new library invites the public, and it is not content with this; it strives to attract the public in very much the same way that a merchant strives to attract customers—by making public the advantages of reading and by letting everyone know what it has to offer in the way of books and aids to their use and appreciation. To this end it is desirable that no one should pass a library without realizing thoroughly that it is a library and without seeing something that will interest him in it and its use, so that he will be tempted to enter. This method of attracting the public has, of course, been long familiar to merchants. We see their attractive shop windows on every street. No one can pass a shoe store without

![Ferguson Library, Stamford, Conn.](image-url)

Teddy, Searl, et al., Architects
knowing not only that it is a shoe store but what kinds of shoes are for sale there. But there are hundreds of libraries that are passed daily by citizens who do not know them to be libraries; or who, if they do, do not realize the advantages or pleasures of using them. Locating a library at a distance from the sidewalk and elevating the main floor above the head of a passer-by make any such plan as this absolutely impossible. It ought to be easy for a pedestrian to look through large windows directly into the library, so that, especially at night when the interior is lighted, everything that is going on is plainly visible to him. My experience leads me to believe that in this case, the number of persons who use the library will be very greatly multiplied. Advise the proprietor of a successful retail store to move to the second floor and take down all his signs, and note his response! Much the same is the librarian's view.

**Interior Book Display.** Coming now to the interior of the building, we find that the prevalence of free access has materially modified the method of book storage. Fifty years ago librarians were greatly divided in opinion regarding the merits of two methods,—the unified stack system and the departmental system. In the former, all the books were shelved in classified order in a separate part of the building, generally inaccessible to the public. In the departmental system, on the other hand, exemplified in the Newberry Library building of Chicago, the books were disposed in the centers of separate rooms, each devoted to a different form of literature and each presided over by an expert. Each of these plans has distinct advantages and compensating disadvantages. Of late, librarians have been striving to combine them in such a way as to obtain the former without the latter, and although success cannot be said to have been complete, these efforts have greatly modified the interior arrangement of library buildings. The most successful compromise is doubtless that made in the new central building of the Cleveland Public Library, where there is a unified stack arrangement, but a separate reading room is in close connection with each section of the stack, all the books being thus subject to free access. Other libraries have followed suit with more or less success. This plan is expensive to administer, and it has been most successful in libraries with large incomes. But no builder of a modern library should
neglect to study this problem and to conclude what modification of it is best adapted to his own purse and his own local conditions. It is safe to say that no completely departmentalized library, like the Newberry, and no library with a completely unified stack arrangement will be built anywhere in the future.

*Providing for Extension.* The most important change, and one whose necessity can be looked forward to with confidence, is that of an extension of the building. Steady growth has been a marked feature of all our library work, and there are no signs that it will be lacking in the near future. Every library building should have adequate ground suitable for such extension. The fact that many large buildings are without such provision is making a great deal of trouble for them now or will do so very shortly. And when the building is planned its future extension should be taken into account, so that additional building will be in the nature of completion rather than of patchwork addition; but at the same time the original structure should not appear to be incomplete. Very few library buildings have yet been planned in this way, and yet experience everywhere is demonstrating the importance of this detail.

The first material extension that is likely to be needed is in the direction of book storage. Our libraries are adding to their stocks of books with great rapidity. My own library, completed in 1912, was provided with space which we estimated would last 20 years, but now, after 15 years' use, we find our storage space already congested. Such space can be added either by lateral wings connecting with the original stack room, by vertical addition in the nature of a "book tower," such as is contemplated in the new Yale Library or by digging into the earth for underground storage. There is, however, another plan, originally proposed many years ago by President Eliot of Harvard, which, it seems to me, is preferable in many cases. This involves the construction of an inexpensive storage building on cheap land, say a mile or so from the central building. All books not likely to be called for more than twice a year or so could be stored there, and with modern motor transportation it would not be much more difficult to obtain them at this distance than it is from a stack room in the same building. President Eliot's position, that it is waste of money to use a building of expensive construction on the costliest...
ground in the city merely for storage purposes, seems to me well taken. The plan seems to be practical.

