



THROUGH THE AGES

SEPTEMBER, 1924

Architecture is the art which so disposes and adorns the edifices raised by man for whatever uses, that the sight of them may contribute to his mental health, power and pleasure.

—*Lamp of Memory*: RUSKIN



THROUGH THE AGES



VOL. 2

SEPTEMBER, 1924

NO. 5

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Statue in Butler Art Gallery, Youngstown, Ohio

THROUGH THE AGES

A Monthly Magazine devoted to
the uses of Marble - its universal
adaptability, beauty, permanency
and economy.

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THE ST. LOUIS PUBLIC LIBRARY

A Building Wherein It Was the Evident Intention of the Architect to "Play Softly As On
An Oaten Pipe, Rather than to Bray Upon Brass or to
Clash the Loud Cymbals"

IN the United States in the last twenty-five or thirty years—definitely since the World's Fair at Chicago in 1892—there has been a renaissance in architectural activity. Where the nineteenth century was characterized by an uninteresting, and in some cases, an indiscriminating eclecticism of style, the twentieth century has seen the beginnings of a more academic, tasteful appreciation of architectural form, regulated by sober taste and technical training.

For the most part, the works of the past dozen years show either a free version of the Greek style or one of the various forms of the Renaissance, though the same architect will often have to his credit buildings designed in such totally different spirits that they would hardly be recognized as coming from the same hand and mind.

It is but natural that the after effects of the Columbian Exposition should be more noticeable in the central and middle western states; and such buildings as the Field Museum at Chicago, the Detroit Library, the Cleveland Museum and Auditorium, the Milwaukee Auditorium, the Denver group

and others were obviously to be expected.

Of an architectural quality equal to any of these, though not so massive as some of them, is the splendid structure in St. Louis that serves as the central building of the Public Library. Cass Gilbert, architect of New York, has many fine works to his credit, but in none of them is there quite the same harmony of interior design, of adaptation of material to purpose, as shown in the St. Louis edifice.

The site occupied by the Library is the southern half of the space formerly known as Missouri Park, bounded by Olive, St. Charles, Thirteenth and Fourteenth Streets, and this portion was bought by the city from the Lucas family in 1854. The whole tract was occupied by an exposition building from 1884 until 1907, when the structure was demolished to make room for the Library. Because the city authorities wished to extend Locust Street through the Park, the southern half was given to the Library and the rest laid out as a sunken garden. The City Hall and Municipal Court Buildings are on Market Street, three blocks



Olive Street Front of St. Louis Public Library.
Cass Gilbert, architect.

south, and it is the intention of the city to raze the buildings on these three intervening blocks between Thirteenth and Fourteenth Streets and form a Civic Center, with the Library at the northern end of this plaza. A new Court House will be built at Chestnut and Market, fronting on the present Twelfth Street Plaza, which will be part of the new Civic Center. A bond issue of \$87,000,000 for this project and other civic improvements was favorably voted upon by the people of St. Louis in 1920.

The St. Louis Library is placed back from the streets on the southern, eastern and western sides, so that it is surrounded by an ample open space adorned with balustraded walls and terraces, suitably relieved by short stretches of turf and planted with shrubbery. The cost of the building, in round numbers, was \$1,500,000, of which

\$95,000 was for furniture, lighting fixtures, carved marble standards, etc. Andrew Carnegie gave \$500,000 towards this cost, and the remainder was taken from funds of the Library. The city contributed the site, representing a value of perhaps a million, or even more.

The soil beneath the Library is hard yellow clay, although it was necessary in some places to go down about 18 feet below the basement-floor level to reach it. Unfortunately the eastern edge of the site was formerly near the center of an old creek and it was necessary to distribute the enormous weight of the walls over the soil by means of steel grillage beams, keeping the weight per square foot on the soil to within two tons. The floors and roof are supported by steel construction independent of the walls, which are self-supporting from the foundation.

Provision against dampness in the building was made by coating the exterior walls below the ground level with from two to six thicknesses of tar and felt in alternate layers and extending the same treatment below all wall footings, floors, trenches, etc.

The exterior of the building is in the form of a rectangle and in the style of the early Italian Renaissance, with three stories and basement. The shape is almost a square, with a pavilion on each of the four sides. A fifth pavilion, invisible from without, is placed in the center of the rectangular space thus formed. The resulting courtyard is thus roughly annular and surrounds the central pavilion, access to which from the outer pavilions is by passageways built as bridges over the court.

The front of the building is on Olive Street. A broad flight of balustraded steps leads up from the street level to a portico

containing three large, round-arched windows, on either side of which are medallion portraits of Homer, Dante, Virgil and Shakespeare. On the bevelled jambs of the three arches are small panels on which are carved, in relief, figures of the nine muses and the three graces.

To either side of the entrance portico, on a level with the entrance archways, are six round-arched windows whose sills form the upper part of stone screens, each carved with shields in high relief bearing the devices that represent printers identified with the history of their art. Below and above the main story windows appear the windows of the ground floor and second floor respectively, similarly placed but square in shape, and separated from the main floor fenestration by frieze and cornice. At each end of the Olive Street pavilion is an arched space filled with variegated Italian marble, carved



Details of Main Entrance on Olive Street.



The Entrance Hall, with its wonderful Tennessee marbles.
In the arch over the doorway is this inscription:

*"Speak low, tread softly through these halls. Here reign in silent majesty
Here genius lives enshrined. The monarchs of the mind."*

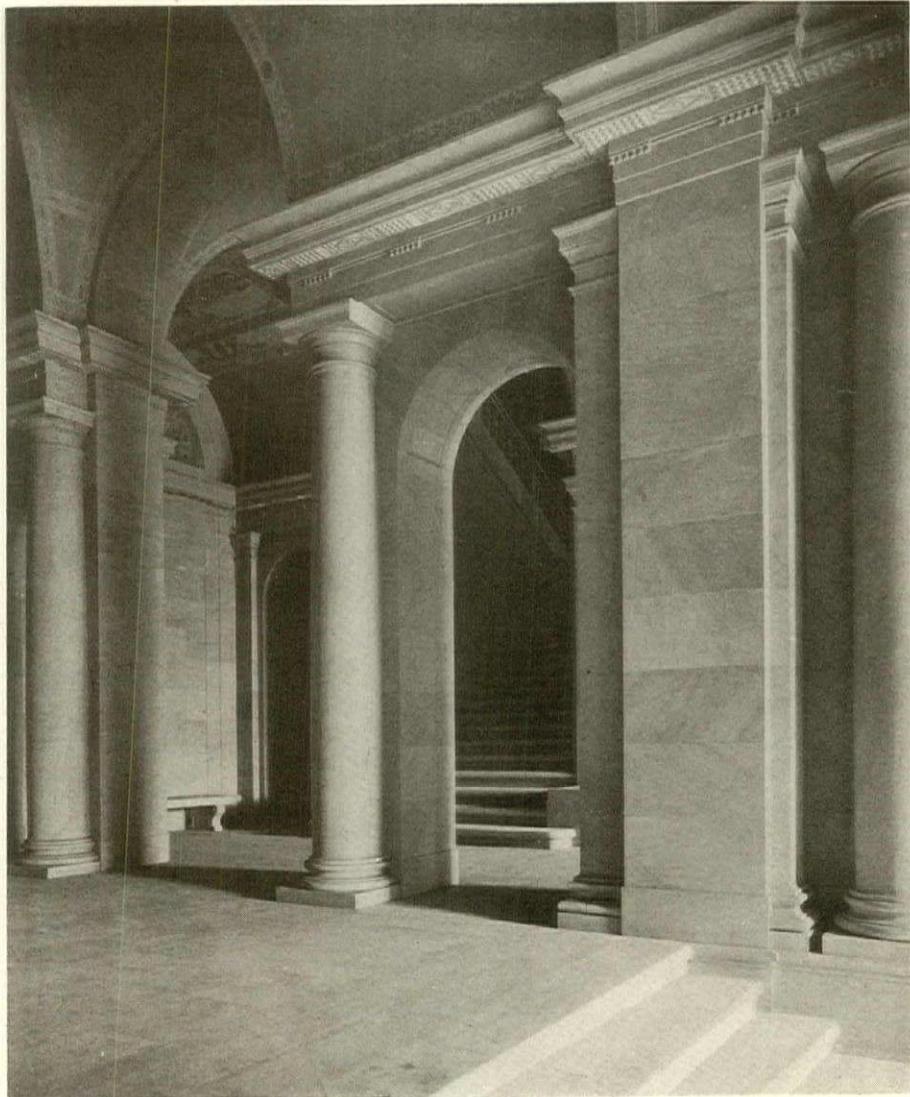
with ornamental designs and serving beside as a background for inscriptions formed of attached bronze lettering. Below are fountains, and above, in place of the single window, is a group of three narrow window openings.

Similar arched spaces are placed at the rear on the ends of the east and west pavilions. The carving and inscriptions on the exterior of the building are both pertinent and numerous, and exhibit intelligence of selection that is unfortunately rare. Above the entrance, on the pediment, is found a quotation from Frederick M. Crunden: "Recorded thought is our chief heritage from the past, the most lasting legacy we can leave to the future. Books are the most enduring monument of man's achievements. Only through books can civilization become cumulative." On the marble panels and over the fountains are quotations from Milton, Carlyle, Longfellow; Carnegie, John Bright and Wm. T. Harris; all of them are appropriate to the building and its purpose. Between the windows of the upper story on three sides are circular medallions, of which sixteen, running across the front, and four on the ends of the front pavilion, are carved, twelve with the signs of the zodiac and the other eight with the seals of the city and library, heads of Minerva and Janus, Pegasus, an hour-glass, an owl and an eagle.

The exterior exhibits a finely proportioned, simple design, unostentatious but not lacking in richness of detail. It is exactly suited for what it is—a fine building to house a fine collection of reading matter and the working force necessary for its proper use. It is the interior, however, that lifts the building out of the class of the usual and places it at once among those structures that are worth the special attention of the architect. The striking features of the interior are due only in part to the general de-

sign of the various portions and their decorative treatment. It is rather on account of the material that is so largely used that the St. Louis Library building is one of the most striking examples of a comparatively simple architectural plan transmuted into a design that is both beautiful and noble. Throughout the delivery hall and main corridors the floors, walls, stairways and arches are of Tennessee marble, of a soft pink gray, almost a dove color. This is hone-finished and not polished, thereby avoiding the glitter so disturbing in a color scheme. Had any other material been used, no matter how skillfully, it is extremely doubtful if the final result would have been nearly so successful. Certainly the use of wood in these places could never have created that impression of quiet strength and dignity that is so fitting to the atmosphere of a public library. Excessive decoration, too, would have been misplaced and yet the absence of variety has a charm in itself that is enhanced by a certain warmth in the pink surface of the marble. The color of the stone overcomes any tendency toward coldness of treatment. Even the fact that only one kind of marble is used, with no variance in floor or wall, stairway or baluster, is almost unnoticed in the splendid effect of the whole. The only exceptions are minor ones, such as the marble benches in the entrance hall and the carved marble light standards in the delivery room and entrance hall.

On passing through the bronze grilled entrance gates, the visitor finds himself in an outer lobby with vaulted mosaic ceiling. Beyond this is a large rectangular entrance hall with marble walls, columns and floor, with a ceiling of barrel vaults. The carving on the architrave, combined with the molded bases and capitals of the columns, relieves the plainness of the general treatment. Nowhere in sight below the level of



Entrance Hall, showing part of stairway on east side.

the springing of the arches is there anything but Tennessee marble.

To either side are the art and periodical rooms, the doors flanked by white Italian marble pedestals, delicately carved, and bearing aloft basins of alabaster through which passes the light from unseen clusters of electric lamps. The general lighting of this hall is from concealed "linolite" lamps hidden below the spring of the ceiling vaults and arranged to throw their rays upward against the decorated ceiling.

The color of the vaulted ceiling is based

on that of the marble beneath it. Gray-blue and violet tones are carried through the design, in order that the marble shall retain its warm tones by contrast. The design follows the Renaissance character of the architecture and is intended to be a sort of obligato, subservient to the order of columns and piers that carry it. Among the painted heads depicted are those of St. Louis, for whom the city was named; De Soto, the discoverer of the Mississippi River; Gutenberg, the inventor of printing by movable types; and Aldus, the famous

Venetian printer of very beautiful books.

