THROVGH THE AGES

NOVEMBER, 1923

Thou, O Marble! centuries old,
Everlasting, we behold.
Sands of time can not efface
Thy enduring strength and grace.

M. A. B.

THROVGH THE AGES

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Photo from E. H. Glidden, Architect, Balto., Md.

The Crypt, Canterbury Cathedral

THROVGH THE AGES

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

VOL. I NOVEMBER, 1923 NO. 7

MARBLE WORKING IN GREAT BRITAIN

THE art of working marble in Great Britain dates back at least to the twelfth century. We find Fosterley marbles used in the pavement of York Minster, the columns of Durham Cathedral and in parts of the Tomb of Archbishop Scrope. Marble from Purbeck, in Dorsetshire, was used in the cathedrals of Winchester, Worcester, Salisbury and Lincoln, as well as in the Tomb of Richard Beauchamp, Earl of Warwick, in St. Mary's Church, Warwick.

The marbles of Devonshire were used extensively through the mediæval period for church buildings in Devonshire and Cornwall; but outside of these areas, they were practically unknown till the beginning of the nineteenth century. Petworth marble was used in Westminster Abbey and Canterbury Cathedral, and Furness marble was employed in Holker Hall, one of the seats of the Duke of Devonshire. Many other instances could be cited showing the early uses of British marbles both for decorative and constructional purposes.

The establishment of the Kilkenny Marble Mills on the River Nore in 1730, worked by water power, was the first known instance of the application of other than hand labor for sawing marble in the British Isles. Today many types of machines are in use for working marble and by far the larger number of these are of British manufacture.

Marble when received by the manufacturer is in block and has to be cut first into slabs. This is accomplished by means of a gang-saw consisting of a number of blades of mild steel set in a frame at distances that correspond to the desired thickness of the slabs, and kept under tension by wedges at the ends. This frame is oscillated by means of a rod connecting with a shafting, or with a motor, and sand and water applied. The frames are automatically lowered by a worm and screw attachment connected with the shafts carrying the suspending rods. Fine sharp sand is the cutting medium most extensively used, but at times other abrasives are preferred, such as crushed steel shot, corundum, diamond grit, and other materials.

The frame saws are constructed to carry any number up to eighty blades and are capable of a cutting speed of from one-half to one inch an hour. Of course, this rate is determined by the nature of the marble and the cutting power of the medium. Too fast a cut will frequently result in a ragged surface, and the quick wearing down of the blades.

The slabs obtained from the gang-saw are placed under a rip-saw, fixed by plaster of

Paris, and cut down to the sizes required. The rip-saw, though somewhat similar to the frame-saw, is lighter in construction and faster working, containing from one to six blades, according to the work to be done.

Another method of cutting the slabs to the sizes needed is by means of the diamond saw, a circular blade containing a number of diamonds set along its edge. The slabs are clamped on a travelling table and carried under the saw. The cutting action is much quicker, but the cut is not as clean as that attained by the older method. There are several types of these diamond-saws. In one the saw blade is carried on a travelling saddle moving along a gantry. In another the saw blade is carried on a saw spindle supported at each end on columns or frame sides. The blades of all of these must be of high-grade steel so geared that the periphery speed is the correct one for the most advantageous using of the diamonds. The diamonds are selected and fitted in by a special method. A cutting speed of six inches a minute is usual in large blocks of stone, and higher speeds have been maintained in thin slabs of marble. No grit or sand is employed but it is essential that an adequate supply of water be constantly fed on to the periphery of the saw.

Some unicolored marbles, when the structure is of such a homogeneous nature as to permit it, are coped to size by blows with a hammer and chisel along a previously marked line. The broken edges are usually quite clean.

For working the marble, many kinds of machines are used. The edges for plain faced work are squared on a rubbing bed, which is a horizontal circular plate of cast iron revolving at a high rate of speed. The marble is held in position while sand and water are thrown on the bed, and the friction soon produces a true edge.

For large flat surfaces, there is used a combination rotary sanding and polishing machine consisting of an octagonal frame faced on the under side with iron knobs for sanding, or covered with rope or felt for polishing. A shaft is connected by a pulley with another shaft geared to a main drive-shaft. The whole is so arranged that an eccentric rotary motion is imparted to the frame. The slabs of marble, having been previously attached on the back by plaster to three-inch boards, are set under the frame and a smooth surface soon results.

For large slabs, a "blocking" machine is sometimes employed. This is a heavy block covered with felt, connected by a shaft to an iron frame, and given a rocking motion by crank action.

The "spinner" is another machine used for facing work, mostly on large surfaces. This is a flat-iron perforated disc; there is a universal joint by which it is connected to the shafting. The disc, when revolving rapidly over the surface of the marble, is showered with sand and water, which, passing through the holes, give the polishing power needed. Sometimes smaller discs are used for soffits of arched work and occasionally discs faced with felt are employed for polishing purposes.

The "Jenny Lind" is a contrivance for surfacing large slabs and is a useful machine for general purposes. It allows the rubbing disc to be operated on a horizontal plane in any direction desired. The rotary motion is gotten by means of belting running over two sets of pulleys.

Mouldings are run almost entirely by machinery, which is usually of two types. One type uses abrasives; the other uses a scraping action. This latter, introduced in 1887, is of heavy construction and depends upon the cutting edges of tools fixed in a massive box running the width of the machine. The

introduction of high-speed cutting abrasives for marble dates from 1903 and is gradually superseding the scraping methods. The cutting medium in general use is carborundum, and wheels of this substance are attached to a spindle capable of revolving from 1000 to 2500 revolutions per minute.

Carborundum is used for the working of mouldings, sawing marble to size and occasionally for surfacing slabs and scantlings. It has displaced the diamond-saw in some instances. Various machines for using these carborundum cutting discs have been introduced. One, the Universal Stone-working machine, has been largely employed. In this device, the working shaft can be adjusted to operate at any angle. There is a wide range of work possible, and special attachments for turning balusters and small ornaments are provided. The advantages secured by the use of abrasive wheels are obvious. The machines required are lighter and simpler; the resulting surfaces are smoother and require less polishing afterwards; there is far more flexibility of manipulation; and the wear upon the discs is slight and the upkeep cost is comparatively low.

Pneumatic tools are used to some extent for moulded and carved work. Another type of machine required is the lathe, and it occupies an important position in the marble worker's equipment. For large columns of seven or eight tons or over, a lathe capable of supporting them on centers must be of heavy build. The work of turning is done by free-revolving cutters of hardened steel made with beveled edges. Sometimes carborundum wheels connected by flexible shafting are used instead of steel tools.

British machinery for marble working is found in many parts of the world and in the past few years many improvements have been made of great value to the trade.

Photo from E. H. Glidden, Architect, Balto., Md.

Doorway of Chapter House, Salisbury Cathedral

A LIST OF THE WORLD'S MARBLES

By J. J. McCLYMONT

Note—In our May issue, Mr. McClymont proposed, for the sake of convenience, to divide the different marbles into four groups. These arbitrary groupings were 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.

Bianco Statuary—See Light Columbia.

Biesanz American Travertine—Group A or American Travertine and Tracon. (This stone is a dolomite, not Travertine.)
Quarried near Winona, Winona County, Minnesota.
Grayish cream with mottles of lighter shade, entire mass contains numerous irregular shaped voids or cavities up to ½ inch diameter.
Takes no polish.

Bigarre—Vari-colored

Bigio—Gray

Bilboa Black—See Noir Veini

Bioulix—See Bleu Belge

Bird's-Eye
Netler Dale Quarries, Ashford, Derbyshire, England.
Varies from dark gray to medium brown dotted with small gray fragments. (Watson)
Takes high polish.
Not available. (Elsden and Howe, 1923.)

Bird's-Eye Griotte—See Griotte D'Espagne

Bird's-Eye Utah—See Nebo Golden Travis

Biscuit De Florence
See Florentine White Alabaster.

Bise African—Group D
Quarried near Bise, Nestier Dis Hautes Pyrenees, France.
Dark green with gray, red and yellow fragments (Breche). (Watson)
Takes high polish.

Bise Rose—Group C
Quarried near Bise, Nestier Dis Hautes Pyrenees, France.
Pink and yellow bands crossed with red veins. (Watson)
Takes high polish.

Bise Violet—Group C
Quarried near Bise, Nestier Dis Hautes Pyrenees, France.
Rich brown filler with fragments of pink and violet (Breche). (Watson)
Takes high polish.

Black Belgium—See Belgium Black

Black Derbyshire—See Derby

Black Dolerite
Baverhalli Quarry, near Kolar, Mysore, India.
Deep black with small white mottles. (Watson)
Obtainable in small blocks only.

Black (English Serpentine)
See Cornish Serpentine and Black Marble (Serpentine).

Black and Gold—Group D or Portor Marble.
Quarried on the Isle of Palmaria in the Gulf of Spezia and at Portovenere, near Spezia, Liguria, Italy.
Black and gold comes from the quarry in three grades:
No. 1—Black with yellowish, yellow, reddish yellow, or brown veins varying from small wavy lines to large flat markings.
No. 2—Same as No. 1, except that a portion of the veins are grayish white.
No. 3—Same as No. 1, except that the yellowish veins are only occasional and the grayish white veins are prominent.

Black and White
Mayumiyama Quarry, near Mito, Hitachi Province, Japan.
Dove gray dotted with small spots of white. (Watson)

Black and White
See Bleu Belge, Grand Antique, or Noir De Sable.