The use of valuable space for corridors and staircases seems largely unjustifiable. I could name libraries where as much as 50 per cent of the ground floor area is occupied by halls and staircases, usually of expensive construction. Stairs, of course, will have to be provided, but they are used only when absolutely necessary and should not be featured architecturally. We go from one floor to another now by elevator, and the elevator service should be ample. Such service should not be limited to the first hallway but provided wherever the reader goes throughout the building, especially in the stacks. Instead of using small lifts for books, it is better to wheel loaded book trucks directly into the elevator in the stack. An attendant can then accompany the truck to the level where it is needed, and time in loading and unloading can be saved. In small buildings, where there are not more than two levels and where passenger elevators are not needed, book elevators save much time and strength, but they should be large enough to admit a loaded book truck.

This necessitates the use of electric power. If this is not available or considered too expensive, a hand-power lift is better than nothing, but in this case it cannot be made large enough to admit a book truck.

Staff Quarters. There are still employers—and among these one must recline the members of some library boards—who cling to the idea that it is possible to make a working staff too comfortable. One may hear this argument today from many who think that a comfortable worker is a less thorough worker than one who is continually subject to a certain degree of discomfort and inconvenience. I believe, on the contrary, that the more thoroughly comfortable the worker is, the better work he will do, and that care taken for staff welfare in planning a building is not only human but economically profitable. The day when every library worker had to stand up all day, had to get lunch by eating a sandwich in the cellar, had to climb stairs to go from the first to the sixth floor, and had no place to lie down when indisposed, is sorely past. A library must have adequate staff accommodations, including a lunch room with at least a kitchenerette, a rest room, and possibly also an adequate recreation room to do its best work.

Beauty and Utility. Fashion, of course, has much to do with buildings as well as with other things, but whereas one may discard clothing that is out of style for more up-to-date garments, nothing of this kind is possible with a building. Period buildings are, of course, always in vogue,—too much so, it has always seemed to me. From a librarian's point of view, an architect should strive to build something that is pleasing and impressive largely from its simplicity and fitting proportions and that will remain so through the ages. Librarian have been subject to the caprices of fashion rather than architects. They have often insisted on some detail of construction that is temporarily in vogue, thinking wrongly that it represents a permanent improvement in administration. Library buildings designed in such cut-off fashions are to be found in all parts of the United States. Agreement between the designer of the building and those who are to use it is absolutely necessary, as has been said, but both librarian and architect should be on their guard against mistaking temporary fads for permanent betterments, as many mistakes in building will testify.

In closing, I desire to emphasize my opinion that not only the entire building but every element of it must be a combination of beauty and utility. That it should have beauty alone or utility alone will not suffice. This rules out ornamental details added merely for the sake of ornament, but it rules out as well useful adjuncts employed merely because of their use without regard to their appearance, such as ventilating stacks that seem to have been added as an afterthought. These considerations, of course, apply to all buildings but in a special degree to a library structure, which is perhaps the one public building that is constantly used by the class of adults that has, or should have, due appreciation of what is fitting and proper. A public library building must necessarily serve its community for a considerable time,—it may cater to several generations of readers,—and its very permanence constitutes a particular claim upon the thoughtfulness and resourcefulness of architect and librarian if the public is to be well served.
ENTRANCE FRONT

CHILDREN'S ROOM

LOS ANGELES PUBLIC LIBRARY

BERTRAM GROSVENOR GODHAUE, ARCHITECT; CARLETON MONIGE WINSLOW, ASSOCIATED

PLATE 97
PLANS, LOS ANGELES PUBLIC LIBRARY
BERTRAM GROSVENOR GOODEE, ARCHITECT; CARLETON MONROE WINSLOW, ASSOCIATED
ENTRANCE FRONT

CHILDREN'S ROOM

McGREGOR PUBLIC LIBRARY, HIGHLAND PARK, DETROIT
EDWARD L. TILTON, ALFRED M. GITHENS, ASSOCIATED, ARCHITECTS
PLANS: MCGRGOR PUBLIC LIBRARY, HIGHLAND PARK, DETROIT

EDWARD L. TILTON, ALFRED M. GITHENS, ASSOCIATED, ARCHITECTS
PASADENA PUBLIC LIBRARY
MYRON HUNT AND H. C. CHAMBERS, ARCHITECTS

Photo: William Cullen
Plate: 37
AN ENTRANCE.