The rear of the entrance hall appears almost as a separate chamber, due to the higher elevation of the floor, and is reached by two or three steps. This portion serves as a stair hall, having to either side a broad flight of steps leading to the floor above. On landings half way up, at the turn of the steps, are large arched windows with leaded ornamental glass. The view from the center of this stair hall is perhaps the most impressive in the building, with the soft light coming from the stained glass windows

above and the play of the shadows on the pink marble columns and on the blocks of delicate-hued marble in the walls, pilasters and floors.

From the stair hall, a carved marble doorway leads to the delivery hall, occupying the full length and width of the central pavilion and extending upward to the roof, two stories above. The marble walls are bare, except for a frieze running around the room at a height of about eight feet and elaborately carved. The marble is carried clear to the ceiling and its rosy expanse is



Entrance Hall, showing west stairway and window on landing.



The handsome General Delivery Room, with its walls and floors built entirely of Tennessee marble.

broken only by the high arched windows filled with translucent cathedral glass, slightly yellowish in tone. The ceiling is of molded plaster, decorated in dull gold, picked out with color. Directly in front are the delivery and registration counters, behind which are offices for the assistant librarian, record department and other departments.

This large room occupies a space that, in most public buildings of this size and character, is not utilized for any purpose whatever, so that there is at present no need for economical utilization of this area. As the librarian, Dr. Arthur E. Bostwick, pointed out, "beauty and harmony of proportion do not lack their utilitarian aspect."

Adjoining the hall is the stack pavilion

on the north, while at either side are openings leading to the reference room on the left, with shelves for 10,000 books; and the open-shelf room on the right, containing about 25,000 volumes. These rooms are, in fact, in the side pavilions fronting on Fourteenth and Thirteenth Streets respectively, and the short passages leading to them are really bridges over the interior courtyard below, though they do not appear so from the interior. Both these rooms overlap the ends of the north or stack pavilion, giving immediate access to the stack from either compartment. All these rooms are on the main floor, which is one story above the street. The ground floor may be reached by marble stairways from the main floor or

through ground floor entrances directly from the street. Here the marble treatment is equally impressive, but more severe because of its generally unbroken surfaces. The floor is traversed by two corridors at right angles, one connecting the entrances at the ends of the front pavilion, while the other runs from the staff entrance in front through the central pavilion and into the stack room. These unite in a large hallway, just beneath the main stair hall.

The chief rooms on this floor are the children's room, the stations department, the applied science room and the daily papers room. In addition are lockers for the staff, a staff lunch room, rest rooms, toilets, storage rooms, photographic department, and various rooms given over to the bindery, the janitor and the department for distributing books to the library's fifty delivery stations.

The upper floor contains an assembly room in the front, to the east of which is the librarian's office, with board room and auditor's office. A large cataloging room takes up all of the east pavilion, while the west pavilion contains pamphlet and map rooms, rest room, the German patents

room and rooms occupied by the library school.

Underneath the whole of the ground floor is a basement whose floor is on a level with the paved bottom of the open courtyard. Access to this is through an inclined driveway on the Thirteenth Street side. A shipping and receiving room opens directly into the yard and lifts communicate with the rooms above. Here are storage rooms, the heating and ventilating plants, and the bindery.

All through the building it is evident that its main purpose was kept constantly in mind. The use of so much marble of one specific kind is decidedly unusual, but the result has justified the choice of the architect. The structure could never be anything but what it is—a library building, and not an art gallery, a museum or a place of entertainment—and as such its architecture and treatment are eminently suitable. A library contributes, as nothing else, to the education, culture and refinement of a community and when this influence is exerted amid surroundings of quietude and good taste, the highest possibilities of such an institution have a chance of realization.



Doorway from Delivery Hall to Open-Shelf Room



Carved marble column in the doorway of the College of St. Mark, Venice, an early Renaissance structure by Martino Lombardo, built about 1485.

EARLY RENAISSANCE IN ITALY

Venetian Houses Express Domestic Security, but Lombardic Influences are Everywhere Apparent

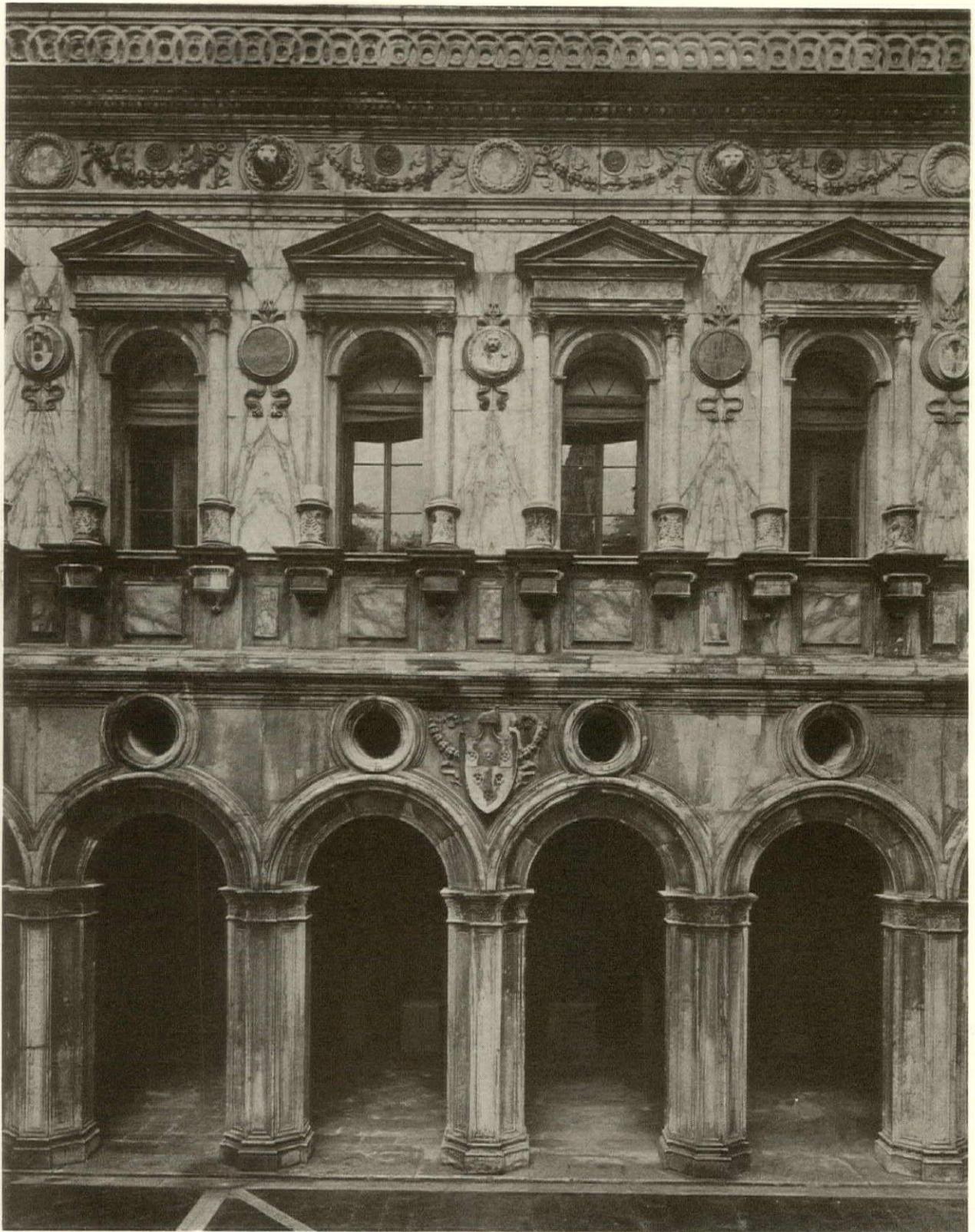
IF we leave the immediate surroundings of Milan and turn at once to the architecture of Venice without stopping to note the gradual changes of feature and treatment as found in Bergamo, Brescia and Verona, we are at once impressed by the individuality of the Venetian Renaissance. The style took a special form there, distinct from the schools of Florence or Milan, as we saw them in our previous articles.

This difference is especially remarkable in the domestic architecture. The fortress-like homes of the Florentine nobles—the Ric-

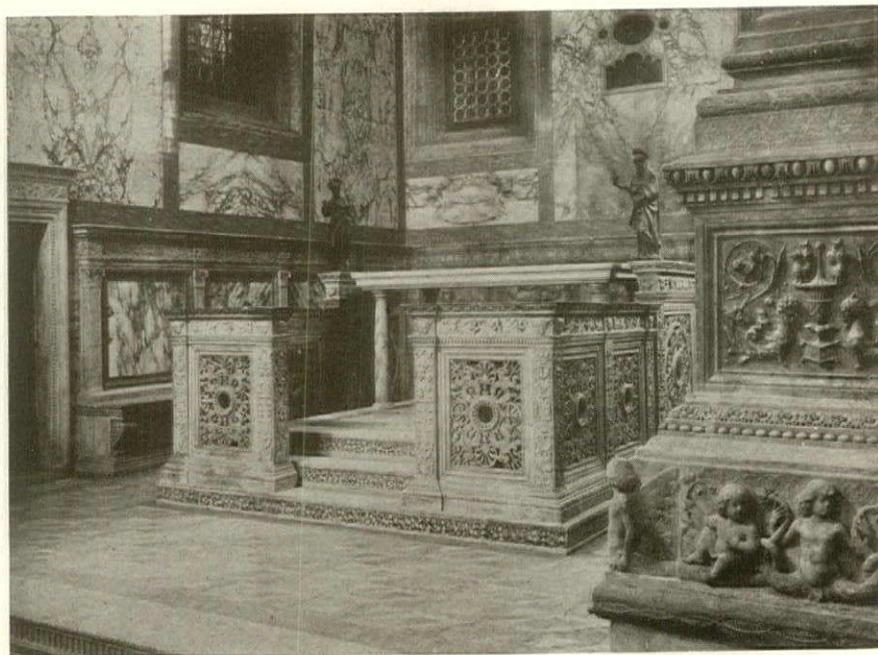
cardi, the Rucellai, the Strozzi Palaces and others—speak of the civic turmoil that prevailed. The Republic of Venice had little to fear from without and all was peaceful within her borders. So the Venetian gentleman had no need to fortify his home after the fashion of the Florentines or the Siense. He built them with large handsome windows and wide doorways, for beauty and comfort and not for defense.

A brief summary of the history of Venice is necessary to enable us to understand more clearly the development of Venetian Renais-

Illustrations, except where noted, courtesy Thomas Machen, Architect, Baltimore, Maryland.



Detail of one of the façades in the grand courtyard of the Ducal Palace, in Venice, begun in 1486, by Antonio Bregno (Rizzo).



The wonderfully carved altar of the Church of the Miracoli, in Venice. Both the interior and exterior of this church is lined with marbles. Pietro and Tullio Lombardo were the architects.

sance. In the early days of her history, Venice could scarcely be called a part of Italy. She stood aloof from Italian politics, gave her allegiance to the King of the Romans on the Bosphorus, fought with Hungary over the possession of the old Roman cities on the coast, traded with the Levant, adopted Eastern arts, and built her St. Mark's after the plans of the Constantinople Church of the Apostles. Her earlier churches and palaces, through the Middle Ages, were decorated in Byzantine fashion, the color of the Orient finding a prominent place in Venetian designs.

Towards the end of the fifteenth century the Republic of Venice reached the apex of its greatness. Her rule extended on one side to Dalmatia and Crete, and on the other side to Padua, Vicenza, Verona, and Bergamo, almost to Milan itself. The Lion of St. Mark was set up in the market place of these cities during this time, as a symbol of Venetian domination.

Naturally the influence of the Lombardic

architecture, even though the contact with the Milanese was unfriendly, was apparent in the introduction of northern forms. This was not unlike the situation at Rome, which "gathered to itself, in time of its greatness, the styles of the known world" (Anderson). The architect of the Porta della Carta was a native of Bergamo; and the Lombardi family, whose fame is closely linked with much that is fine in Venetian architecture, probably belonged to

some part of Lombardy, as implied by the name.