Black (India)—See Sungmosa

Black Marble (Japanaise Serpentine)
Uyama Quarry, Tajima Province, Nippon Island, Japan.
Dark green, almost black, with few patches of lighter shade. (Watson)

Black (Spanish)—See Noir Veini.

Black Tennessee
Undeveloped deposits of black, and black and white marble are known to occur in Tennessee.

Blanc
Blank, clean, clear, white or white color.

Blanc Ancy Le Franc
See Ancy Le Franc (Blanc).

Blanc Clair Bed I.J.—Group B
Eastman Quarry, West Rutland, Vermont.
Milk white to faintly clouded milk white. (Vermont State Geological Survey.)
Fine grain. Takes medium polish.

Blanc Clair—Group B
Quarried at West Rutland, Vermont.
Much of the surface is pure white with irregularly scattered light clouds.
Takes high polish.

Blanc Clair (Italian)—See Bianco Chiaro

Blanc De St. Beat—Group A
Quarry at St. Beat, Haute-Garonne Pyrenees, France.
White statuary. (Watson)
Takes high polish.

Blanco—Silver gray

Blanco P—Same as Bianco P

Blanco Roseado
Quarry in Province Navarra, Spain.
White with yellow and rose colored patches. (Watson)

Bleu Ancy Le France
See Ancy Le Franc (Bleu).

Bleu Belge—Group C
Sometimes called Grand Antique Belge or Belge Grand Antique.
Quarry at Namur and Bioulix, Namur, Belgium.
Dark blue-black with slender white markings.
Takes high polish.

Bleu Fleuri—See Bardiglio Fiorito

Bleu Fleuri De Louvie
Louvie-Soubiron Quarry, Basses Pyrenees, France.
Light bluish gray. (Watson)
Not always available.

Bleu De Savoie
Quarried at Cieix, Savoie, France.
Bluish gray with white veins. (Watson)

Bleu Savoie—Mentioned by Elsden & Howe

Bleu St. Remy
Quarry near St. Remy, Rocheford, Namur, France.
Reddish brown background, clouded gray and white veining. (Watson)

Bleu Turquin or Bardiglio Turquine
Quarried at Seravezza, Italy.
Dove colored, slightly clouded with numerous white markings. (Watson)

Blout
One of the counties of Tennessee that produces Tennessee marble.

Blue Building (Stone)
See Gray Building (Stone).

Blue Fleuri—See Bardiglio Fleury

Blue John or Fluor Spar
Quarried at Castleton, Derbyshire, England.
Blue, purple and amber wavelike bands with light gray background. (Watson)
Suitable for inlay work.

Blue John Amethyst
Quarried at same place and similar to Blue John.
Not available in large blocks.

Blue Pentelic—See Blue Pentelikon

Blue Pentelikon—Group A
Monastery Quarry, Pentelikon, Attica, Greece.
Blue gray. (Watson)
Takes high polish.

Boardman Hill Quarry
A non-producing quarry at Clarendon, Vermont.

Bois Jourdan
Quarried in France.
Gray-black with red veins.
Takes high polish.

Boise—Wainscoted

Boiser—Wainscot

Bon—Good quality or the best

Bonassola
Northeast of this town is located the quarry producing Levanto.

Bond Pink—Group A
Quarried at Knoxville, Tennessee.
Dark pink slightly variegated, veins and crow feet at intervals, few white lines.
Takes high polish.

Bongard—Group D
Lahn Quarries, Wetzlar Nassau, Germany.
Gray with patches of pink and cream colored shades.
Takes high polish.

Bonita—Pretty

Borba (Red)
Borba Quarry, near Evora, Alemtejo, Portugal.
Light pink with clouded dark red veins. (Watson)
Not suitable for interior work.

Borba (White)
Borba Quarry, near Evora, Alemtejo, Portugal.
Light pink with light red clouded veins. (Watson)
Used for inlay work.

Borenore (Blue)
Quarried at Orange, N.S.W., Australia.
Blue with white dots and markings. (Watson)
Takes high polish.

Borenore (Red)
Quarried at Orange, N.S.W., Australia.
Red with white dots and markings. (Watson)

Botticino (Dark)
See Botticino Mazzano Scura.

Botticino (Light)
See Botticino Mazzano Bianco.

Botticino Mazzano Bianco—Group C
(Light Botticino)
Botticino Quarry, Brescia, Province Lombardy, Italy.
Light cream few white patches and some slender brown markings.
Takes high polish.

Botticino Mazzano Semiscura—Group C
(Semi Dark or Medium Botticino)
Botticino Quarry, Brescia, Province Lombardy, Italy.
Light brown with patches of near white and slender brown veins.
Takes high polish.

Botticino Mazzano Scura—Group C
(Dark Botticino)
Botticino Quarry, Brescia, Province Lombardy, Italy.
Dark brownish cream with clouds of darker shade and with slender brown veins.
Takes high polish.

Botticino Medium and Semi Dark
See Botticino Mazzano Semiscura.

Bouches Du Rhone Marbles
See Marbre De Cassis and Rouge Jaspe Antique.

Bouere Quarry
See Rose De La Peliviere and Gris Bois Jourdon.

Bou Hanifa
One of the Algerian Onyx Quarries not in operation.

Boulogne
For marbles quarried near this place see Napoleon and Jainville.

Bowringpet
Quarry at Baverhalli, three miles south of this place "Black Dolerite" is quarried.

Box Ground Stone—Group A
Or ground Bed and St. Aldhelm's Stone.
Quarried near Bath, Somersetshire, England.
Light brown. (Free stone)

Brandon
See Brandon Italian (Vermont), Brandon Statuary Middlebury, and Pittsford Valley H.

Brandon Italian
Quarried one-half mile south of Brandon, Vermont.
Light bluish gray background, more or less thickly veined with black or bluish lines or spots and blotches.

Brandon Italian, High Street
See Pittsford Valley H.

Brandon Statuary
Seldon Quarry, Brandon, Vermont.
Clear white without suggestion of color. (Vermont State Geological Survey.)
Not available.

Bravik Fjord
On the side of this mountain at Marnorbruket the Ringborg Marble is quarried.

Brazilian Onyx—Group D or Argentina Onyx.
Quarried at San Luis, Argentina.
Semi-translucent white background with gold colored veinings running to a green background with more pronounced golden markings. (Watson)
Takes high polish.

Breccias
Fragmental stone, the individual particles of which are large and angular in form. (Merrill)

Breccia Aurora—Group D
Paitone Quarry, Brescia, Province Lombardy, Italy.
Light fawn colored irregular fragments with brownish red filler.
Takes high polish.

Breccia Blanc—See Bianco Breccia

Breccia Calacata—See Calacata

Breccia Di Seravezza—See Breccia Violetto

Breccia De Setti Bussi
See Breccia Violetto.

Breccia Di Smyrne—See Breccia Stazzema

Breccia Stazzema—Group D or Breccia Di Smyrne.
Stazzema Quarries, near Seravezza, Italy.
Brownish ground moss tinged with green with fragment of various colors.
Takes high polish.

Breccia Violetto—Group D
Stazzema Quarries, near Seravezza, Italy.
Light purple filler with fragments of white, red or brownish purple.
Takes high polish.

Brecciated—Broken or fractured

Brecciated Marble
An ornamental stone composed of angular fragments of one or various colors cemented together by a natural filler of one or more colors that will take and retain a polish.

Breche or Brechi
Breche and Brechi are used for Breccia by various producers and we have aimed to follow their spelling.

Breche African—Group D (an Onyx Marble).
Ain Smara Quarries, Constantine, Algeria.
Rich crimson background with mottles that appear to have been crushed of white pink, amber and purple. (Watson)
Not available.

Breche Benou Jaune
Same as Jaune Lamartine.

Breche Blanc—Group A
(Bianco Breccia, a Second Statuary Marble.)
Quarried at Carrara, Italy.
Cream white brecciated with black and gray veins.
Takes high polish.

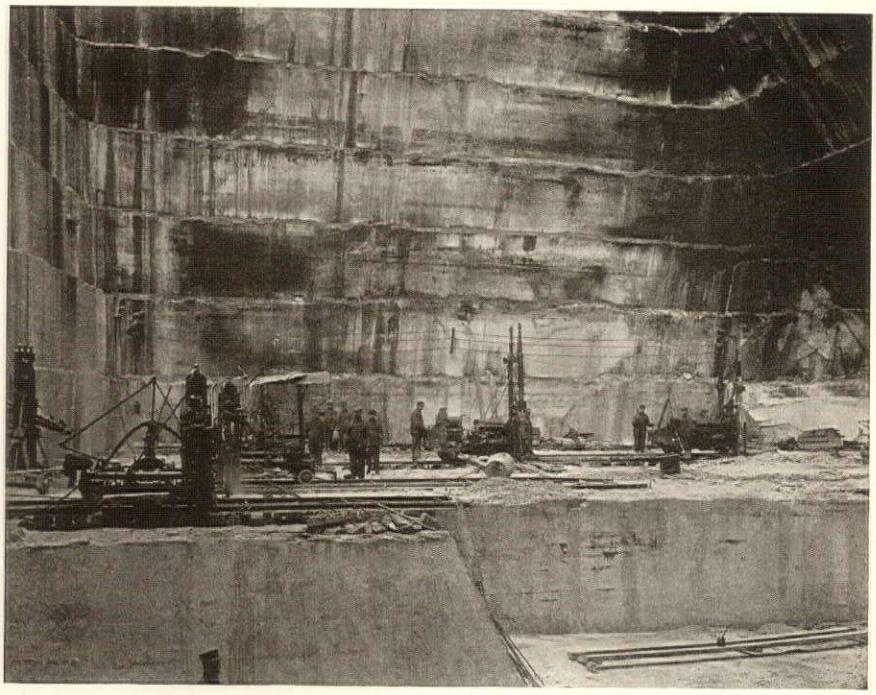
Breche Corralline—Group D or Vigauner.
Vigaun Quarry, Hallein Salzburg, Austria.
Gray filler a background with numerous pink and fawn colored fragments. (Watson)
Takes high polish.