HENRY E. HUNTINGTON LIBRARY, SAN MARINO, CAL.
MYRON HUNT, ARCHITECT
PLAN, J. J. HILL REFERENCE LIBRARY AND ST. PAUL PUBLIC LIBRARY

ELECTUS D. LITCHFIELD, ARCHITECT
PUBLIC LIBRARY, BIRMINGHAM, ALA.
MILLER & MARTIN, ARCHITECTS

Plate 103
VENTILATING AND LIGHTING LIBRARY BUILDINGS

By SAMUEL H. RAWCK
Chairman, Committee on Ventilation and Lighting, American Library Association

LIBRARY buildings as a rule are open and in service long hours; frequently in our large cities 80 or more hours a week; every week of the year; and on seven days of the week. During the scholastic year, some of our university libraries are open even longer hours than public libraries. Churches, theaters, schools, and other public places are rarely open half so many hours; many of them less than one-twelfth as many as the library in the course of a year. These long hours with a variable load at different hours of the day and in different rooms at the same hour make the problem of library ventilation particularly difficult. The number of persons in the rooms to be ventilated might be termed the "ventilation load," and a variable load is always much more difficult to handle than a constant load. A special reading room, that is a room for a special class of readers, such as a medical reading room or a reading room for teachers, illustrates what is meant by a variable load. Such a room may have only one or two readers, or none for many hours of the day, whereas during the winter months, a newspaper or magazine room may be crowded to the limit all day long. The amount of air required for good ventilation in one room may be many times that in another.

Certain of our large city libraries have an additional problem in the winter months, particularly in newspaper reading rooms, which are frequented largely by unemployed persons who come from cheap lodging houses. Some of these people seem to go without a change of clothing for a whole season. This is also a problem in some children's rooms, where it is not unknown to librarians that certain children have their clothing sewed on in the fall, with no change until spring. Such persons bring to the library the problem of dealing with human odors.

Besides the reading rooms and ordinary public rooms of the library, we have in many of our library buildings lecture rooms or auditoriums. A lecture room filled to capacity usually seats from three to four times as many persons as the same floor space when used as a reading room. This causes wholly different problems of ventilation in two rooms otherwise identical, and this difference must be duly considered.

In the main building of the Grand Rapids Public Library, we have a very good illustration of this, the reference room and the lecture room being on the same floor and identical in size. An audience that fills the lecture room will ordinarily raise the temperature at least 10 degrees in the course of an hour when it is freezing outside. The building is heated and ventilated by a plenum system, so that if the lecture room is comfortable the other rooms are entirely too cold. If, on the other hand, the other rooms are comfortable, the lecture room is hot and "stuffy." People have difficulty in keeping awake, and everybody feels and knows that the ventilation is bad. We have remedied this somewhat by shutting off the plenum fan for the lecture room for several hours before a lecture begins and by opening the windows wide, thus chilling the room and walls down to nearly 60°. The fan, forcing air that will keep the rest of the building comfortable, takes on the load of the lecture room half an hour before the lecture begins.

Conditions of this sort make it absolutely necessary, in planning a library building, that the heating should be independent of the ventilating system. Furthermore, in a large library building it is most important that the ventilation be controlled in every room at every hour of the day, in accordance with the conditions in each room. This means fans, for it is impossible to control the ventilation of a large library building without use of a system of fans.

Ventilation is primarily a physiological problem, for the comfort or discomfort of persons in a room, because of air conditions, is a physiological condition. Heat, humidity, odors, lack of motion in the air all affect the action of the bodily organs, causing comfort or discomfort as the case may be, thus greatly affecting the amount and quality of their work, and ultimately bad conditions will injure the health of persons long exposed to them. When the reaction produces comfort, we say the ventilation is good; if discomfort, bad. And psychology plays an important part in one's reactions to such conditions. Thirty-five years' experience in operating public library buildings and studying library buildings generally, has convinced me that psychology is a very important factor in successful ventilation. Different persons are affected differently by the same conditions. The heart beats of some people are much faster than those of others; for example, mine is about 20 beats per minute slower than my wife's. Usually persons with high pulse beats require very much less heat for comfort than persons with slow pulses. This is largely regulated by their clothing. However, if a person feels hot and uncomfortable, and sees the windows all closed and no evidence of air coming into the room, the psychological effect is bad; whereas, if windows are partly open or ribbons or something colorful are placed at the vents through which the air comes into the room indicating air in vigorous motion, the psychological effect is good. In short, the whole problem of ventilation is essentially a "human" problem. It is a problem of ventilating people rather than ventilating buildings; and we know that people are more or less temperamental. For this reason one can never depend wholly on automatic mechanical devices—thermostats, etc.—to give entirely satisfactory results. Good horse sense
with an understanding of the whole problem must be
used,—with some dependence placed upon diplomacy!