When we consider that Michelozzi and Alberti were dead, and Brunelleschi had been buried for thirty-four years before the new art was adopted in Venice, it seems remarkable that sixty years should elapse from Brunelleschi's Capella Pazzi in Florence to the appearance of the first truly Renaissance building, the Church of S. Maria dei Miracoli, begun in 1480 by Pietro Lombardo. The explanation is found in the events of the period. In 1438 the Florentines came to the assistance of the Venetians against the depredations of the Duke of Milan. Various circumstances led to a break between the two peoples, and the Florentines went over to the camp of the enemy. In retaliation, the Venetians expelled every Florentine from the city, and later, in 1467, war was declared between them. The natural contempt felt toward all things Florentine prevented in no small measure the adoption of the new archi-

tectural style. It is not surprising that the architects of Lombardy which he had conquered should be welcomed in Venice, and since these districts and forms of architecture of these districts were not affected immediately by the new thoughts emanating from Florence, the late date of their adoption in Venice is readily explained.

The S. Maria dei Miracoli is lined both within and without with slabs of marble as in St. Mark's. These slabs are separated by stiles of slight projection and of a stronger color. All the carving on the white marble doorways and pilasters is refined and delicate. The arrangement of the chancel and steep stairway is unique, while at the other end square marble pillars support a gallery that is screened off from the rest of the church. Though it has pilasters with round arches and a form of the Gothic capital, it is more a Byzantine building than Renaissance. We see the eastern love of color in the circles inlaid in the inside walls and rounded gable end of the exterior. These and porphyry discs have interlacing borders like the pavements of Opus Alexandrinum in the twelfth and thirteenth centuries. The Palazzo Dario on the Grand Canal belongs to the same school, and speaks eloquently of Venetian taste and passion for graceful form. It is faced with lovely marbles and inlaid with discs of porphyry and serpentine enclosed in delicately sculptured borders.

In 1485 Martino Lombardo designed the College of St. Mark, the most fantastic work

of the early Renaissance in all of Roman Italy. The details are beautiful, but the ground floor has panels in perspective relief that attempt to picture a colonnade. Such caprices were not uncommon, and many really able architects of the time imperilled their own reputations and that of their works by oddly trying to represent on a limited plane surface the effects of distance and foreshortening.

The needs of a tranquil and rich community found expression in a style of decoration that made lavish use of marble incrustations. "Nowhere else," says Hamlin,



Courtesy The University Prints, Boston

Exterior S. M. dei Miracoli, Venice.



Courtesy The University Prints, Boston

Court, Ducal Palace, Venice.

“unless on the contemporary façade of the Certosa at Pavia, were marble inlays and delicate carving, combined with a framework of thin pilasters, finely profiled entablatures and arched pediments, so lavishly bestowed upon the street fronts of churches and palaces. The family of the Lombardi (Martino, his sons Moro and Pietro, and grandsons Antonio and Tullio) with Ant. Bregno and Bart. Buon, were the leaders in the architectural Renaissance of this period, and to them Venice owes her choicest masterpieces in the new style.”

The Church of S. Zaccaria was begun by Antonio di Marco in 1457 in a Gothic style, but it has a façade whose semi-circular gable to the nave and small decorative arcades show an application of Classic details, somewhat timid but nevertheless interesting. The front is designed with five stories

below the pediment, of which the two lower are panelled and are solid except for windows at the aisle ends and doorways. The upper stories have columns and overheavy entablatures. The whole has a structural interest that is pleasing, but it does not rank with the best examples of early Renaissance planning.

One of the most satisfactory of the Venetian structures of the period is the famous Palazzo Vendramini (Vendramini-Calergi) by Pietro Lombardo in 1481. The orders are applied throughout, and the use of engaged columns supporting entablatures and separating mullioned windows is one of the earliest examples of this feature of Venice. Its lines are simple, but stately. The monotony of an equal division of height is partly avoided by the introduction of a balcony at the principal floor and the irregular but

massive treatment of the basement. The grouping of the central windows is characteristic of all Venetian buildings of every age, and is the logical development of having three suites of rooms, extending front to back, the central one being the grand hall and sometimes occupying the full length of the building, and lighted from front and back. The windows have tracery with the bars somewhat flat, more in the nature of archivolts, while the eye has assumed spherical form.

The Palazzo Cornaro-Spinelli, on the Grand Canal, presumably the work of Lombardo, shows a Gothic roundness of the sections of the window tracery bars and a beautiful leaf form for the eyes. The basement is rusticated and contains windows freely distributed, released from the obligation of the orders. Special features are the

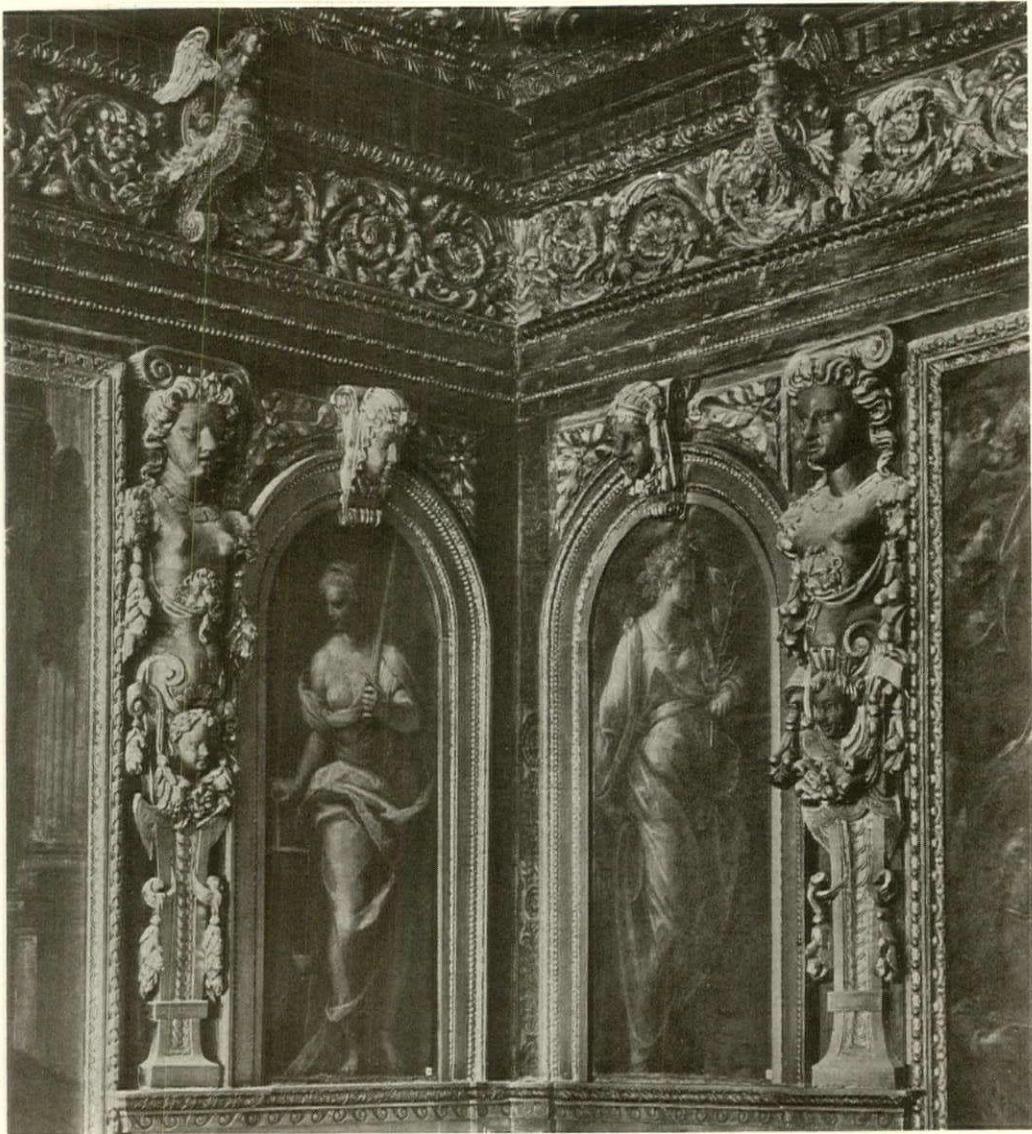
pilasters at the angles and the arrangement of the balconies and their various shapes. Between the windows is a plain wall space that affords a relief.

A contemporary of these palaces is a smaller one, the Palazzo Dario, previously mentioned, which exhibits a different type and one better suited for buildings of less dimensions. The fine effect is secured mainly through the use of well-ordered openings and incrustated panelling of colored marble.

In 1486 Antonio Bregno, also known as Rizzo, a Veronese artist, began the construction of the inner court of the Doges Palace. He was assisted by the Lombardi and Scarpagnino. Previous to this the Bergamo architect, Bartolomeo Buon (or Bon) had introduced signs of classical influence in the treatment of the mouldings and in the shell of the Porta della Carta (so called



Detail of the façade of the Palazzo Vendramini-Calergi, in Venice, built by Pietro Lombardo in 1481.



Hall of the Senate in the Ducal Palace in Venice.

from the cards or placards announcing the edicts of the Republic) of the Palace. But in the court there are clearer signs of Renaissance influence; however, this was some fifty or sixty years later in date, after buildings on purely classical lines had been built in Venice. "In the main block," says Jackson in his *The Renaissance of Roman Architecture*, "facing the court on one side and the canal on the other, there is no pretense of classic regularity. There are round arches on the ground floor, pointed arches on the first

floor; the two stories above have windows variously treated, and placed just where they were wanted by the interior arrangement, and those above are not placed with any reference to those below. They are drilled into order only by the fine friezes and cornices that run from end to end of the building on each floor. The result is a picturesque composition, in which a faint suggestion of classicity is given by the pronounced horizontal lines of the entablatures, but otherwise everything is as free as in the

style of the Middle Ages. The side towards the canal is, if anything, better than that to the court. In the latter, facing the entrance through Bartholomeo Bon's Porta della Carta, is the famous Giant's staircase at the head of which the Doges were instituted, between Sansovino's colossal figures of Mars and Neptune. Opposite in niches facing the stairs are the admirable figures of Adam and Eve by Rizzo, which though wanting the grace of the Florentine chisel are full of character and expression."

The small façade beyond the Giant's staircase is by another Bergamo architect. Guglielmo Bergamosco. It was built in 1520 and is worthy of notice.

The Confraternita di San Rocco, begun in 1517 and finished in 1550 by Scarpagnino, is one of those exuberant creations of the early Renaissance in Italy that cannot be praised too highly. The bays are divided by advance columns that carry broken-out entablatures, projected merely to cover these pillars. The first striking feature is the wreath around each fluted column, whose boldly spreading capital is beautifully designed. These wreaths are formed, one of an interlaced vine, another of laurel and a third of oak. The lower floor has simple Renaissance window-tracery, similar to that in the Spinelli and Vendramini palaces; the upper floor shows two-light openings of arched de-

sign set between graceful columns carrying entablatures and pediments. The abacus of the projecting capitals is supported by figures at the angles. At the corners of the plinth where, in work of the Middle Ages one occasionally finds the spur, are carved animals four inches high. The crowning entablature with its rich frieze and well-planned cornice is admirable, and the whole setting of windows and doors is particularly good. The upper window and the niche fashioned after the classic form are also worthy of attention.

Of this same period is the Palazzo Contarini della Figure, though possibly a little later than those mentioned. It belongs properly, however, before the time of Sansovino, Sanmicheli, Peruzzi and Palladio and other architects of the middle periods. In this palace we see the abandonment of the traceried windows and in their place the substitution of single windows of very high proportions. The middle story retains the grouping of the central windows, but above them we see an innovation—a not particularly successful pediment. Pateras and oblongs of colored marbles were placed between the windows of the mezzanine over the water story, as well as the arched windows of the top floor. These marbles are framed with mouldings and tied up with ribbons.