Breche D'Alet—Group D
A conglomerate.
Quarried in the Valley of Tholonet, near Aix, France.
Pinkish background with pebbles of dull pink, yellowish and drab.
Takes medium polish.

Breche D'Aste—Group D
Quarried near Bagneres De Bigorre, Hautes, Pyrenees, France.
Orange background with white fragments which in turn have orange veins. (Watson)
Takes high polish.

Breche De Dourlais
Same as Breche De Waulsort.

Breche De Kiefer—Group D
Kramsach Quarry, Tyrol, Austria.
Bright red filler, with fragments of pink, fawn and white. (Watson)
Takes high polish.



TUNNELING FOR MARBLE

[Reprinted through courtesy "The Monumental News"]

IT has always been customary to give the name of "quarry" to any opening in the earth's surface that leads to a bed of marble. No doubt that is the correct term, whatever may be the form of the hole in the ground, and yet one is prompted to speak of the large quarry at West Rutland, Vermont, as a "mine." Perhaps it might be well to compromise and call it a quarry at the top and a mine at the bottom.

If it were possible to take the stairs out of the Bunker Hill monument—294 steps, 8 inches apart—and stand them up on the front side of this quarry there would be no more than enough to reach the bottom. This does not mean that there are no stairs at West Rutland. On the contrary, there are a series of flights, all worn smooth by the resistless tramp of the laborers.

A stranger standing on the top step and looking down might well be pardoned for thinking that he was seeing it all. The darkened walls of the quarry; the long stretch of derrick rope; the massive marble pillars left standing to support the overhanging weight; the workmen on the lower floor crawling about like so many insects—all this he could see, and possibly he would conclude that the West Rutland quarry is like all other large marble quarries. In that event he ought to be taken to the foot of the stairs and initiated into the mysteries of the vast underground cavern that is spread out under the mountain.

Let us suppose that he makes the descent on a summer's day. It is uncomfortably warm at the top, but on the lower level there is a chill in the air. On reaching the last step he buttons up his coat and cranes his neck up toward the patch of sky that is still visi-

ble. Then turning about he discovers a string of electric block cars moving away into the darkness and here and there in the gloom he locates the glimmer of an electric light. The shouts of the quarrymen mingle with the rattle of drills and channeling machines and echo to the far corners of the tunnel. Perhaps the rumble of distant blasting may float out to him from some shelf where a new floor is being started. All he can make of it is a confused jumble of sound and shadow.

As a matter of fact, though, there is very little confusion in that covered quarry. Every man knows what he is expected to do, and he does it. Scattered around there on the different floors are something like fifty channeling machines and thirty drills, each operated by its little gang of toilers. The electric road which has pushed its way through 800 feet of the tunnel is worked by another gang. The inclined cable track on which the block cars are given a climb of 500 feet to the top of the quarry commands still another gang. And so it is in all parts of this underground system.

The West Rutland marble "mine" is in reality a series of quarries merged into one. Only at the surface do they retain their individuality; at the bottom the partitions have all disappeared. The combined stretch of tunnel covers a distance of about 2,000 feet. On one side it has a reach of 400 feet back into the mountain; on the other it has eaten its way for 300 feet under the railway track. The greatest depth is approximately 300 feet.

Within this marble encasement an army of about 500 men has been assembled. It is as if the entire population of one of the smaller Vermont villages should clamber down the quarry stairway every workday morning and troop out again every night. It is almost like being placed in another world, and yet it is far from being a bad world. Modern appliances have wrought many changes in quarry conditions. An old issue of *Mine and Quarry* contains this word-picture of the West Rutland tunnel:

"In visiting the quarry pits the traveler who is sufficiently inquisitive is led down a steep ladder some 100 or 200 feet to the bottom of the quarry, or to a hole in the side of the hill into which it is difficult to see more than a few feet on account of the steam. In this atmosphere the electric arc lights are merely an aggravation of the gloom. One is told that in this quarry there are about twelve channelers, but he could not believe it except for the deafening roar which he knows must come from the blows of the steel and the exhaust. Nothing short of a photographic flashlight will reveal the busy machines and their operators until the visitor is almost near enough to feel them as well as see them."

Today that description would be altogether misleading. The steam pipes have all been taken out and the electric wires have come to take their place. This does away with much of the gloom and dampness and tends to relieve the burden of the arc lights. As a further aid in the elimination of dampness, there has been installed a large electric pump by means of which the quarry is kept free from water. It is expected that there will be a certain amount of darkness and moisture; the best that can be done is to bring it down to a minimum, and in the West Rutland plant the minimum has become a reality.

Thus have the men been given a better place in which to work—which is only another way of saying that they have been given a chance to do better work. This improved service has in turn raised the standard of production and increased the efficiency of the entire system. In short, it has con-

tributed to the general welfare of both wage-earner and employer.

* * * *

The marble beds are well described in one of the reports of the State Geologist:

"The marble in some quarries varies but little from layer to layer, while in others there are several varieties in a single layer. Some layers produce pure white statuary, others most daintily veined or clouded, show a white ground variously streaked, blotched or veined, with green in one bed, blue in another, yellow or light brown in another, olive in another, and it is easily seen that the mixtures and relative amount of these veins in the white ground may be innumerable. I do not know how many shades are recognized in trade, but in the state collection there are blocks which represent twenty varieties."

It is estimated that fully 10,000 quarry blocks are taken out yearly from the West Rutland vein. In this connection it would be interesting to know how many millions of tons have been removed since the beginning of operations. Nor is it possible to refer to the early days of the industry without raising a query as to how the business actually started.

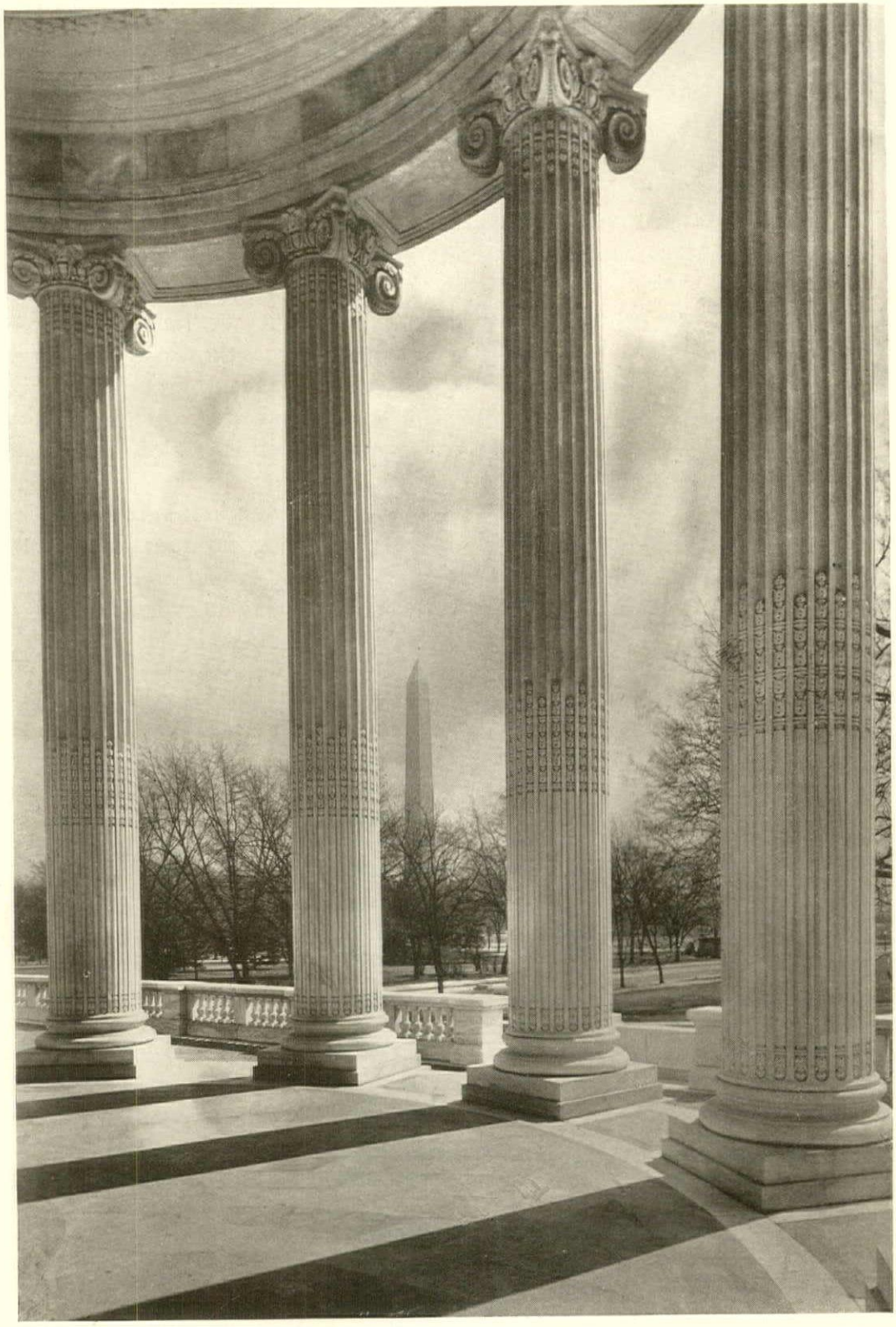
Child's Rutland County Directory for 1881–82 contains this interesting paragraph:

"These quarries were opened about the year 1843 and the past thirty-eight years marble has been taken from them to the depth of 250 feet. In the beginning the business was limited and not very profitable, as in the absence of railroads the entire product had to be hauled by teams from the quarries to Whitehall, N.Y., the nearest shipping point, a distance of twenty-five miles. But the completion of the railroad in 1851 gave an impetus to the business. In the spring of 1850 Messrs. Sheldon and Slason erected an eight-gang mill, running nine months of the year in the daytime only, and then more nearly met the demand than they do now with a 48-gang mill running night and day all the months of the year. The machinery is driven by a 300-horsepower engine, which also hoists the stone from the quarries. In quarrying, sawing and shipping marble 350 men are employed."