The public rooms of most library buildings are
ordinarily too warm. People come into the build-
ing with their wraps on, while the women employ-
es in the building, dressed in the present style, often
have little clothing below the knees, with arms bare
to the elbows or shoulders. How can we get satis-
factory conditions for both these groups? When
the building is too warm it affects the action of the
skin and the heart of the individual, unless the air
is in motion, and furthermore, in raising the temper-

ature from 66 to 72 in a crowded room containing a
considerable number of the unwashed, odors become
very strong. The higher the temperature above 70
the greater the problem presented by odors from
human bodies. Hence, keeping the temperature down
reduces this very materially and improves the venti-
lation,—important, since many object to fresh air.

Securing good library ventilation, therefore, pres-
ents a problem of proper control so as to give the
greatest amount of satisfaction possible under the
varying conditions that exist in different parts of
the building at different hours of the day, and to
two groups,—the workers and the general public.
It may be added with reference to the unwashed
that as a rule they are very much opposed to any
evidence of fresh air in a room, and my experience
in public library buildings is that there is a great
deal more criticism from this group about too much
fresh air than from those who feel that there is not
enough. When there is added to the unwashed the
presence of a number of persons whose favorite dish
is garlic, one can imagine the difficulty of the whole
problem! The physiologists and the medical profes-
sion have not yet definitely agreed upon what is
"optimum" ventilation, and what ventilation really
does in a physiological way. The engineering pro-
fection could greatly improve conditions if once it
were really known what is the best thing to do. Most
ventilating systems have been unsatisfactory because
they are based on the wrong theory of what ventila-
tion must really accomplish to be satisfactory.

Most of the ventilating apparatus in library build-
ings, and in public buildings generally, until within
recent years, was based on the carbon dioxide
theory,—namely, that human beings in breathing
give off a certain percentage of carbon dioxide which
poisons the air. The functions of ventilation ma-

chinery according to this theory are to supply fresh
air from the outside to dilute the polluted air in the
building and to remove the vitiated air, so as to keep
the carbon dioxide content of the air of a building as nearly as possible equal to that of good fresh air from the outside. It is this theory that is responsible for the laws in many of our states requiring 30 cubic feet of air per minute delivered into certain public rooms for each person in such rooms. This theory has been explored by a number of studies and investigations, a description of which it is not possible to go into here. It is interesting on its own account.

As already indicated, the primary problem of ventilation is that of controlling the conditions of temperature, humidity, odors, and motion of the air so that the human body, especially the heart, the lungs and the skin, will function to the best advantage for health and efficiency. To bring this about with any kind of machinery requires constant observation and intelligence on the part of someone in every library building. In all too many of our libraries the ventilation service is a failure on account of improper operation on the part of the janitor or engineer in charge. Such machinery in its operation should be made as simple and as nearly foolproof as possible. Every room in a library building should be equipped with an ordinary good thermometer, and there should be in the building in one or two places a hygrometer which in winter months should never be allowed to register much below 50°. A self-registering thermometer properly placed is also a good investment to check up on the work of the heating plant every minute of the 24 hours. In a large library building an anemometer should also be available to test occasionally the amount of air being delivered to the various rooms, so as to be sure that everything is functioning properly. Where there is a high degree of human intelligence used in looking after these things, even with relatively poor machinery or apparatus, excellent results may be achieved; whereas the most expensive and up-to-date apparatus may prove a failure because of lack of intelligent operation. In our main library building in Grand Rapids last winter we got better results than ever before by having the fireman in cold weather go through the building every hour during the busy part of the day, reading the thermometers and observing the conditions in every room. If one room went below or above par, he took steps to remedy such a condition, restoring it to normal.