A capital of S. M. de Miracoli.



The New Brooklyn Office of the New York Title and Mortgage Co.

REMODELING WITH MARBLE

THE New York Title and Mortgage Company, of New York City, which owns all the stock of the American Trust Company, decided about two years ago to enlarge the Brooklyn office. Property for the improvement had been purchased about a year before from the Mechanics Bank and comprised a 75-foot frontage on Montague Street adjoining a 25-foot lot in the 200 block already owned by the Company. The two sites gave a frontage of 100 feet dominating the heart of Brooklyn's financial district.

The larger building before being remodeled was occupied as stores and the street front was finished entirely in stucco. In order to convert the two buildings, as they stood, into one structure suitable to the needs of the Company, quite an interesting alteration job was required. The

building purchased was two stories high. The renovation was begun immediately upon the expiration of the existing leases and by midsummer of 1922 was completed. It was deemed advisable to have the main façade of the building of marble, and Imperial Danby from Vermont was chosen as the material to be used. In order to have the marble surface structurally correct, it was necessary before refacing the building to cut away from 4 to 6 inches of masonry. At each end of the building is a doorway of classic design surmounted by a pediment; above this is a balcony on a level with the second floor. Four fluted pilasters extend from the street level through both stories, and these are topped by caps picked out in soft colors. A highly ornate frieze, above which is a heavy cornice of elaborate design, finishes off the whole structure in a most

unusual and altogether striking manner.

Although no structural changes were made on the interior, it was necessary, in order to make the premises attractive, to make a liberal use of marble. The round cast iron columns were enclosed with octagonal bases of Botticino marble having an egg-shell finish, while this same material was used for the banking screen and the stairs leading to the second story. The floor is a mottled gray marble tile which matches up well with the marble wainscot. The upper parts of the iron columns are covered with plaster tinted a light coffee color, while the ornamental column caps and paneled ceiling are tinted in old ivory.

The interior gives an impression of dignity and space. As one enters he sees a concourse of generous proportions. In the center of the apartment are arranged comfortable seats, back to back. At the front are the officers' quarters separated from the public space by a marble railing. Specially designed lighting fixtures have been installed to give the maximum amount of light without glare. All the furnishings are walnut. One feature of the interior decoration is a handsome marble stairway of Italian design leading to the second floor. Modern safe deposit vaults have been installed. Everything, in fact, has been done to make the building suitable for the transaction of such a banking and investment business as is carried on by the



Marble stairway leading to second floor.

Company. The architect, Mr. Horace S. Luckman, has fully demonstrated what can be accomplished—and at a very reasonable cost—with a proper use of marble.



Main Banking Floor, mostly of Botticino marble.

A LIST OF THE WORLD'S MARBLES

By J. J. McClymont

Note—In a past issue, Mr. McClymont proposed, for the sake of convenience, to divide the different marbles into four groups. These arbitrary groupings are as follows:

GROUP A—Any marble or stone sold to the trade in fair-sized slabs or blocks of commercial size, rectangular shape and guaranteed by the seller to be sound, free from natural defects, that can be finished at a minimum cost, and sold to the consumer as sound marble.

GROUP B—Any marble or stone sold to the trade in slabs or blocks of fair or medium size, generally rectangular shape, guaranteed to be sound and free from natural defects, the finishing of which, because of texture, the size of slabs, the shape and size of blocks, is somewhat more expensive than those in Group A.

GROUP C—Any marble or stone that cannot be sold as sound but contains a minimum amount of natural defects, such as dry seams, old fractures, partially or completely healed surface voids, etc., to be treated by the manufacturer in the most approved manner, reinforced where necessary by liners on back or metal inlays and sold to the consumer as semi-sound marble.

GROUP D—All marble, stone and so-called serpentine marbles, and Onyx, which, by their peculiar formation are known to be fragile, such as Breccias and nearly all highly colored marbles and serpentines, and that are sold to the trade in irregular shaped blocks or slabs without a guarantee as to their soundness, treated by the manufacturer in the most approved manner reinforced where necessary by liners on back or metal inlays and sold to the consumer as unsound marble.

Grand Antique (Nord)—Group C

Quarried at Jeumont, Nord, France.

Black, with white veins and occasional white patches.

Takes good polish.

Grand Antique Belge—Same as Bleu Belge.

Grand Antique (Swiss) or Swiss *Grand Antique*—See Cipollino (Swiss).

Grand Chartreuse

Chartreuse Quarry, in Isere, France.

Mottled white, gray, pink, brown and yellow. (Blagrove)

Grand Deuil

Quarried at Moulis, Ariège, France.

White with black veins. (Watson)

Grand Jaspe

Quarried in the Biros Valley, Ariège, France.

Variegated, gray, yellow, brown, green and white. (Blagrove)

Grand Noir

Quarried at Pouilly, in Doubs, France.

Black. Sometimes marked with white and gray. (Blagrove)

Grand Rouge

Quarried at Belasta and Montferrier,

Ariège, France.

White, gray and red. (Blagrove)

Granitello—A granite sometimes called Ker-santon.

Quarry near Raid-de-Brest, Finistere, France.

Gray. (Blagrove)

Granite of the Forum—Same as Claudian Stone.

Granite Vert des Vosges—Same as Vert des Vosges.

Granito—Granite

Granito Bianco E Nero

This ancient granite, according to Pullen in "Roman Marbles," is a syenite; the color of which is white with round and oval black spots evenly distributed.

Granito Bianco E Nero Della Colonna—Ancient Granite.

Light gray and white, with large oblong black stains due to crystals of hornblende; evenly distributed. (Pullen)

Granito Bigio or Lapis Syenites

From Syene, Egypt.

Black, with minute lichen of gray, tinged with pinkish brown.

According to Pullen this and the following varieties of Ancient Granite, the names of which are prefixed "Granito Bigio," are all from Syene:

Granito Bigio Btonzato—Dark gray, with short faint black lines and spots of coppery mica.

Granito Bigio Cupo Tigrato — Dark gray, with lighter pools.

Granito Bigio Dendritico — Foliated like the branch of a tree.

Granito Bigio E Nero—Bluish gray on jet black.

Granito Bigio Macchiato—Gray, spotted with white.

Granito Bigio Minuto—Minute mixture of black, white and pink.

Granito Bigio Minuto Confuso—Dark bluish gray with lichen of lighter shade, indistinctly traced.

Granito Bigio Minuto Lineare—Similar, with disposition to lines.

Granito Bigio Minuto Rossastro—Similar, with suspicion of pink.

Granito Bigio Perlato—Black dots and white spots on pearly gray.

Granito Bigio Rossastro—Similar, with hue of pink.

Granito Bigio Terro—Whitish earthy gray sown with spots of black.

Granito Bigio Turchinico — Grayish lilac, with foliation of white and spots of black.

Granito Bigio Verdaastro — Greenish gray.

Granito Bigio Verdognolo (Pedicolare) —Small oblong whitish and black crystals on greenish gray.

Granito Bruno

An ancient granite from an unknown quarry. Brown with small markings.

Granito Bruno Giallastro

Ancient granite from unknown quarry. Sooty brown, with minute round light spots like transparent gems.

Granito Carnicino Grigiastro

Ancient granite from unknown quarry. Mottled with flesh color, pale gray and black.

Granito Corallino Minuto

Ancient granite, unknown quarry. Minute mixture of fiery red and reddish black.

Granito Del Foro

All of the Del Foro granites are supposed to come from Syene, Egypt.

Generally, white quartz and feldspar with spots of mica equally distant, and a few yellowish dots.

Granito Del Foro Arrugginito

Rusted with chocolate or bronze.

Granito Del Foro Bicolore

Similar, banded with red.

Granito Del Foro Roseo

Rosy, with spots and veins of grass green.

Granito Della Sedia

An ancient granite from unknown quarry. White and green, irregularly distributed, with large patches of brownish green. (Pullen)

Granito Del Sempione

According to Pullen this ancient granite is from quarries near Baveno.

Bluish-white freckled with black, and regularly marked with crystals of transparent bluish gray.

Granito Dendritico (Erborizzato)

Ancient granite from unknown quarry. Lilac and white grounds with foliation of black.

Granito di Elba

An ancient granite from the Island of Elba.

Grayish white, dotted and punctured with black mica.

Granito di Giglio

From the Island of Giglio, in the Mediterranean.

Gray with large crystallized lilac spots.

Granito di Giglio Macchiato

Similar, with stains of black and white.

Granito di Levanto

Same as Verde White di Levante.

Granito Grafico or Lapis Judaicus

A modern granite probably unknown to the ancient Romans, from Tyrol and Siberia. Earthy gray with black crystal lines like Hebrew letters and sparkling chips of bronzed mica.

Granito Minuto Della Sedia

Similar to Granito Della Sedia and probably from the same quarry, but in this variety the brownish green is entirely absent.

Granito Nero or Lapis Hethipicus

The ancient granites bearing this prefix, according to Pullen, from whom the following list is taken, are all from Ethiopia. Are generally black, faintly mottled with greenish red, metallic, spotted with brown rust, like bits of red granite:

Granito Nero Brecciato—Mottled with greenish red, and veined or waved with bright red, pinkish gray, with fragments of black.

Granito Nero Macchiato—Black with round gray spots and stains.

Granito Nero Rossastro Minuto—Minute dusky gray, tinged with pink and green.

Granito Nero Tigrato—Black with large white spots and tinge of pink.

Granito Nero Verdastro—Black, dusted with metallic green.

Granito Persichino

Ancient granite from an unknown quarry.

Gray, plentifully flushed with lilac.

Modern granite similar to above is from Sardinia.

Granito Roseo

An ancient granite from unknown quarry. Vivid rosy red.

Granito Roseo Fasciato

Ancient granite from unknown quarry.

Rose, yellowish white, and black, banded or stained with small red and black crystals evenly distributed.

Granito Roseo Minuto

Ancient granite from unknown quarry. Rose, with tiny chips of black mica.

Granito Rossastro

Ancient granite from unknown quarry. Pink.

Granito Rossastro Tigrato

Ancient granite from unknown quarry.

Pink with pools of gray at even distances.

Granito Rosso or Granito Rosso Antico (or Lapis Pyrrhopecilus)

Is an ancient Syenite granite. The varieties prefixed with Granito Rosso are all from Pullen's "Roman Marbles."

Granito Rosso Delle Gulie—Large rosy crystals with smaller ones of yellowish white and black.

Granito Rosso Fasciato—Red, banded with gray.

Granito Rosso Macchiato—Mixture of red and black granite in patches.

Granito Rosso Minuto—Red, with very small markings.

Granito Rosso Pallido—Pale red.

Granito Rosso Verdastro—Greenish hue in the feldspar.

Granito Rosso Verdognolo—Greenish red.

Granito Rosso Violaceo—Red, with violet hue.

THE BOWERY SAVINGS BANK

A New York Institution that Will Soon Celebrate
Its One Hundredth Anniversary

UNDER a little glass case in the lobby of a modern New York bank is a curious leather covered chest 12 by 8 by 8 inches in dimensions. Inscribed on the lid of this chest are the initials B. S. B. This rare piece of bank antiquity is the original strong box of a New York bank of ninety years ago.

In this little box were kept the cash, securities and other assets of the Bowery Savings Bank when it began business on that old historic street, the Bowery, June 2, 1834. The deposits for the first day amounted to \$2,020.

In those days modern conveniences were practically unknown in New York. There were no telephones or telegraph; no automobiles or aeroplanes; no steam railroads, subways or elevated; no typewriters, adding machines or cash registers; no moving pictures, phonographs or radio; no running water or electric lights. Wood was the only fuel.

The city extended north only to Fourteenth Street; the Bowery was near the center of business operations; Forty-second Street was as distant as Albany is now.

Today, the five great boroughs of New York City cover more than 200,000 acres of ground. The lands and buildings are assessed at twelve billion dollars, and over 6,000,000 people live and work within the city's boundaries.

Throughout the years the Bowery Savings Bank kept abreast of the city's progress. Today, its resources amount to more than \$200,000,000, while its surplus has grown to over \$25,000,000. But its crowning achieve-

ment is the magnificent new building at 110 East Forty-second Street, that serves the great uptown currents of humanity passing constantly through the subways, the Grand Central Terminal and employed in places of business of this rapidly growing center.