Such figures may have seemed large in those days, but they are now far in the background. In view of the present force of over 4,000 employees those 350 men appear like a rather insignificant group. The 300-horsepower engine has been replaced by an electric wire which is one of the arms of a 10-000-horsepower circuit. The eight-gang mill was only the first link in the chain; there are today 450 gangs turning out marble for the Vermont company. Surely the industry has passed through a marvelous transformation.

The question which vexes the visitor, as he stands on the edge of the quarry and looks down into that gigantic rift in the mountains, usually has to do with the supply. How much has been taken out and how much remains in the ground? Such inquiries can, of course, only be answered in a rather indefinite fashion. Figures may be provided and estimates made, but all they can ever do is to open the way for a certain amount of guesswork.

Nevertheless, it is known that the old marble quarries of Europe have been in operation for a good many hundred years and that in spite of the enormous waste they are still in a state of activity. What has taken place there is likely to be repeated in our own country. The geologists claim that there are great masses of Vermont marble which are as yet scarcely touched; they even go so far as to say that the supply may be considered inexhaustible. If this be true, the quarries of Vermont should be able to meet all the demands made upon them in the coming centuries.



View of Washington Monument from the South Portico of
Memorial Continental Hall

MEMORIAL CONTINENTAL HALL

The National Headquarters of the D.A.R. in Washington

THE National Society of the Daughters of the American Revolution was formally organized in the city of Washington on October 11, 1890. A small band of women, eighteen in number, had gathered together with the desire to perpetuate the memory of their ancestors, the men and women who had achieved American independence. In their veins ran the blood of those who had fought for their country over one hundred years before. Their patriotism was as ardent as was ever that of these Revolutionary forbears.

The physical expression of this spirit was the erection of a building in Washington suitable for the conduct of the affairs of the Society. Land was acquired on Seventeenth Street, a few blocks south of Pennsylvania Avenue, and here was built, at a cost of $700,000, the beautiful marble structure known today as Memorial Continental Hall.

The building stands between the Red Cross Building and the Pan American Building, and these, along with the Corcoran Art Gallery at the northern end of the group, form a quartette of strikingly handsome structures that make Seventeenth Street at this point one of the show places of the National Capital. The Hall faces the President's Park lying between the White House and the Washington Monument. Just to the south is the beautiful Government Reservation, Potomac Park.

The architect, Edward Pearce Casey, of New York, was chosen in 1903, and on April 19, 1904, the cornerstone was laid under the auspices of the Masonic fraternity, the gavel used being the one with which George Washington laid the cornerstone of the National Capitol in 1793. Vermont marble was used in the construction of the entire Hall, and in design and general appearance it resembles classic buildings of the Revolutionary period.

The roof of the front portico is supported by sixteen immense drum columns with the

The South or Memorial Portico, with its thirteen monolith marble columns, one for each of the original thirteen states of the Union.

The Entrance Hall is of marble from Vermont. Notice the busts in the niches between pilasters.

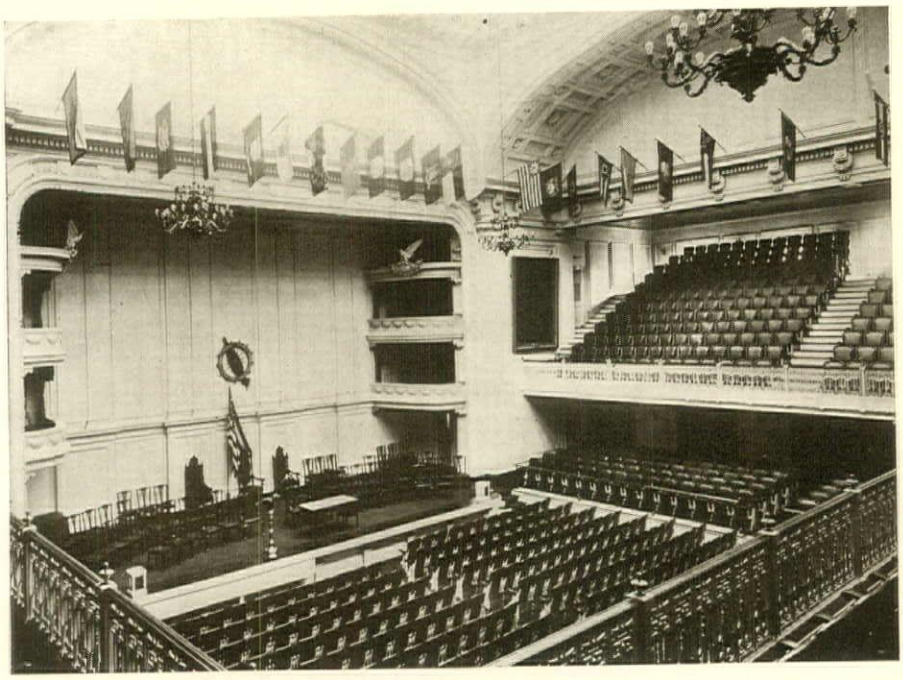
inscription "Memorial Continental Hall" across the front above them. The three pairs of bronze doors at the front entrance are memorial gifts, the central pair to the Founders, the north and south doors to the Chapter heroes of Connecticut and Massachusetts by these states.

In the center of the floor of the main Entrance Hall is sunk the coat of arms of Pennsylvania, the state giving this part of the building. In the niches forming the frieze are marble statues of Washington, Hancock, Adams, Hale and other historic characters, presented by various state Chapters. Leading from the Entrance Hall to the second floor are two staircases of fine dignity and impressiveness; the north one a memorial to Mrs. S. V. White, whose name is associated so intimately with the Wallabout prison ships martyrs' monument; the south, a gift of the Minnesota Chapters.

The Auditorium, with its three galleries, seats two thousand persons. In the galleries hang several portraits and oil paintings of excellent merit. From the ceiling is suspended during Continental Congress Week the Betsy Ross flag, with its circle of thirteen stars on a field of blue.

The various office rooms throughout the building were furnished by state Chapters and contain articles of historic significance. Every state has had its part in the completion of the building and in furnishings of various kinds. Indeed, every part of it is the gift of some Chapter, Daughter or State. Doors, stairs, electroliers, statuary, books, pictures—all are suitably marked with the names of the donors.

On the south side of the building, the roof of the Memorial Portico is supported by thirteen monolithic columns. These were presented by Chapters or Legislatures of the thirteen original states of the Union, and they are arranged in the order in which they

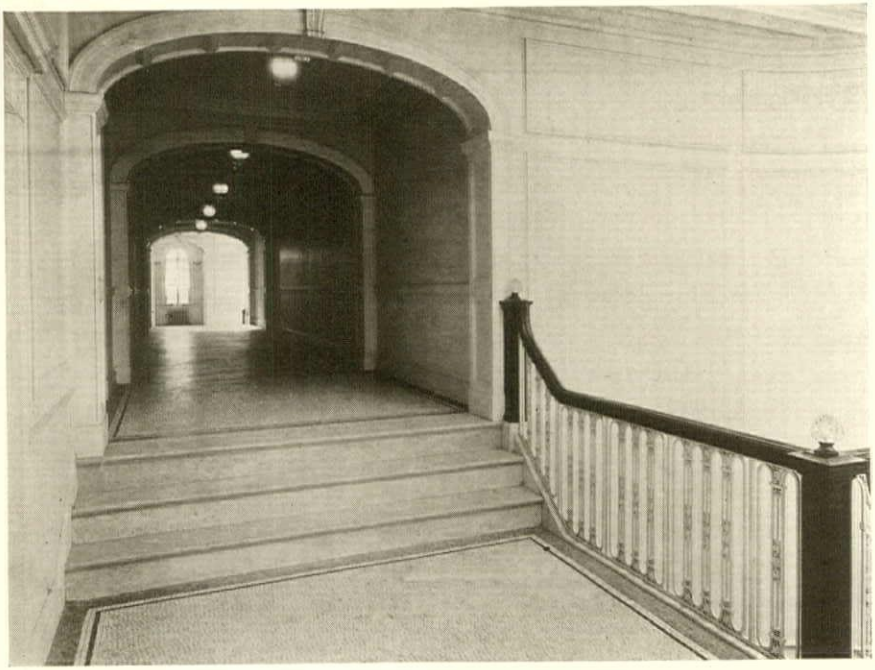


The Auditorium, capable of seating 2,000 persons. The double galleries contain many fine paintings.