Good ventilation means maintaining indoors a supply of air which causes the body to function as nearly as possible as it does in approximately pure air out of doors. To achieve this result in a library building, or any large structure for that matter, ventila-
tion must be subject to control so as to meet the varying conditions or needs of the situation. And all this means machinery properly laid out and installed. Proper control also greatly reduces the cost of operation, for then there will not be tons of fuel wasted by heating air and forcing it through the building when it is not needed or used. Small library buildings, especially in neighborhoods that are not congested, may get good results from intelligently operated natural ventilation. But where there are large crowds in small buildings at certain hours of the day, natural ventilation will fail to give satisfaction, especially when the air outside is stagnant. Small electric fans, such as are in common use in hot weather, may then be used as an inexpensive solution of this problem, and sometimes with good results, by delivering a greater number of foot candles to the tables at one end of the reading room than at the other. Thus needs of readers of many classes are met.

The problem of lighting is largely an engineering problem. If we know how much light is needed on the reading plane, it is a very easy matter to wire the building and to put in lamps, shades and reflectors to give that result. Every library, however, should have a foot candle meter to test the amount of light that is being delivered on the reading plane. The age of electric lamps and the accumulation of dust and dirt on them, on shades and on reflectors, greatly affect the amount of light delivered, sometimes by as much as 50 per cent. Laying out the lighting system so that it is relatively easy for the janitors to get to the lamps and reflectors for
frequent cleaning is a most important part of the work of the architect or lighting engineer. I am of the opinion that the psychological effect in a public reading room is very much better with semi-indirect light than with either direct or indirect lighting. I regard it as more satisfactory also in some other ways.

Natural light is, of course, to be preferred for reading rooms and work rooms, but when such rooms are open many hours of the day, artificial light must be largely used. In our cities very little can be done with the orientation of buildings so as to get into all the rooms the greatest amount of daylight possible, for so many of our streets are laid out according to the four main points of the compass. Orientation can frequently be worked out better on a college campus. For instance, a building facing one of the four main points of the compass will get less sunshine in all its rooms than if it were faced say southeast. Latitude and climate are also important factors in the ventilation and lighting of library buildings, but these cannot be gone into here.

Arrangement of stacks for the storage of books in the library should, I believe, depend entirely on artificial light. The windows in the average stack room of a library are wholly inadequate for lighting the center of the stacks, even on a bright and sunny day, so that artificial light must be used in any event. By eliminating the windows and the aisles that usually go along the walls, and by depending on artificial light and mechanical ventilation entirely, the capacity of the average stack room for book storage would be increased by approximately 20 per cent. The stack rooms are usually the most inefficiently lighted of any part of a library building. The light source is at the ceiling, and the farther a book is away from the lamp, say on a bottom shelf, the smaller the angle of light incidence, so that both distance and this angle increase the difficulty of reading the numbers or the lettering on the backs of the books, especially when the books are somewhat worn from use. For the smooth running of the library it is of the first importance that books may be found readily and placed back on the shelves in the same way. This means adequate lighting as the first requisite for this work. It can be greatly helped by having the floors of the stack rooms of white marble or tile, or even painted white, so as to reflect the light to the backs of books as they stand in the shelves. A number of libraries have done this in recent years, having the shelves, walls, floors, ceilings, and everything about the stacks in white. In the reading rooms the tables should be as free from lighting fixtures as possible. The colors of the walls
and of the furniture have an important bearing on the general effect on the reader. The unsatisfactory combining of mere utility and lighting efficiency with general artistic effect presents an interesting problem for the library authorities and the architects to work out. It is a problem well worth the necessary study.

It has long seemed to me that it should be possible for the stacks to be wired so that an employee who is putting books back on the shelves or is getting a number of books for patrons should be able to throw a light switch with the feet rather than by hand, for it is extremely awkward to attend to these switches when one has an armful of books. This would enable such a person to have the hands entirely free for books. The lighting system should be installed so that it is easy to cut out light in the stacks when it is not needed, thus greatly reducing the cost of building maintenance. Large library stacks can easily waste more light than the rest of the building uses.