This building, though constructed primarily for efficient service rather than for beauty, has a distinct charm of design. It is in the Italian Romanesque style, a form of architecture that is not often used in buildings as high as this—eighteen stories. The main banking room, which is 65 feet high, 80 feet wide and 160 feet deep, is of basilica type with variegated limestone walls, interspersed with blocks of Ohio sandstone.

On entering the room, one stands on a beautiful buff, monotone, marble floor, inlaid with harmonious patterns of colored mosaics, whose materials have come from marble quarries of more than half a dozen countries.

On each side wall are six huge columns of different colored marble, carrying five great stone arches. Between these columns are panels of unpolished marble mosaic from the quarries in France and Italy.

Inserted in each of these wall mosaics, and above each of the stone arches in the main body of the wall, are twenty perforated marble radiators, through which the air, tempered and filtered by the latest processes of purification, is admitted to the room. These are of Napoleon marble from quarries in Phoenix, Missouri.

The marble in the columns in the east wall of the room are:



Architects, York and Sawyer, N.Y.

Interior of the Bowery Savings Bank.

1st. Rouge Jaspe—From the South of France.

2nd. Alps Green — From the Polcevera Quarry in the Italian Alps on the border between France and Italy. It is also known as Polcevera Green.

3rd. Campan Melange — From the Espiadet Quarries in the Campan Valley, Hautes-Pyrenees, France.

4th. Rouge Royal—From the quarries near Vodel in the northern part of Belgium.

5th. Tinos—From the Isle of Tinos in the Grecian Archipelago.

6th. Levanto—From the quarries in the Appenine Mountains in Italy.

The columns on the west wall are of identical materials to those on the east wall, but are located differently.

The lower portion of the counter screen and the wainscot against the walls are of Levanto marble from the Italian quarries near Carrara.

The upper part of the counterscreen,

check desks and doors are of bronze modeled in the same Romanesque style as the general design of the building.

The ceiling is beautifully decorated in colors, with a large amber ceiling light in the center. There are also great arched windows at either end.

The officers' rooms are so arranged in the rear of the room as to provide conveniences for a working organization and easy access for the public.

The vault is about 10 feet by 36 feet. It has doors 3 feet thick with a weight of 30 tons each, so constructed as to provide the highest resistance against burglary or explosives.

But the real story of this old bank is not altogether of buildings and vaults, or the accumulation of money resources. It is also a story of the homes that have been bought; mortgages that have been paid; the vacations that have been enjoyed from the savings of the thousands of plain people who have come and gone in these ninety years.

A MINNEAPOLIS HOTEL

The Marbles in the Radisson Astonish
Visitors to the Twin Cities

IT is recorded in histories written prior to 1896 that the first white men to see the upper Mississippi River and the territory of Wisconsin and Minnesota were La Salle, Marquette and Du Luth. This is, however, a statement that is contrary to facts, and we know that the honor of the discovery belongs to Pierre Esprit Radisson, a daring French explorer. This fact was established by the finding, in 1896, of Radisson's original diary, which proved incontrovertibly that he visited the upper Mississippi about the middle of the seventeenth century, eleven years earlier than La Salle and fourteen years earlier than Marquette.

For over 200 years the name of Radisson had remained in obscurity. The disclosures contained in his diary, however, quickly focused public attention upon this intrepid character of a time long past, and his name is now frequently applied to streets, buildings and parks in that section of the country that he once explored.

Could the bold adventurer traverse again the territory through which he passed 200 years ago, he would find many evidences of civilization undreamed of in his day. He would find where once were the "Nunneries of silent nooks, the murmured longing of the wood" now a land of fertile fields, thickly spotted with towns, with here and there a vaster gathering of buildings and people, the concentration points of civilization's mighty march.

One such point is Minneapolis and one of its most prominent buildings bears the name of the spirited Frenchman. This is the Hotel Radisson, built about fifteen years

ago, and even today the largest transient commercial hotel in the Northwest. It stands on Seventh Street near Nicollet Avenue and its cost of construction exceeded that of any other in the Twin Cities. Its size and general appointments compare favorably with the better houses of New York and Chicago. The building has had two additions since its original erection, and even now a third is required, in spite of its 500 bedrooms. There are four public cafes, and an assembly hall containing 10,000 square feet of floor space, besides numerous special rooms contained inside its walls.

But it is not only the size and the cost and the mechanical completeness that distinguish the Hotel Radisson. It is, rather, the manner in which marble was used on the lower floors wherever such material was at all possible. Such lavish marble installation was not only decidedly unusual fifteen or twenty years ago, but even today, it is frequently found that, in hotel construction, there is a tendency to specify wood.

The marble was installed in those portions of the hotel where decorative service was required and where it would, at the same time, reduce cost of repairs and maintenance. Specifically, beginning with the basement, the floors and wainscoting were marble, including the barber shop and billiard room. On the main floor, the lobby and all that portion of the parlor which is virtually a part of the lobby, has a marble floor. The walls of the lobby as well as the stairways leading both up and down stairs, are of marble, while the mezzanine floor shows much of the same material. In addition, all



Hotel Radisson, Minneapolis, Minn.



The Rear of the Lobby, showing the Desk.

corridors have borders and bases of marble, and the shower bathrooms make use of it very effectively.

So as not to make the marble installation too monotonous or too cold, the treatment was varied in rooms such as the Teco Inn, one of the cafes in the building, where Teco tile was used to present, in natural colors, scenes of the Northwest. The kitchens, serveries, etc., were supplied with tile floors and wainscoting.

That the choice of material was a wise one is proved by the experience of the owners. Mr. Simon Kruse, the President of the Hotel Radisson Company, recently declared: "We adopted this scheme for the reason that we believe it economy in the long run to build with marble and tiles rather than with wood. After fifteen years of experience with cleaning, polishing and repair bills, we are of the opinion that this policy was practical and economical. The expenditures for

cleaning and repairs have been very nominal and the effect on the public has been gratifying. The marble installation, from the standpoint of beauty, cleanliness and low maintenance cost was the most practical installation we made at that time. From the standpoint of publicity, and from the standpoint of making a favorable first-hand impression on the guest, the installation is without doubt superior to wood or plaster.

Were we building another hotel today, we would be strongly inclined to duplicate the marble installation even though the cost were 100 per cent in excess of wood or plaster, which it is far from being. In my opinion, this use of wood and plaster is good, practical construction for a limited period of time, and until redecoration is necessary. At that time, the decorative cost will far exceed the cleaning cost of marble, and after



Corner of Ladies' Waiting Space, in Lobby.

fifteen years the wood and plaster methods of finish will prove more expensive than the marble installation. Besides, the marble, as I said before, appeals to the public and it has, therefore, a great publicity as well as artistic value."

The hotel is in the center of the business district, and virtually in the heart of the shopping and theater districts as well. The architects, Long and Long, of Minneapolis, planned the building in the shape of a hollow rectangle, the shorter side of 126 feet fronting on Seventh Street. The structure is twelve stories in height, with the façade showing six semi-engaged columns running through the first two stories, but half-hidden by the Marquis. At the tenth floor, the angles show a decorative treatment that is unique, and this treatment develops between the eleventh and twelfth floors into a series of balconies connected by a frieze,

with the windows of the eleventh floor adding to the Renaissance effect by their drapings and shields. The heavy cornice is in keeping with the general ornateness of the exterior.

The Seventh Street front to the left of the entrance is given over, on the street level, to two stores over 45 feet deep. Just within the entrance lobby to the right is the opening to the ladies' waiting room, while beyond is the elevator lobby, about 28 feet wide. This leads into the main lobby, a spacious room about 65 feet long by 39 feet wide.

This room has a floor of Tennessee marble laid in basket-weave design. The walls are wainscoted with Pencil Vein Italian, while this same marble was used in the columns, overhead beams, ledges and moulding. Slabs of handsomely veined, vari-colored Bresche-Violette marble from the Stazzema Quarries



Another view of the Lobby, showing the fine marble treatment.



View from Mezzanine Floor.

near Seravezza, Italy, are set in the walls in the form of panels. Their light purple shades, contrasting with the fragments of white, red and brownish purple with which the slabs are filled, give a degree of ornamentation unobtainable with any other medium.

Strips of Pentelicon, a Grecian marble known to the ancients, are also used as borders to these slabs, while the cone bases are of Alps Green. A painted frieze depicts the leading events in Radisson's career, and this is carried completely around the room.

To the right of the main lobby is the grand dining-room, an exact replica of a dining hall of the time of Louis XIV, expressing the culture of the French Court 300 years ago. This "Chateau Room" has a floor of pink Tennessee marble, with a ceiling of wooden beams.

Other rooms on this floor are the writing-room, the men's cafe, a private dining-room,

the servery and the various check, baggage and storage rooms found in most modern hostelries.

The stairway leading from the basement to the first floor and thence to the mezzanine is wainscoted with English Vein and Bresche-Violette, with a base of Alps Green, another Italian marble. The treads and risers are of Tennessee, and this latter material is also used for the border of the Adams Room, a handsome compartment on the mezzanine floor done in the middle Renaissance manner.

The Radisson, while not by any means one of the "big" hotels of the Northwest, certainly has a lobby and general "downstairs" treatment that compares favorably with the best houses in the country; and credit for the appearance is almost entirely due to the marbles that were used, and the highly intelligent way in which the various surfaces were placed in respect to each other.

A HANDBOOK ON MARBLE

It is the purpose of the National Association of Marble Dealers, to publish as soon as possible, a handbook on marble. The material contained in this book will be contributed by those best qualified to speak in an authoritative manner on the various matters treated. This is the ninth installment and contains part of the third chapter, written by John Stephen Sewell, President of the Alabama Marble Company. These extracts will probably undergo some slight changes before appearing later in book form.

CHAPTER III—Sawing and Finishing Marble

MARBLE is taken from the quarry in the form of blocks of considerable size. The blocks are almost invariably separated into smaller pieces by sawing—very rarely by splitting.

The reasons for this are several:

1. As marble is invariably quarried by the use of channeling machines, and by drills and wedges—occasionally by drills and wedges alone—without the use of explosives, there is a considerable cost value in the material as it comes from the quarry; this is very appreciably greater than in the case of stones that can be quarried with explosives.

The material wasted in splitting marble blocks is, in the great majority of cases, worth more than the cost of making the cut with a saw. Of course there is some waste in sawing; but saw cuts average about $\frac{1}{4}$ inch in thickness. It would be a rare case where the waste in splitting would be as little as $1\frac{1}{2}$ inches, and it might easily reach 3 inches. Even where it is desired to use marble in masonry work, with a "rock face," it is usually more economical to saw it to size and then pitch off the exposed face to produce the desired effect.

2. In the great majority of cases, the finished surface desired is smooth, in which case the surfaces as they come from the saws, require a minimum of labor to produce the required finish, with a further waste of material rarely amounting to more than $\frac{1}{16}$ inch, in plain work; of course, if the stone is to be molded, cut or carved, there is a

further waste of material, but even so, it is more economical to saw the marble to size than to split it.

3. Marble nearly always has a well-defined grain in one direction; splitting it at right angles to the grain is a very uncertain operation; the break is very ragged, and may be so irregular as to make one or both of the resulting pieces too small.

Even in the other two directions, breaks in marble are less certain and more ragged than they are, for example, in most granites. Moreover, as marble is quarried, the "grain" often runs diagonally through the block. In such cases, the material would be extremely "cranky" to split; in fact, it would be impracticable to handle it in that way. When blocks are reduced to pieces of the required size by sawing, it makes no great difference how the grain runs. The sawing is usually a little faster across the grain—but the difference is very slight, and there is no special difficulty in sawing marble in any way desired.

4. It would, of course, be quite out of the question to split any stone, except slate, into slabs $\frac{7}{8}$ inch thick—and often as much as 10 to 14 feet long and 5 or 6 feet wide. The production of such slabs of marble for interior use is by no means rare, nor is it specially difficult nor prohibitively expensive; but it can be done only by sawing.