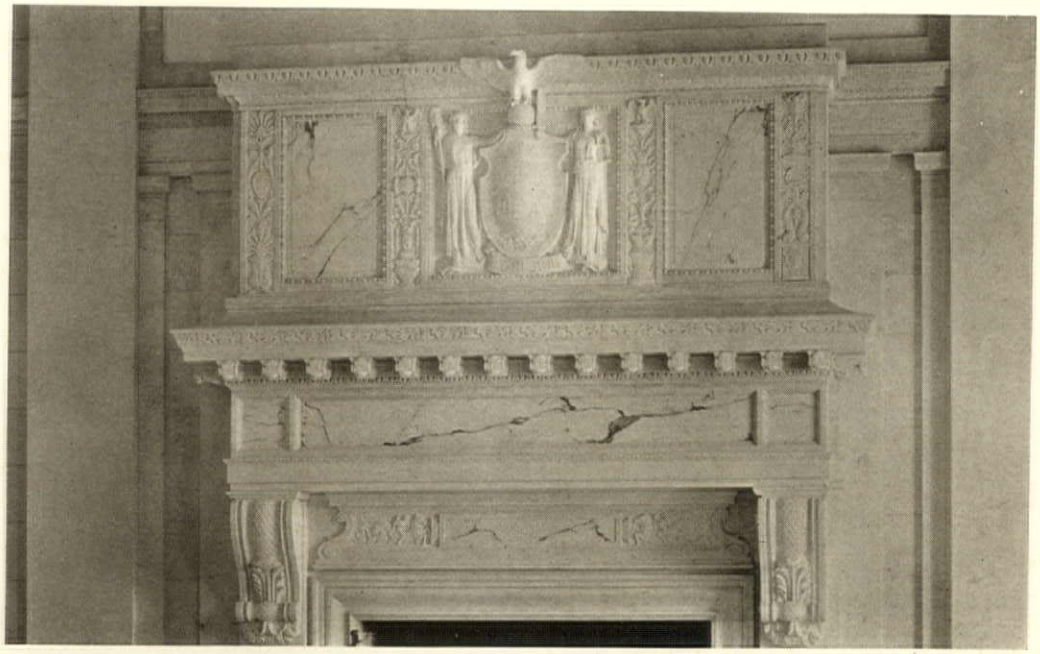
entered the Union, beginning with Delaware and ending with Rhode Island.

Among the rooms furnished by the individual states, several stand out with special prominence. The New Jersey Committee Room, for instance, used the historic oak of the British frigate *Augusta* which sank during the battle of Red Bank, in 1777, as the material from which to fashion the woodwork and furniture. The office of the Recording Secretary General, a memorial provided by New York, contains a historic table on which George Washington and his wife Martha ate their suppers, and an original autograph poem by Dolly Madison dated 1848. The Maryland Room, used as the office of the Treasurer General, contains a history of the burning of the *Peggy Stewart*, framed with some of the actual wood from that vessel.

In the rear of the main building has been erected an office building to care for the increased detail connected with the management of the Society. The rapid growth and expansion of its work necessitated this addition, and much of the work formerly done in Memorial Hall is now carried on in this new annex. It contains two stories and a high, well-lighted basement and is connected with the Hall both by an underground passage and through an artistic pergola.



Corridor leading to the Annex. Marble is used here with fine effect.



Library of the State Capitol, Albany, New York. The marble is Second Statuary with American Pavonazzo panels.

FIREPLACES AND MANTELPIECES

"Men make them fires on the hearth
Each under his roof-tree,
And the Four Winds that rule the earth
They blow the smoke to me."

—*Kipling*

THE open fireplace was one of the earliest contrivances invented to contribute to the health and comfort of man. It is true that the principle of the chimney was probably understood long before the practice of constructing it became general, but it was a rare object even in the sixteenth century. Leland in his "Domestic Architecture" speaks of how "chimeneys were conveyed by tunnells made on the syds of the walls betwyxt the lights in the hawle" of Bolton Castle and expresses his surprise at this innovation.

The first chimneys consisted of the entire house, the fires being built in the middle of the hut or building and the smoke escaping through a hole in the roof. The next step, described by Viollet-le-Duc in his "Habitations of Man," was a sort of chimney built over the opening of the roof. This was followed by the construction of jambs on each side of the fire in order to avoid lateral currents of air, and the chimney flue was brought down to within a few feet of the fire.

In milder climates we find the portable brazier, without any provision for the outlet of the smoke, the system generally of the Greeks and the Romans. These braziers often were very elegant pieces of furniture.

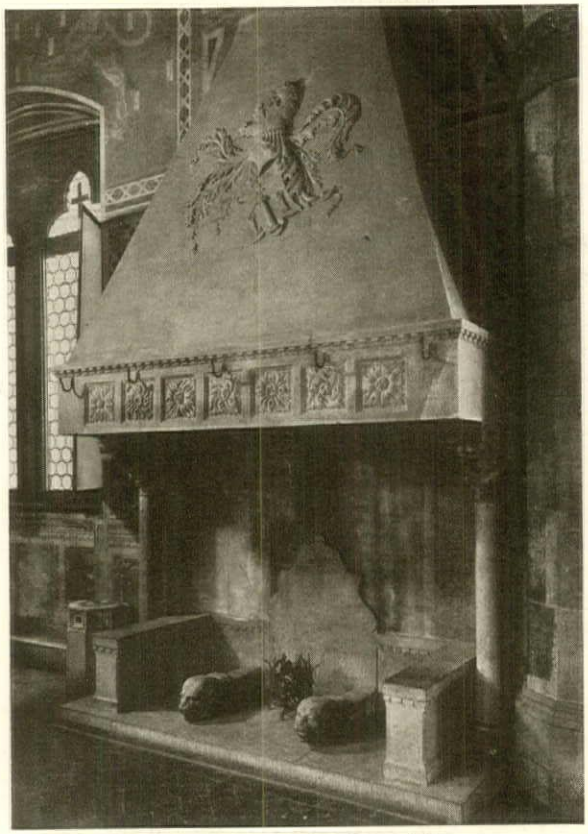


Photo from Thos. G. Machen, Architect, Balto., Md.

Chimney from the Palace of the Duca d'Atene, now in the National Museum in Florence, Italy. The ducal arms are carved on the hood. Notice the curved hooks for hanging meats and pots.

This graceful chimney in the Chateau de Blois, Aisle de France, is in the ornate style of the Renaissance. The alternating fleur-de-lis and letter H's form a background for the large paneled H.

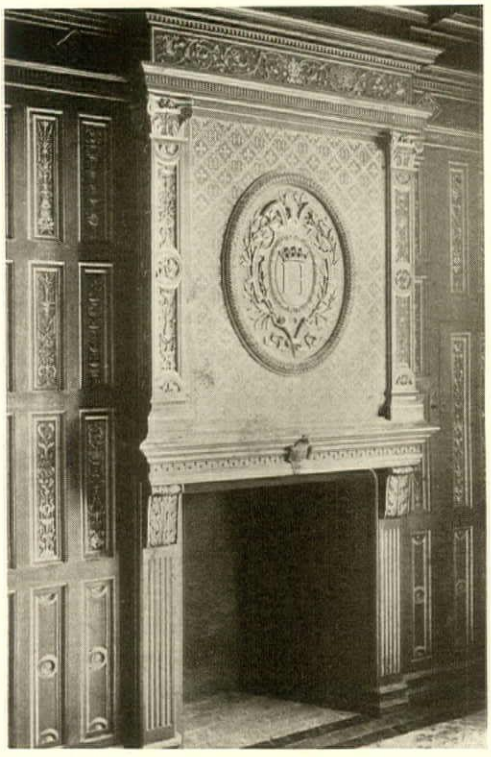


Photo from Thos. G. Machen, Architect, Balto., Md.

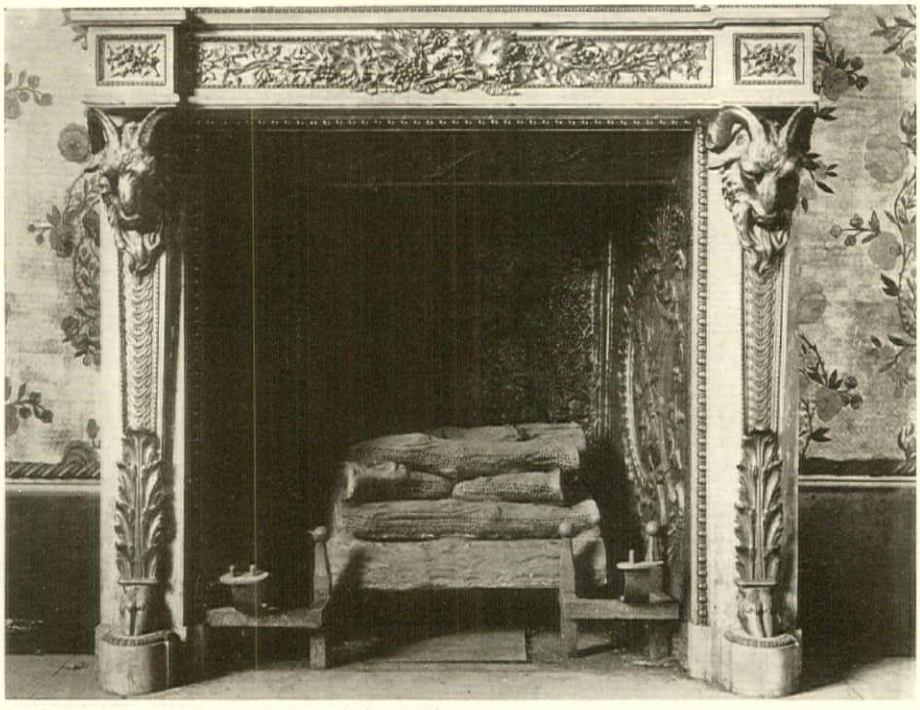


Photo from Thos. G. Machen, Architect, Balto., Md.