In both ventilation and lighting, the cost of operation is an important factor. It is a well known fact that many elaborate and costly systems of ventilation are not being operated as designed because of the costs. Take the case of a large library building with one fan system for the ventilation of every room in the structure; all the air to be outside air—no recirculation; the building heated with the same fan system that ventilates it; air heated in zero weather to keep the rooms at about 70° Fahrenheit; half the rooms used very slightly many hours of the day; air delivered to them the same as to the rooms with many people in them—all this results in most expensive operation and waste, for much cold air will be heated to a high temperature only to be forced out of the building without being of the slightest use to anyone. It is conditions such as these that lead engineers and janitors in charge of buildings to begin "monkeying with the machinery," and often on instruction from the heads of trustees. Here are 14 points most to be remembered in designing ventilating and lighting systems for library buildings, all very well worth considering:

1. Supply the fresh, invigorating air that most normal humans crave, without "cookery" the life out of it by heating it to a very high temperature, thus destroying its invigorating feeling of freshness.
2. Deliver air in the proper quantities, without waste through supplying much more than is needed in some rooms and at the same time not enough in other rooms, because of the variation in loads in the different rooms. This is a highly important detail.
3. Humidify the air for the sake of the people
in the building and for the sake of the books, the humidity in the winter months to be about 50 per cent of saturation. An open steam jet in the fan room will produce fairly satisfactory results. Air washers not only humidify the air but they also free it from dirt. They are, however, expensive to operate and sometimes are troublesome in other respects.

4. Separate the heating system from the ventilation system,—use the "split" system. This makes possible the supplying of air in the quantity needed, and without heating it so as to destroy its freshness,—simply tempering it during cold weather.

5. Provide for easy, independent control from the room itself of the amount of air to be delivered into that particular room from the ventilating fan system.

6. In crowded rooms, especially rooms frequented by odoriferous persons, move the air in vertical rather than in horizontal or semi-horizontal lines. This will not cause the spread of odors across the room to the annoyance of persons along the way.

7. Provide for natural ventilation,—windows,—as much as possible when there are only a few people in the room, reducing the cost of operation of ventilation system. Use of windows is often sufficient.

8. Provide, especially in a crowded room such as a filled lecture hall, for sufficient motion in the air (without at the same time causing drafts) so that people have the sense of freshness in the air they breathe. This will keep them more alert and awake so that they will be able to get more or do more from their presence in such air. Such air ventilates the body and gives a sense of satisfaction akin to that which we feel when outdoors in a refreshing breeze.

9. In cities take the air for the fans from the roof of the building rather than from the street level, thus avoiding pumping into the building much dirt and dust. Air filters may be used to keep out much dust, but their burden ordinarily will be less when the air is taken from the roof. Many library buildings are settling basins for the dirt in the air that is pumped into them. Air from a roof level is much cleaner.

10. Plan the lighting system to deliver without glare 10-foot candles to the reading plane, with provisions for more light for persons whose eyes require it. Use stronger lighting at one part of a room.

11. Plan a color scheme for the walls, windows, and draperies to give an artistic effect. It will attract readers and be more restful to all who use the room. Red is not a restful color to have in such a room, but there are other colors which possess just that quality.

12. Give special attention to the lighting of the book stacks. Here utility should be the first and
last consideration. It is of the highest importance.

13. Have all lighting fixtures, switches, apparatus, etc., easy of access to both janitors and workmen. Electric fixtures that can be cleaned or adjusted only from the top of a 20-foot ladder which does not reach the ceiling will not get the attention they need.

14. Architects, librarians, and library boards should always keep uppermost in mind that the function of a library building is to serve human needs, and that it must be operated by average human beings. We must, therefore, adapt to the fullest extent possible, ventilation, lighting and everything else about a library building to human beings rather than expect human beings always to adjust themselves to the building. When all this has been accomplished, we shall have "humanized" our libraries.

The 14 points here given cover the considerations of the ventilation and lighting more from the point of view of the readers and staff than from that of the technician. The human side is thus stressed in the hope that it may lead architects to bring this aspect of the problem to the attention of their consultant experts in either field so that each room will be considered as a special case, the comfort of the readers being the paramount objective. The scientific and technical attitude may need to be tempered with the human touch, and the cold factors of "cubic feet per minute" and "footcandles" should always be accompanied in the mind of the designer with the thought of the probable actual comfort of those who will use the building. Those who operate and control the ventilation and heating systems are not always as expert as could be wished, and it is therefore wise to consider them and to make their controls simple.
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