The saws used in sawing marble are strips of iron or steel, $\frac{1}{8}$ inch thick, from 3 to $3\frac{1}{2}$ inches wide, and of the necessary length. The edges are not serrated nor cut into

teeth in any way. The cutting is done by an abrasive material—usually sand—which is carried by a stream of water from a pump, and with which the block of marble is drenched, while the saws swing back and forth, coming into contact with the marble at the middle point of the swing each way.

In these modern times, a machine known as a "saw-gang," or simply a "gang"—capable of taking as many as eighty blades at one time—is used for sawing marble. It is driven by power, and the sand and water are served to it from a power-driven pump. It can be arranged to feed the "gang" of saws downward and through the block of marble automatically, at any rate desired; this is determined by the maximum rate at which the material can be sawed, without making the cut irregular. It is highly important that the sides of the cuts—*i.e.*, the faces of the slabs—be truly plane surfaces, or "out of wind," as the workman expresses it. This limits the rate of sawing which is practicable to much less than the maximum possible.

Fundamentally, the process of sawing marble is very old—possibly among the oldest of industrial processes in present-day use. At first, a single saw blade was used, and it was operated by man power. It is said that this method is still in use to some extent in Italy. In fact, to a limited extent for making single cuts in small pieces, it is not unknown in the most modern shops. But even in the best and most modern "gang" the process is still the same—the improvements consist entirely in the details of its application.

The origin of the process is unknown; one of the earliest writers to refer to it was Pliny the Elder; in his *Natural History*, Book XXXVI, he has much to say of marble. He strongly condemns its use in the private houses of rich men, as an extravagant

luxury which ought to be prohibited by law. He seems to have felt that so rich a material should have been reserved for the temples and statues of the gods. However, his indignation at the extravagance of his day did not prevent him from taking a keen interest in so practical a thing as the sawing of marble blocks into slabs. The following quotations are a part of what he says:

"I am not sure whether the art of cutting marble into slabs is not an invention for which we are indebted to the people of Caria. The most ancient instance of this practice, so far as I know of, is found in the Palace of Mausolus, at Halicarnassus, the walls of which, in brick, are covered with marble of Proconnesus. Mausolus died in the second year of the hundred and seventh Olympiad*, being the year of Rome, 403.

"But whoever it was that first invented the art of thus cutting marble, and so multiplying the appliances of luxury, he displayed considerable ingenuity, though to little purpose. This division, though apparently effected by the aid of iron, is in reality effected by sand; the saw acting only by pressing upon the sand within a very fine cleft in the stone, as it is moved to and fro."

After referring to sands obtained from Ethiopia, and even from India, for use in sawing marble, Pliny further states:

"The above were the several varieties of sand used by the ancients in dividing marble. More recently a sand has been discovered that is equally approved of for this purpose; in a certain creek of the Adriatic Sea, which is left dry at low water only; a thing that renders it not very easy to be found. At the present-day, however, the fraudulent tendencies of our workers in marble have emboldered them to use any kind of river sand for the purpose; a mischief which very few employers rightly appre-

* 250 B.C.

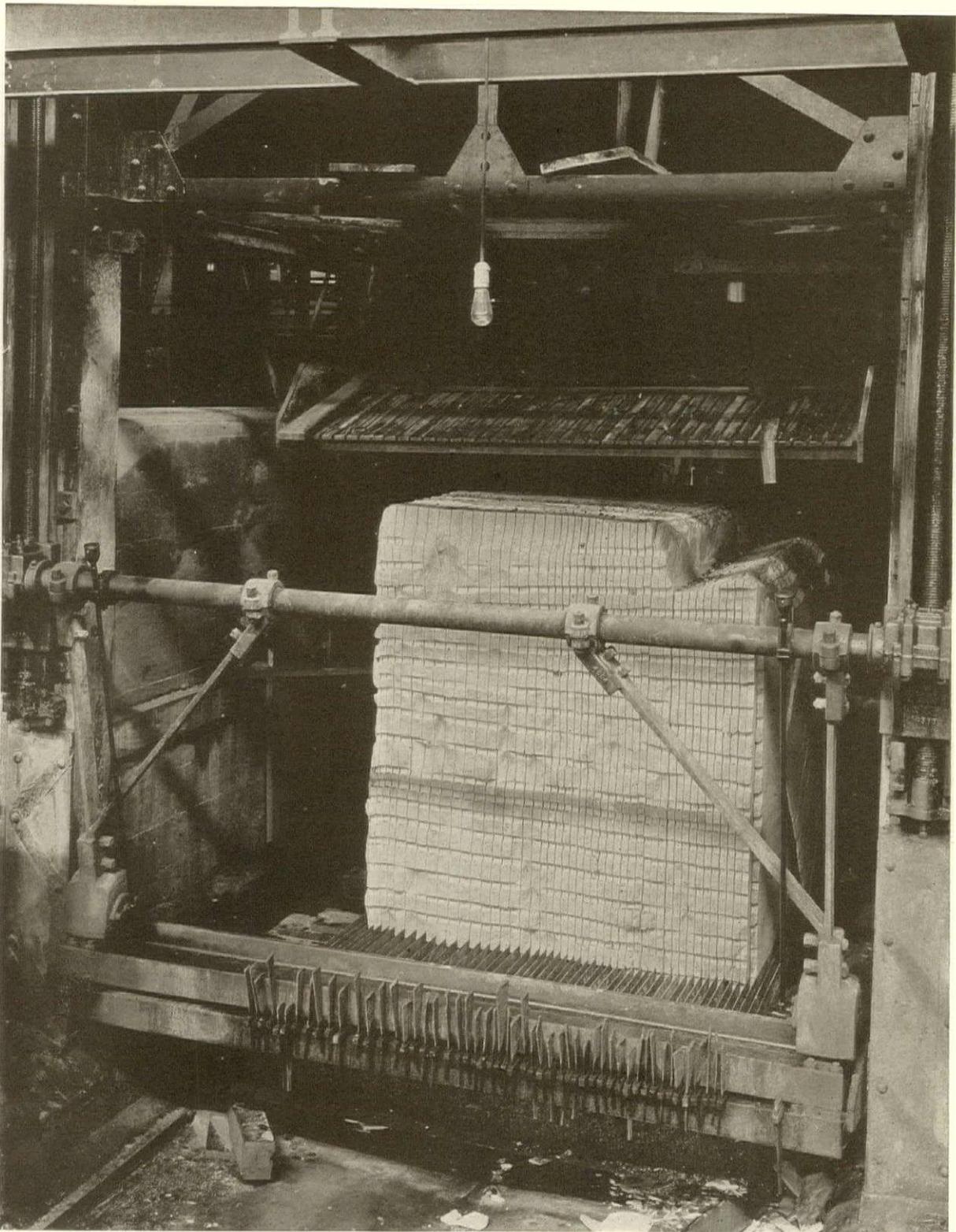


Illustration courtesy Hilgartner Marble Co., Baltimore, Md.

An 8-foot gang saw, one of the newest types. This saw takes marble blocks up to 12 feet long, 8 feet high and 8 feet wide.

ciate. For the coarser the sand, the wider is the division made in the stone, the greater the quantity of material consumed, and the more extensive the labor required for polishing the rough surface that is left; a result of which is that the slabs lose so much more in thickness."

Anyone familiar with present-day practice in sawing and finishing marble will agree that Pliny was well informed and had the faculty of perceiving what was essential and important in any practical process.

To this day, sand is the abrasive principally used for sawing marble, especially for interior work. The sand should be hard, sharp, with medium or small sized grains, tough, and absolutely free of small pebbles or even of very coarse grains. If the sand is too coarse, the saw cut is unnecessarily wide and the texture of the sawed surfaces is very coarse, requiring more labor and expense in subsequent processes. If the sand is too fine, it cuts too slowly. If it is not sharp, it does not cut well. If it is too brittle, *i.e.*, not tough, it pulverizes too rapidly under the blades, and cuts too slowly. If there are pebbles or very coarse grains in the sand, they get lodged in the saw cuts and if slabs are lifted a number at a time from the "gang-saw" on which a block is placed to run it under the saws, much breakage may result. This will be explained in more detail later on.

The rate of sawing may be considerably increased by using carborundum, or other modern abrasive, of proper sized grain, along with sand. But so far the relatively high cost of these abrasives has more than counterbalanced the increased output in the final result on the unit cost of sawing. Marble may also be sawed more rapidly by the use of steel shot and crushed steel. These materials have been used with success in plants where the marble was to be used for

exterior or monumental work and did not require a fine finish of any kind. But wherever the final finish is to be what is known as a "fine sand finish"—a "hone finish"—or where the marble is to be polished, shot and crushed steel are unsuitable. It is impossible by any amount of care, in cleaning the sawed slabs and pieces, to be sure that no small fragment of shot or steel shall adhere to the marble and go with it through the subsequent processes. Such a small bit of steel getting onto the rubbing beds and gritting machines in the shop may do more damage in one hour than can be saved by any increase in the rate of sawing for a week or a month. This will be explained in more detail later.

Saw blades, in modern gangs, are almost invariably made of a grade of steel which would be classified as medium (referring to its hardness). If the steel is too soft, it wears rapidly. If it is too hard, it crushes the sand and diminishes its abrasive power. It is probable that, with the right degree of hardness in the blade, the grains of sand "bite" into the blade so as to be more or less dragged along with it; scratching the marble as they go. Of course, the sand is soon worn out, and saw blades do not last long.

In marble of ordinary hardness, a blade can generally be used in two blocks of average size. After that it must be discarded. A blade cannot be used until it breaks—a new blade cannot be put through a saw cut started by another, except at great expense. It is cheaper to lose the cut. Therefore, blades must be discarded, as a rule, when about two-thirds worn through.

Another reason for this is that, in order to insure straight cuts, the blades are put into the gangs under considerable tension, and when they become so reduced that the necessary tension would strain them to the elastic limit, they are useless. More than

this, for this state to be reached by wear and tear before a block is sawed through, means the loss of saw cuts and therefore of much material, just as surely as if the blades had actually broken.

As gangs are arranged, the sand and water, after deluging the block that is being sawed, escape into the pump pit. This is arranged with an overflow; the surplus water escapes by this overflow, carrying with it most of the marble from the saw cut, and that portion of the sand that is reduced to sizes too small to be useful. The remainder of the sand is used over.

The marble that is removed from the saw cuts is in an impalpable state of fineness. The sand that escapes from the pump pit is still of a granular structure, but very fine. With an average calcareous marble, the amount of sand used is just about equal in *volume* to the marble removed from the saw cuts. This means that if the outflow from the pump pits were all caught, and all of the marble dust and worn-out sand recovered from the water, there should be about equal parts of each.

This mill slush is an excellent material to apply to lands that need lime, and especially if they are stiff from too much clay. There is no direct fertilizing value in the slush, of course, but the marble, in its finely divided condition, is lime in its most useful form, and the sand improves the physical condition of the soil.

The plant of the Alabama Marble Company at Gantt's Quarry, Alabama, is located in a region of stiff clay loams, greatly in need of lime. The mill slush is in considerable demand because of its proven value when applied to these soils.

When a perfectly clean gang, with new clean sand, is first started, it does not cut very well for a few hours; but after a little of the marble slush has accumulated in the

pump pit and the grains of sand get coated with it or mixed with it, they seem to drag better under the saw blades, and the gang cuts faster. A very small amount of clay in the sand acts, initially, in the same manner. Of course, too much fine, sticky material slows down the sawing; so at intervals gangs must be stopped and the pits, drains, etc., thoroughly cleansed of all old slush.

With calcareous marbles of normal hardness, and with from forty to eighty blades in the gang, the rate of sawing will be from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch per hour; so that, with blocks averaging about 6 feet in height, a gang can be "brought down," as it is expressed in the trade, about once a week, running twenty-four hours per day, six days in the week. It requires some time, of course, to remove the block that is sawn, overhaul the gang, put a new block in and set the blades for sawing it. A gang of average size—*i.e.*, one capable of taking blocks about 7 feet wide, 7 feet high, and 10 or 12 feet long, working on blocks of average size and shape, will saw, once, about 400 cubic feet of marble per month or about 5,000 cubic feet per year.