This Louis XVI style chimney is found in the Chateau de Bagatelle. The gas logs are a modern touch. The large and quaint andirons were commonly met with in fireplaces of this period.

This marble column forms one side of the fireplace in the Hall of the Guards, Chantilly. Only a small part of the huge opening is shown in the illustration.

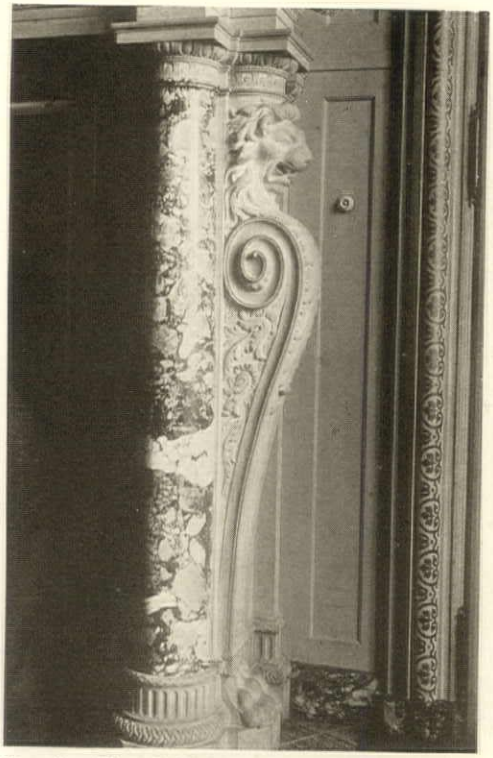
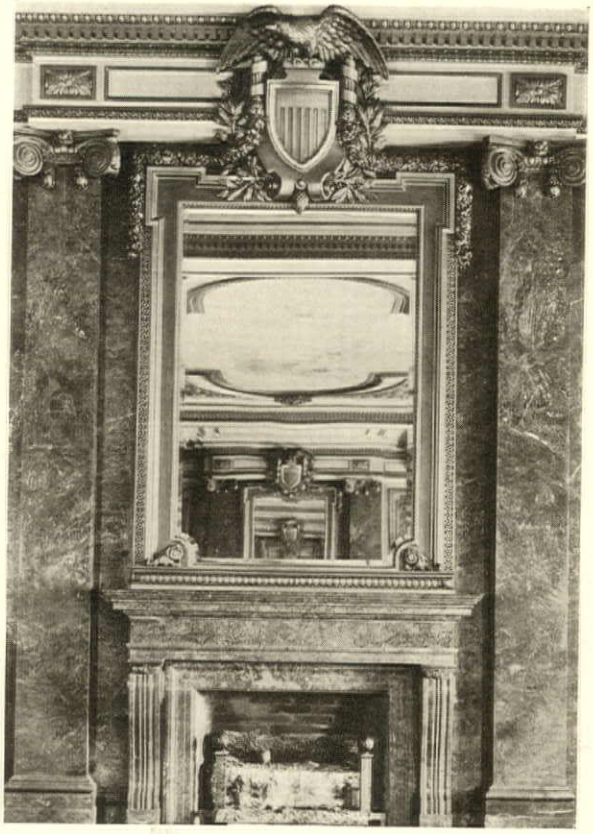
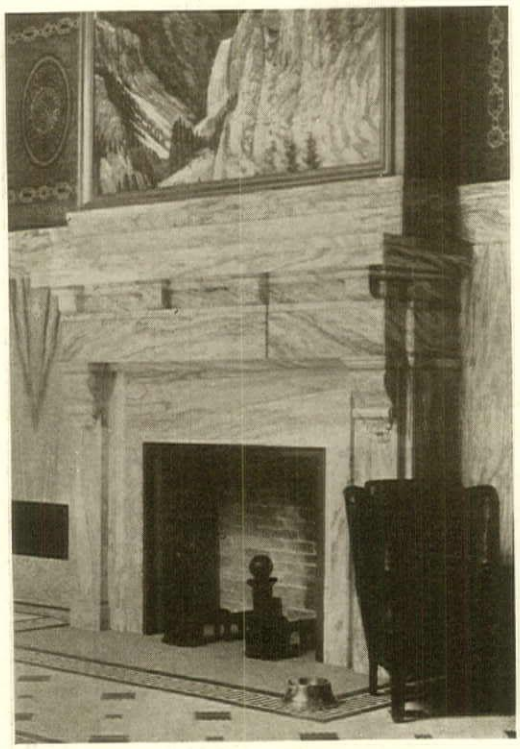


Photo from Thos. G. Machen, Architect, Balto., Md.



Dark Utah Golden Travise marble was used for this mantel in the Governor's Reception Room in the Utah State Capitol at Salt Lake City.

This dignified room is found in the First National Bank Building at Hazelton, Pennsylvania. American Pavonazzo marble is the material from which it was constructed.



The Northern Hotel, at Billings, Montana, contains this beautiful open fireplace flanked on either side by wainscoting of effective marble slabs. The whole treatment is done in Royal Antique from Vermont. Linke and Haire were the architects.

English Bath Stone was chosen for this fireplace when A. F. Hanson, of New York, designed the home of C. L. Bliss, in Boston, Massachusetts. This is one of several fireplaces in this very unusual residence, and much of its charm depends upon the inclusion of this particular feature.

It was not an uncommon thing for deaths to occur from the poisonous charcoal fumes.

In colder climates, the brazier reappears in the form of the smoky lamp of the Laplander and Esquimau. The hearth in the middle of the hall still existed as late as the fourteenth century. The great logs were simply piled on andirons and the smoke escaped through the louvre on the roof. According to Putnam, the idea of building the fireplace against the wall probably originated in England in the eleventh century at the time of the Norman conquests. Since the roofs of fortresses were used for defense, the fireplace was moved to an outside wall, and an opening made in this wall above the fire for the exit of the smoke. This led to the ordinary chimney as it is now built. Rothery, in his "Chimney Pieces and Ingle Nooks," takes a different viewpoint. He claims the change from a central fire to a semi-enclosed fireplace and chimney was brought about through the practice of building a field fire against a rock and protecting it on each side with stones piled one on another.

At first fireplaces and flues were very large. In France, royal edicts as late as 1723 fixed the size of the flue at 3 feet wide and deep enough to admit the chimney-sweep. In this country old-fashioned fireplaces were often 8 feet long and 3 feet deep. So great was the draught that screens were necessary to protect the inmates from the powerful currents of cold air. Large hoods were sometimes built above them and hospitable benches grouped about the opening. This hood was afterward abandoned, partly because it was thought to interfere with the

decoration of the apartment and partly because of the desire for novelty. The smoke, in many of these designs, would enter the room and, to offset this, the mantel and shelf were lowered.

The oldest fireplaces of the middle ages were often circular in form, the back of the fireplace forming one segment of a circle, the mantel and hood the other. Up to the fourteenth century the fireplaces of private houses and chateaux were generally of great simplicity and it was only later that we see any attempt at decoration.

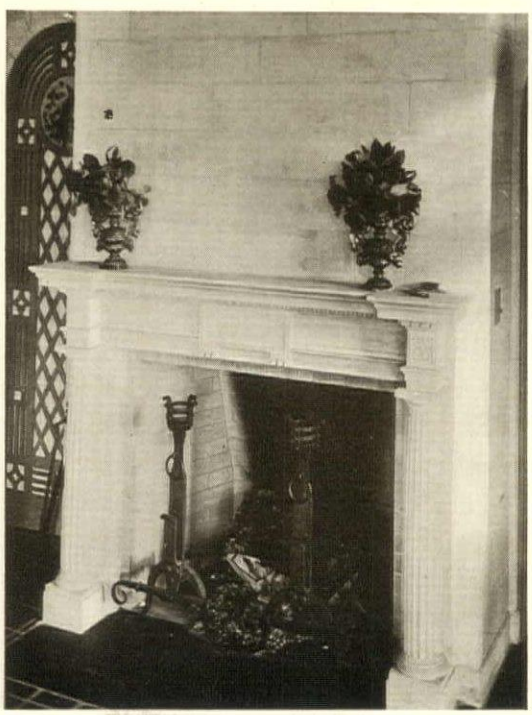
In the oversize fireplaces of the middle ages, the problem was to correct the smoking. The first recorded effort to study the matter seriously was by Louis Savot, a physician of Paris, who died in 1640. He was the designer of the famous fireplace at the Louvre. Several of his ideas have been adopted in present-day methods. The smoking chimney continued to vex the architect for many years. Benjamin, Count of Rumford, in his Essays published in 1798, says: "The plague of a smoking chimney is proverbial, but there are many other very great defects in open fireplaces . . . . which, being less obvious, are seldom attended to."

After Savot came Gauger with a ventilating fireplace, in 1713. Then followed many improvements, both for the consuming of smoke and for the form of the chimney-throat, until today there is no reason at all why anyone should bear with a smoking chimney or an ineffective fireplace.

The development of the fireplace corresponded with the general advance of domestic architecture. It was seen that the separate parts that make up the chimney-piece possessed decorative possibilities, and builders began to recognize the fireplace as one of the chief interior features. Marble and brick were from the beginning the materials mostly utilized in its construction. The durability

This very unusual treatment in white marble is found in a residence in Washington, D.C. All the doorways, baseboards and chair rails were of the same material.

Another of the several marble fireplaces built into the residence of C. L. Bliss, in Boston, Massachusetts. This also is made of English Bath Stone.



The fine large living-room in the residence of Mrs. Bell in Washington, D.C. This view shows a small section of the library. The marble mantelpiece is very handsomely carved.

and adaptability of marble, the effects that can be obtained through having so wide a range of color selection, its ease of cleaning and imperviousness to staining have naturally made it the choice of the majority of architects. Even where every provision for ample heating is made, the age-long habit of thinking of the hearth as the heart of the home will continue; and the fireplace will always be found as the dominant feature of interior domestic architecture. This entails the acceptance of an important fact—the chimney piece must truly form part of the picture regarded as a deliberate and vital composition. This does not compel to a dead level of uniformity in design. Rather the fireplace is a fitting opportunity for the display of individuality.

PANTHEON SERVES AS BANK MODEL

Philadelphia Financial Institution Follows Classic Structure When Building its New Home

THE Girard Trust Company of Philadelphia had occupied the northeast corner of Chestnut and Broad Streets for nearly two decades. Then, one Saturday afternoon in August, 1908, while thousands of curious Philadelphians watched the proceedings, the unusual feat of transferring cash securities and valuables worth two hundred millions of dollars from the old quarters to a new home across the street, was accomplished. Guarded by a detail of uniformed policemen and a squad of plain-clothes men, the vast wealth was trundled on trucks to the marble palace that had just been completed after two years of work.

The new home, which is still occupied by the company, stands at the northwest corner of the principal business intersection of the city, on a plot of ground probably the most valuable of its size in all Philadelphia. The building was modeled after the famous Pantheon at Rome, the noble and dignified lines of the original having been faithfully reproduced in white Georgia marble. It was first decided to use granite, but the architects, Allen Evans and Charles E. McKim, urged the selection of the more beautiful material. Georgia marble was chosen because of its peculiar hardness, and also because it is non-absorbent and therefore less likely to show stains from the smoke and grime of the city. It was used inside and out, except that, for decorative purposes and for the attainment of certain effects in parts of the interior, panels of Pavonazzo marble were employed. More than nine thousand

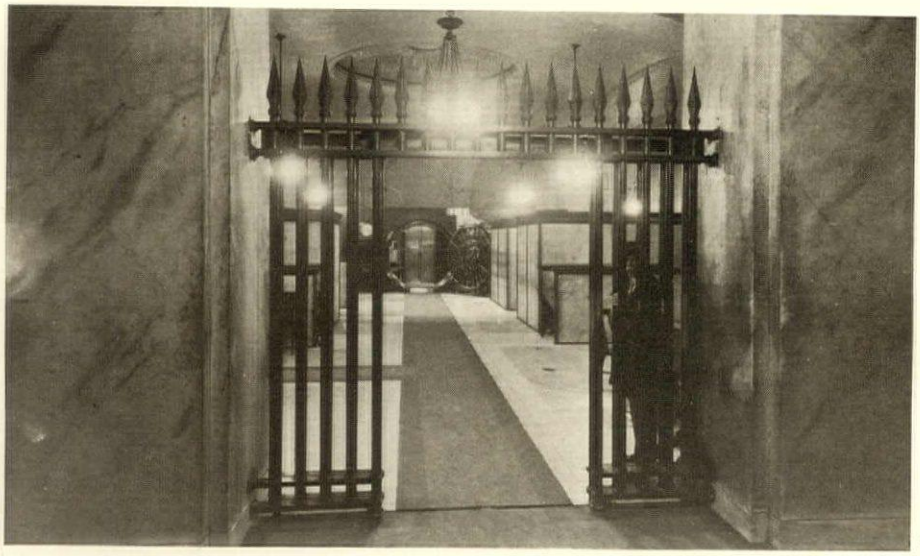
View of the main banking room, showing the large inclosure in the center and the bookkeepers' gallery.

tons of marble were required for the work, representing in value over a half-million dollars.

The foundation excavations were carried down until a solid pan of hard water gravel was found, upon which was laid a footing of cement. The building has a sub-basement 32 feet below the ground level, a basement, a main floor and three upper floors, besides a gallery in the dome. This dome is 129 feet above the basement floor and contains an immense skylight that affords ample lighting for the entire interior. The structure fronts about 137 feet on Broad Street and 140 feet on Chestnut Street.

As usual with domed buildings of this character, the interior conveys an impression of more spaciousness than suggested by the exterior. The center of the main floor is occupied by the general banking room, measuring some 80 square feet and having in its center an inclosure for tellers and clerks. Ranged around the walls are the executive offices of the company. From this central chamber a wide marble stairway leads to the safe deposit department in the basement,

At the right is seen the doorway leading towards the safe deposit vaults. Georgia and Pavonazzo are the marbles used.

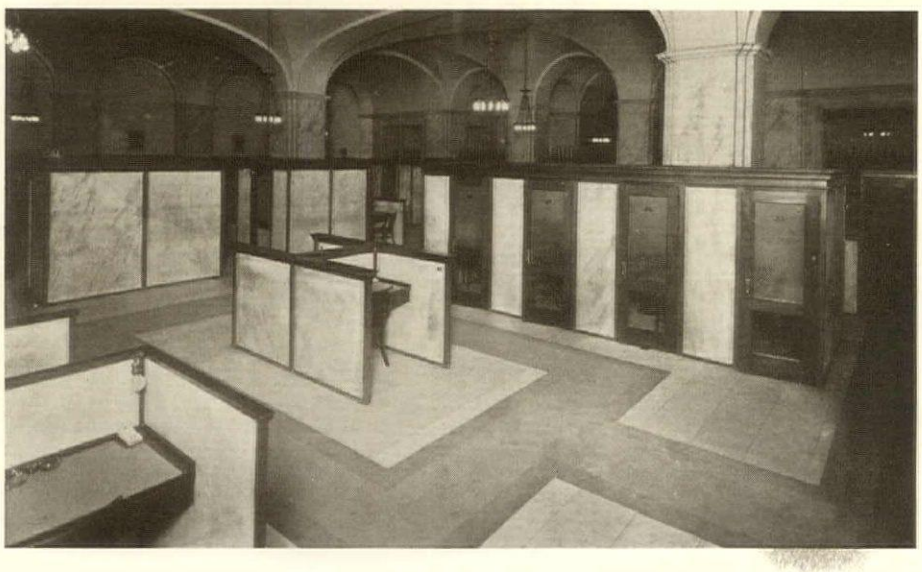


The iron gate guarding the entrance to the safe deposit vaults. The huge circular door to the big safe is seen in the rear.

where is located a huge vault of steel armour plate with its intricate locking devices. Within this vault are marble booths for the convenience of the renters of the safe deposit boxes.

The bookkeepers occupy the gallery, and a Board of Directors' Room is on the second floor, with stockholders and committee rooms in the rear. Dining-rooms, lockers, lavatories and storerooms occupy the third floor, with kitchens on the fourth.

Great attention was paid to the installation of the heating and ventilating systems and the machinery for accomplishing the desired ends excited much favorable comment at the time of the occupation of the building. That the choice of building material was a wise one is shown by the kindly way in which time has treated the structure since its erection fifteen years ago. No signs of deterioration are apparent and the building stands today as imposingly dignified as it did when first finished. Like its prototype in Rome, it will probably outlast by many years the surrounding buildings, even though many of these are "skyscrapers."



A view of the marble booths for the convenience of the depositors in the Safe Deposit Department. The floors and walls are also of marble.