With only six or eight blades in a block, the rate of sawing may be from $1\frac{1}{2}$ to 2 inches per hour. But, with any considerable increase in the number of blades, the rate rapidly comes down to the smaller rates named above. A skilled sawyer, devoting most of his time to a single gang, may bring it down in two-thirds of the normal time, with some risk of a few bad saw cuts. This always increases the unit cost of sawing, however, even if there are no bad saw cuts. Ordinarily, a good sawyer can look after from four to six gangs; it is better to solve doubts in favor of a smaller number of gangs per man, because bad saw cuts in a material as valuable as marble are very expensive.

Bedford limestone saws three or four times as rapidly as an average calcareous marble, although the chemical composition is almost identical.

Calcite, of which marble is composed, stands at No. 3 in the scale of hardness. Sand, which is quartz, stands at No. 7. Probably the rate of sawing would be faster and the sand would last longer if it were less brittle and more difficult to crush; but in that case it would almost certainly be necessary to use only a very fine grained sand. Otherwise, it might present some of the same objections as steel shot or crushed steel.

The average flat cost of sawing marble at the present time is probably not less than \$1.10 to \$1.25 per cubic foot for each cut. A custom mill, with not less than ten gangs, might stay in business if running to capacity, on a charge of about \$1.50 per cubic foot, if favorably located, but it would not be able to pay any appreciable dividends. A great deal of the marble that is sawed costs very considerably more to saw than the figures named.

The speed at which a gang is driven is of importance. In practically all gangs the frame carrying the saws is swung on arms pivoted on shafts so that any point of a saw or of the frame describes the arc of a circle, and the saw blades are in contact with the marble only at the middle and lowest point of the swing; on either side of this point, they are raised above the bottoms of the cuts. During the interval between the middle points of successive swings, the sand and water get under the blades, so that a little fresh sand is available between the blades and the bottoms of the saw cuts for the middle part of each stroke.

If the gang is driven too slowly, much of the sand may escape without being utilized. If it is driven too fast, there is not time for a

sufficient supply of fresh sand to get under the blades. If a gang is driven too fast, vibrations of the whole machine will be set up, which will make the sawing inaccurate.

The time required for the sand to get under the blades under the action of gravity sets very definite upper and lower limits for the practicable speed of the gang. Between these limits, the best speed may be determined by the point at which vibration begins to be serious. But this is a limit which may be raised above the upper limit above referred to, by making the gangs heavy and rigid and by keeping them accurately adjusted. A heavy continuous foundation to carry both the gangs and the driving mechanism (the "Hurst frame" as it is called) is of great assistance in preventing vibration. There is some difference of opinion as to the most desirable actual speed. A few years ago all makers of standard gangs adjusted them for a speed of from 85 to 90 revolutions per minute of the crankshaft on the Hurst frame—*i.e.*, for 85 to 90 double strokes of the saws. For some reason, the gangs of those days would all develop serious vibrations at a speed only a little greater than 95. Since then, gangs have been made to run as fast as 125 revolutions per minute, and the average is probably greater than 90.

No thoroughly scientific investigation of this question has ever been made. It is certain that the speed, the rate of sawing, the power required, and the quality of the sawing are all related to each other in a functional way—*i.e.*, so that any variation of any one or more will be followed by necessary variations in the other. To make a thoroughly conclusive investigation would necessitate the construction of a special gang that would be heavier, more rigid and more accurately made than any that ever has been made, so as to eliminate, once for

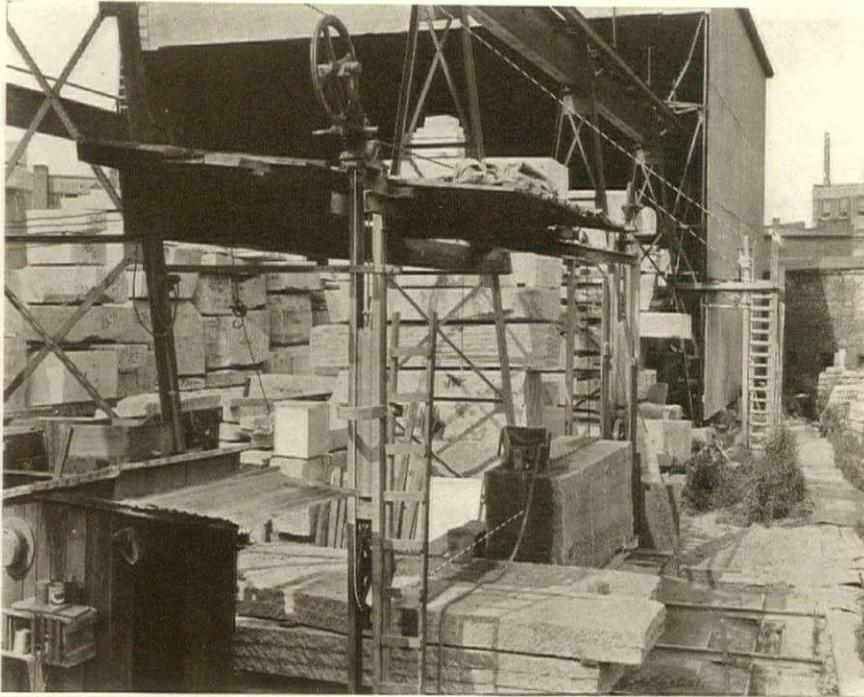


Illustration courtesy Hilgartner Marble Co., Baltimore, Md.

A wire saw 200 feet long, for cutting any size slabs.
Its length prevents overheating.

all, the danger of harmful vibration.

It is highly probable that such an investigation would point the way to an increased rate of sawing—*i.e.*, good sawing—at least 25 per cent greater than the average which now prevails. It is quite certain that this would entail a considerably greater cost for the gangs, and, possibly, the expenditure of more power per square foot of saw cut. Whether, when increased capital investment and all other items are taken into account, the total unit cost of good sawing would be diminished is open to question. It is possible that the present practice is a case of one of those processes involving a number of variable factors which by purely empirical methods has been brought to a state where the best compromise between conflicting conditions is already attained.

Where a number of parallel cuts must be made through a block of marble, or through a number of pieces that can be assembled

together like one block, there is no known method that is better or more economical than the one of a saw gang, using sand and water and applying the fundamental principle so clearly described by Pliny.

But where only one or two cuts are to be made, other methods are sometimes preferable.

A machine capable of taking but one saw blade is sometimes used. It is often called a "ripsaw." The blade is driven with a reciprocating motion.

In a saw gang, the block to be sawed is put in and taken out in the direction in which the saws swing or move back and forth. The reason for this is obvious when one considers the construction of the gang. In the case of a ripsaw, for equally obvious reasons, the work is put in and taken out in a direction at right angles to the motion of the saw. In a ripsaw, the abrasive may be sand, or shot, or crushed steel, or the blade

itself may be set with diamond teeth, or teeth made of modern artificial abrasives. In a plant for interior marble, a rip saw should not be fed with shot or crushed steel. But it may be made to saw much faster than a gang, for several reasons, the chief of which are that it may be driven more rapidly without setting up serious vibrations, and, in many cases at least, it is not necessary for the cut to be perfectly true. A rip saw set with diamond teeth and maintained in continuous contact with the marble, will cut very fast, but cannot be driven with sufficient speed to realize the full value of the diamonds. Any sort of rip saw is at best only an auxiliary convenience, and is by no means a necessary article of equipment. In places where it is most useful, a regular diamond saw is preferable.

A "wire saw," so called, made of a long continuous cable, generally of three wires twisted together, the whole about $\frac{1}{4}$ inch in diameter when new, can be used for cutting large blocks in two, or for making single cuts in pieces of marble in a variety of ways. Such a saw can be carried around through otherwise wasted spaces in a plant, by running it around a driven wheel and then around pulleys that support and direct it as required; it is generally kept at a uniform tension by running around a grooved wheel attached to a weighted car which runs on an incline, so it can take up or give out slack, as required. Two successive pulleys a reasonable distance apart, mounted so they can be raised and lowered, over which the wire saw runs, provide a ready and cheap means of making a single cut. The piece or block of marble is set under the wire, the pulleys being raised so that the wire may run over and on top of the marble, the latter being set at such a height that the tension in the wire will bring it down clear through the marble. A device for feeding

sand and water to the wire at the point where it first touches the marble is necessary. Under such conditions, the wire will cut through the marble with surprising speed. The cut is not very true, but it costs very little. A wire saw run in various ways, both horizontally and vertically, may be made to provide a number of points in a plant where a piece of marble may be quickly and cheaply cut, in a great variety of ways. A long cable used as a wire saw, will last a long time; but if a large block is to be cut, it is well to make sure that the cable is not so worn as to break before the cut is finished—for a new one will bind in the cut made by the old one.

A wire saw may be quite useful at a quarry for truing up irregular blocks and cutting off material that would add to cost of freight and sawing in the gangs without yielding any useful stock. It is used to a considerable extent in Europe in actual quarrying operations; the places in this country where it can be so used to advantage are very few, and its use has been quite limited. A wire saw in a finishing plant is a very useful adjunct but not at all necessary. It is mainly useful where the workmen are familiar with it and like it. It is not known to be used in any sawmill, properly so called, though it would seem to have a possible sphere of usefulness in small mill, sawing "cubic stock" as it is called—*i.e.*, relatively "chunky" pieces for monumental and exterior building work. The wire saw is very old—it is not a modern device except as to some of the details of its application.

Next to the gang, the most useful machine for sawing marble is the diamond saw, which is a modern creation. It consists of a circular steel plate, carrying on its periphery a series of steel teeth each of which has from one to three diamonds set in it so that as

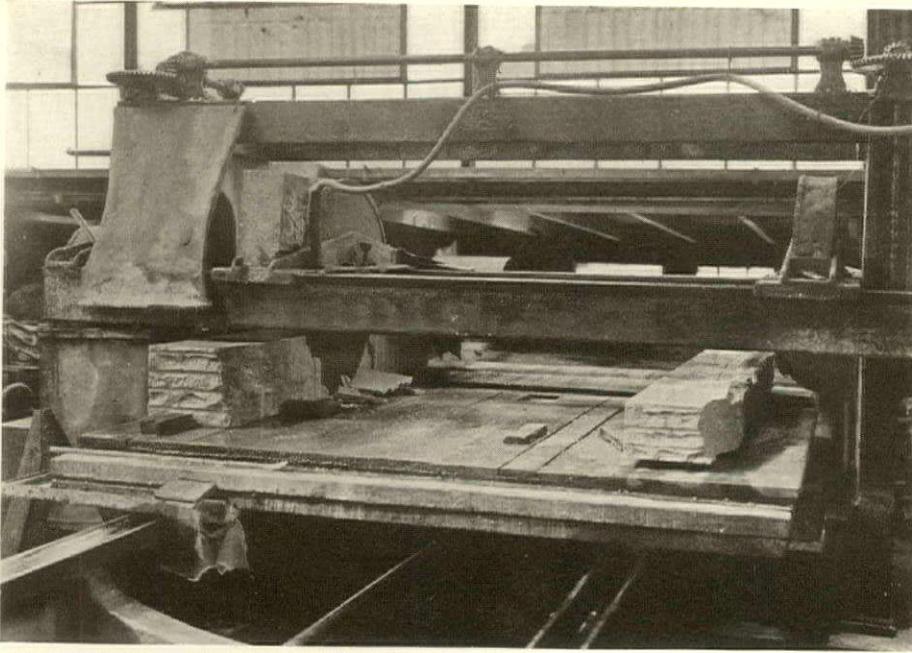


Illustration courtesy Hilgartner Marble Co., Baltimore, Md.

One of the smaller diamond saws, capable of sawing slabs up to 14 inches in height. There are seventy-two diamond teeth in the edge, with two or three black diamonds in each tooth.

the saw revolves and the work is fed against it—or the saw against the work—the diamonds scratch and cut their way through the marble. For cutting marble into large rectangular pieces, such that not more than two or three could be cut at one time in a gang, the diamond saw is the best available tool. For such purposes, it is cheaper to saw the marble with diamonds at from \$900.00 to \$1,000.00 per pound than with sand at \$1.00 per ton. Stones suitable for use in a diamond saw cost from \$4.00 to \$5.00 per carat, and there are about 210 carats in a pound avoirdupois.

Where conditions are such that a considerable number of pieces can be handled in a gang at one time—and where so many are required—the advantage of the diamond saw over the gang rapidly disappears, so far as cost of sawing is concerned. But if shop equipment is standing idle waiting for the pieces sawed to size, they will begin to

come from the diamond saw in less than an hour, while from the gangs it may be a matter of days; the diamond saw is often a life-saver in cases of this kind.

For making irregular or oblique cuts, the diamond saw is very convenient; it can do work of this kind that is very difficult to do in the gangs. It is almost a necessary part of any modern mill intended for sawing either limestone or marble.

Diamond saws may be obtained with a diameter as great as 76 inches; a 76-inch saw can go through a piece of marble 30 inches thick.

In some makes, the saw is mounted on an arbor with a movable platen, on which the work is laid and fed against the saw. In others, the saw is so mounted that it may be fed against the work. There are advantages in both types.

Diamond saws are run at such a rate that the peripheral speed is about two miles per minute.

LIST OF QUARRIES AND MARBLE MANUFACTURERS

REPRESENTED IN THE MEMBERSHIP OF THE
NATIONAL ASSOCIATION OF MARBLE DEALERS

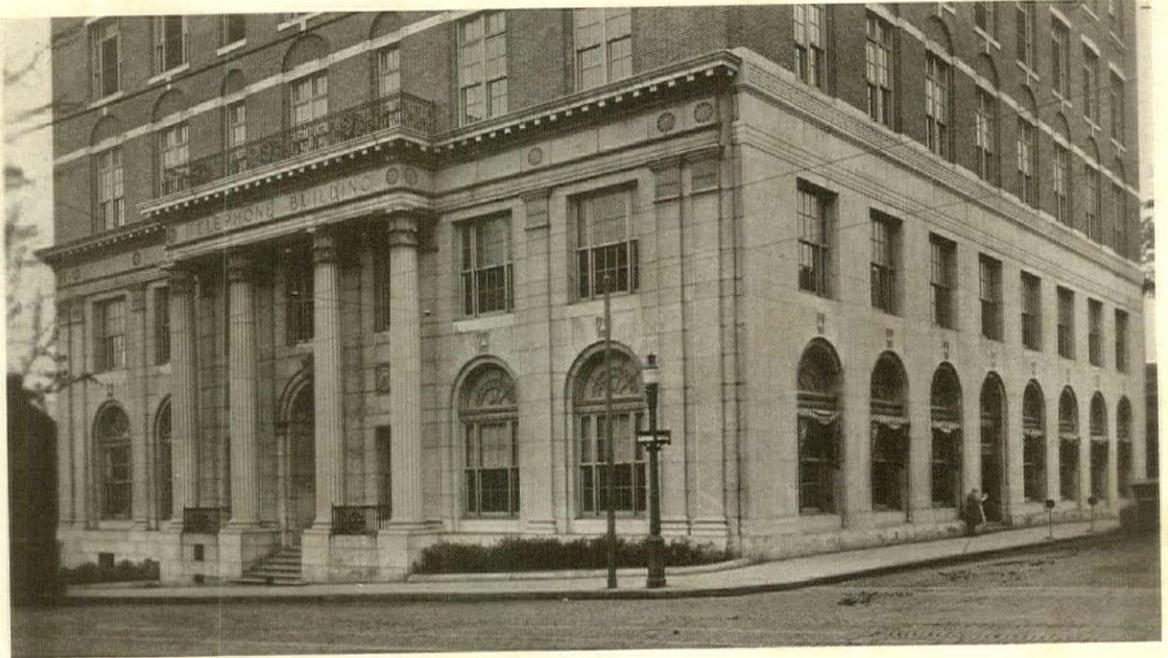
<i>City and State</i>	<i>Company</i>	<i>Representative</i>
Akron, Ohio.	Flower Marble and Tile Company	Jas. T. Flower
Atlanta, Ga.	Reeves Marble Company	Alex. Reeves
Baltimore, Md.	Hilgartner Marble Company	A. H. Hilgartner
Baltimore, Md.	Jos. B. Dunn & Sons, Inc.	Chas. Scheidt
Baltimore, Md.	P. B. and W. Marble and Tile Co., Inc.	Richard T. Salter
Birmingham, Ala.	Alabama Marble Company	John S. Sewell
Boston, Mass.	Troy Bros. & Company	M. W. O'Brien
Buffalo, N.Y.	Geo. W. Maltby & Son Company	Wm. C. Maltby
Buffalo, N.Y.	Lautz Marble Corporation	R. K. Glass
Carthage, Mo.	Arnosti Marble Co.	A. Arnosti
Carthage, Mo.	Carthage Marble and White Lime Co.	Geo. S. Beimdiek
Carthage, Mo.	Consolidated Marble and Stone Co.	Millard Bryan
Carthage, Mo.	Ozark Quarries Co.	T. R. Givens
Carthage, Mo.	F. W. Steadley & Company, Inc.	K. D. Steadley
Carthage, Mo.	Lautz Missouri Marble Company	—
Carthage, Mo.	Spring River Stone Company	John E. O'Keefe
Chicago, Ill.	American Marble Mill Company	T. J. Murphy
Chicago, Ill.	Black & Gold Marble Company	J. J. Bauer
Chicago, Ill.	C. N. Marthens Marble Company	C. N. Marthens
Chicago, Ill.	Corley-Meservey Marble Company	B. F. Meservey
Chicago, Ill.	Davia Bros. Marble Company	Humbert Davia
Chicago, Ill.	Enterprise Marble Company	Thos. A. Knudson
Chicago, Ill.	Flavin Marble Mill	F. A. Flavin
Chicago, Ill.	Frank P. Bauer Marble Company	Frank P. Bauer
Chicago, Ill.	Henry Marble Company	K. H. Townsend
Chicago, Ill.	Jas. B. Clow & Sons Company	A. Bunz
Chicago, Ill.	M. Keating & Sons Company	Thos. F. Keating
Chicago, Ill.	Naughton Marble Company	Thos. Naughton
Chicago, Ill.	Peerling Marble Company	Frank J. Peerling
Chicago, Ill.	Standard Mosaic Tile Company	C. R. Borchardt
Chicago, Ill.	Taylor Marble Company	Geo. W. Bowler
Cicero, Ill.	National Mosaic Tile Company	George Wilde
Cincinnati, Ohio	Cincinnati Marble Company	H. L. Pike
Cleveland, Ohio	Allen Marble Company	R. M. Allen
Cleveland, Ohio	Empire Marble Company	—
Cleveland, Ohio	Haworth Marble Company	W. J. Haworth
Cleveland, Ohio	Interior Marble and Stone Co.	E. M. Fritz
Cleveland, Ohio	Prospect Marble and Tile Company	S. J. Weingarten
Cleveland, Ohio	Roy-Cliff Marble Company	L. G. Yeau
Columbus, Ohio	Wege Marble and Tile Company	C. F. Wege
Dallas, Texas	J. Desco & Son	J. C. Bruggen
Dallas, Texas	Southwest Marble Company	J. Desco
Dallas, Texas	McElhinney Tile and Marble Co.	William Jessop
Denver, Col.	Denver Mantel and Tile Company	D. C. McElhinney
Denver, Col.	Des Moines Marble and Mantel Co.	W. D. Watson
Des Moines, Iowa	Holbrook Marble and Tile Company	J. R. Golden
Des Moines, Iowa	Christa-Batchelder Marble Co.	H. F. McAdow
Detroit, Mich.	Detroit Marble Company	E. L. Leavenworth
Detroit, Mich.		B. L. Cummins

THROUGH THE AGES

<i>City and State</i>	<i>Company</i>	<i>Representative</i>
East Cambridge, Mass.	Johnson Marble Company	T. J. Johnson
Fort Worth, Texas	Good Marble Company	H. G. Good
Houston, Texas	Salt Lake Marble and Supply Co.	Geo. E. Rieder
Indianapolis, Ind.	F. E. Gates Marble and Tile Co.	F. E. Gates
Kansas City, Mo.	Kansas City Marble and Tile Co.	G. F. Keller
Kansas City, Mo.	Phenix Marble Company	Mastin Simpson
Kansas City, Mo.	Sutermeister Stone Company	C. O. Sutermeister
Kasota, Minn.	Babcock & Willcox	Tyrell S. Willcox
Kasota, Minn.	Breen Stone and Marble Co.	Tyrell S. Willcox
Knoxville, Tenn.	Candoro Marble Company	Craig C. Day
Knoxville, Tenn.	Gray Eagle Marble Company	E. F. Klein
Knoxville, Tenn.	Gray Knox Marble Company	J. B. Jones
Knoxville, Tenn.	John J. Craig Company	John J. Craig
Knoxville, Tenn.	Knoxville Marble Co.	John M. Ross
Knoxville, Tenn.	Ross & Republic Marble Co.	W. E. Moses
Knoxville, Tenn.	Salomone-O'Brien Marble Company	Walter O'Brien
Knoxville, Tenn.	Tennessee Producers Marble Co.	B. L. Pease
Little Rock, Ark.	Southwestern Tile Company	R. E. Overman
Long Island City, N.Y.	Clarendon Marble Company	Alexander Thomson
Louisville, Ky.	Peter & Burghard Stone Co.	Jos. E. Burghard
Memphis, Tenn.	Central Mosaic and Tile Co.	Louis B. Marus
Milwaukee, Wis.	Andres Stone and Marble Company	Edgar Andres
Milwaukee, Wis.	Breidster Marble Company	Fred. W. Breidster
Milwaukee, Wis.	McClymont Marble Company	J. J. McClymont
Minneapolis, Minn.	Twin City Tile and Marble Co.	F. O. Streed
Minneapolis, Minn.	Northwestern Marble and Tile Co.	Chas. Gramling
New Orleans, La.	Albert Weiblen Marble and Granite Co.	Albert Weiblen
Oklahoma City, Okla.	Taylor Marble and Tile Company	G. W. Taylor
Omaha, Neb.	Sunderland Bros. Company	J. P. Williams
Peoria, Ill.	Peoria Stone and Marble Works	H. A. Farley
Pittsburgh, Pa.	American Marble Company	Max Weiner
Pittsburgh, Pa.	Iron City Marble Company	George L. Sibel
Pittsburgh, Pa.	Pennsylvania Marble and Mosaic Co.	John A. Fiore
Somerville, Mass.	Phil. H. Butler & Son Company	P. H. Butler
St. Louis, Mo.	Bradbury Marble Company	I. P. Morton
St. Louis, Mo.	Pickel Marble and Granite Co.	H. A. Feldman
St. Louis, Mo.	St. Louis Marble and Tile Co.	R. C. McDonald
St. Louis, Mo.	Shaw Marble and Tile Company	A. Coerver
St. Louis, Mo.	Union Marble and Tile Company	W. C. Fox
St. Louis, Mo.	Weis & Jennett Marble Company	Joseph Weis
St. Paul, Minn.	Drake Marble and Tile Company	W. E. Andrews
Tate, Ga.	Georgia Marble Company	Sam Tate
Wichita, Kan.	Hawkins Marble and Tile Company	M. K. Hawkins
Wilmington, Del.	Geo. W. McCaulley & Sons, Inc.	C. W. McCaulley
Winchester, Mass.	Puffer Mfg. Company	A. W. Puffer

CO-OPERATING—

Vermont Marble Company, Proctor, Vermont.



These two pictures of the Telephone Building serve a three-fold purpose. They illustrate the use of Vermont Plateau marble for exterior construction—how Vermont marble can be effectively combined with brick—and how American Pavonazzo with Verde Antique base gives the needed touch of distinction and stability to the interior. The Telephone Building is in Providence, R.I., Clark and Howe were the architects.

VERMONT MARBLE CO. - PROCTOR, VERMONT
 BRANCHES IN THE LARGER CITIES

See Sweet's Catalog, Eighteenth Edition, for Specifications and Other Data