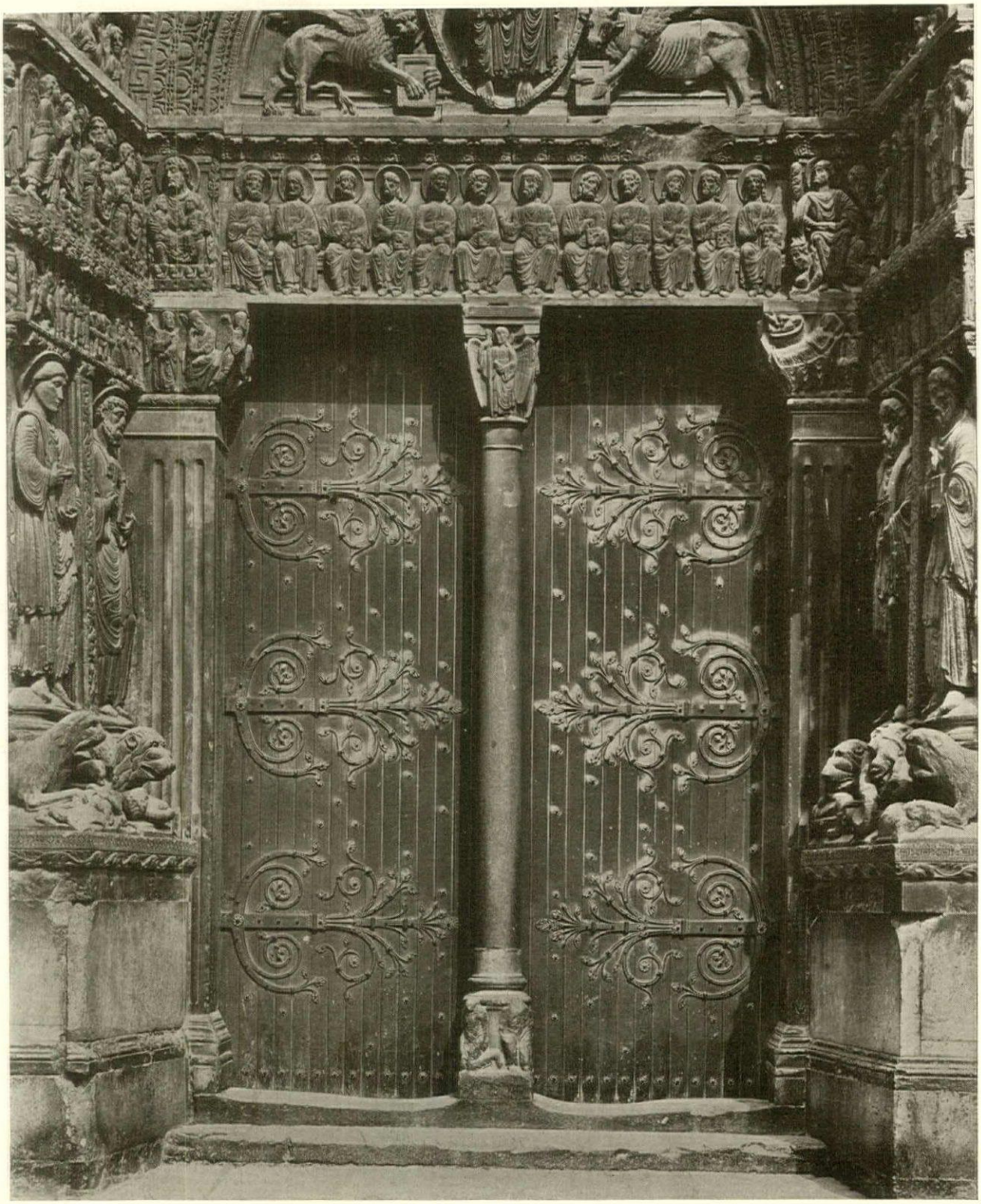


Photo from Thos. G. Machen, Architect, Balto., Md.

The main portal of Saint Trophîme at Arles. The carving is characteristic of the Romanesque style, with the elaborate bas-relief and grotesque figures of animals. Notice the capitals over both central column and pilasters.

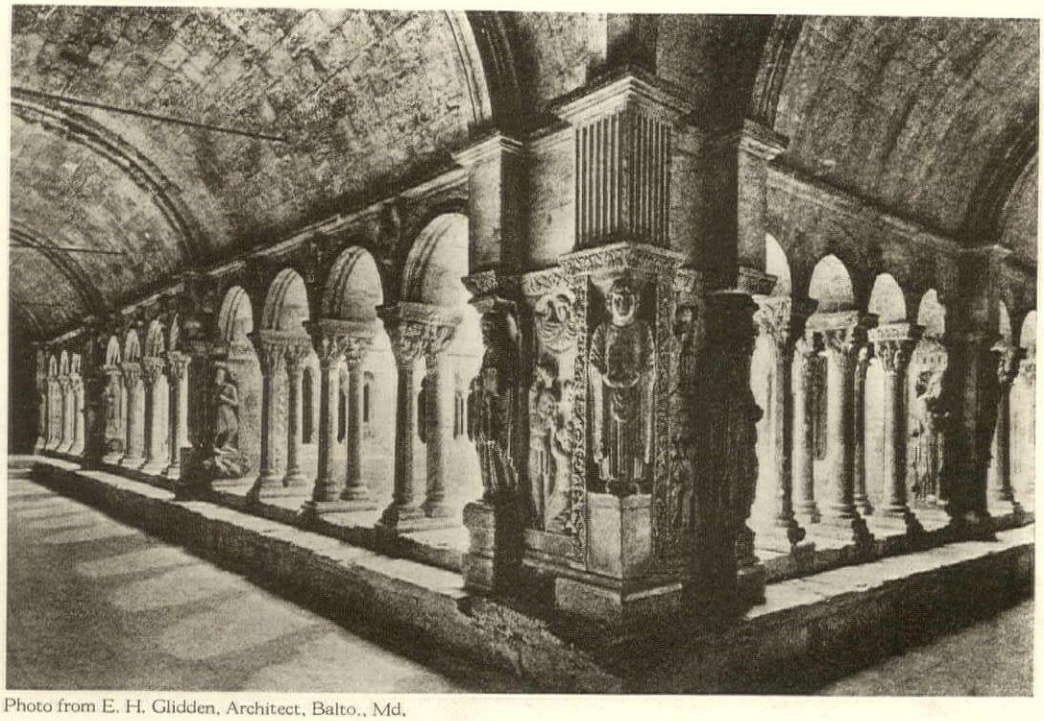


Photo from E. H. Glidden, Architect, Balto., Md.

Cloisters of Saint Trophîme at Arles.

FRENCH ROMANESQUE ARCHITECTURE

The First Evidences of the Flying Buttress are to be Found in Northern France

IF we begin the discussion of the French Romanesque with the southern styles and work toward the northern, we will at times depart from the chronological order. The fault in this case is not a serious one and we gain decidedly in clearness.

We find in France, as indeed all through western Europe, that the problem of the architects of the eleventh and twelfth centuries was to adapt the basilican plan to the exigencies of vaulted construction. Massive walls, round arches stepped or recessed to lighten their appearance, richly carved but heavy mouldings, clustered piers and jamb-shafts, capitals either of the cushion type or imitations of the Corinthian, and strong and effective carvings in which is clearly shown the influence of Byzantine ivories are outstanding features. France was not a unified nation, but a group of feudal states under powerful dukes who gave slight allegiance to the king at Paris. Wide variations are found accordingly in different regions. The southern and central styles have, however, one important common characteristic: predilection for the barrel vault and consequent inorganic feeling.

Many of the southern churches possess marked Byzantine features, the outcome of the close trade relationship between Venice and the east. Provençal Romanesque is, in fact, the most classic of all Romanesque styles, as was inevitable in a district that contained countless examples of Roman antiquity. The façade of the Saint Trophîme at Arles has capitals which are almost true Corinthian and a suggestion of entablature that is modified classic Roman. The porches

Saint Front at Perigueux. A general view from the southeast. The similarity to St. Mark's is striking. Both were probably inspired by the church of the Holy Apostles at Constantinople.

of an interesting series of churches at Avignon, St. Gilles, Montmajour, etc., are rich with figure sculpture and elaborately carved details. These churches were almost all barrel vaulted, as were their cloisters, and they display Byzantine and Lombard influences. At St. Gilles, the façade is even more elaborate than that of Saint Trophîme, and even the masonry recalls classic Rome. The main portal is flanked by channeled pilasters of almost deceptively classic character. Some of the Corinthian columns need only a delicate entasis to appear stolen from some old Roman edifice.

Going farther north and west, we find similar barrel vaulting but new dispositions in plan. In the churches of Auvergne, apses are provided, with ambulatories and radiating absidioles, and absidioles are often added to the eastern walls of the transepts. More freedom is used in the treatment of the barrel vault. The nave is usually covered with a vault of this character, but the aisles often have half-barrel vaults. The thrust of the great nave vault is counteracted by the inward thrust of these aisle vaults. Such an arrangement made it impossible to light the upper part by means of clerestory windows. The nave vault was therefore dependent upon clear, sunshiny weather for sufficient illumination; otherwise the interiors were gloomy, even though perhaps more impressive by this very lack of light.

The use of volcanic stone for facing the exterior walls with a kind of structural mosaic was resorted to in this region, with

Photo from Thos. G. Machen, Architect, Balto., Md.

Details of the gallery of the Cloisters, Saint Trophîme, Arles.

good effect. The individual members and general construction of the Auvergnat churches are usually very massive, another fact which makes them impressive, if sometimes ungraceful. The exterior is lightened by absidioles, stepped lanterns, arcades and repetition, and the net result is a decided picturesqueness.

The best known of the Auvergnat churches are Nôtre Dame du Port at Clermont-Ferrand; St. Etiennes, Névers; St. Paul at Issoire; and Orcival (Puy-de-Dôme). The churches of the Languedoc district are usually classified with the ones above, though they are built on a more monumental scale and with a greater delicacy in single members and sculptural detail. The five-aisled church of Saint Sernin at Toulouse has a lofty and very graceful lantern over the crossing. The building is on an elaborate scale and exhibits a great delicacy of material and workmanship.

North of Languedoc, in Aquitania, is a distinct type of structure characterized by the closest resemblance to Byzantine style of any of the French churches. In the church of St. Front at Perigueux (A.D. 1047), the plan closely resembles that of St. Mark's, Venice; the interior is roofed over with domes in a similar manner, but they are constructed externally in stone, instead of having false wooden roofs as the domes of St. Mark's. The interior is finished in stone, with none of the rich interior decoration of the Venetian church.

The numerous other churches of this district, with their domes on pendentives, unusual in French Romanesque, were probably

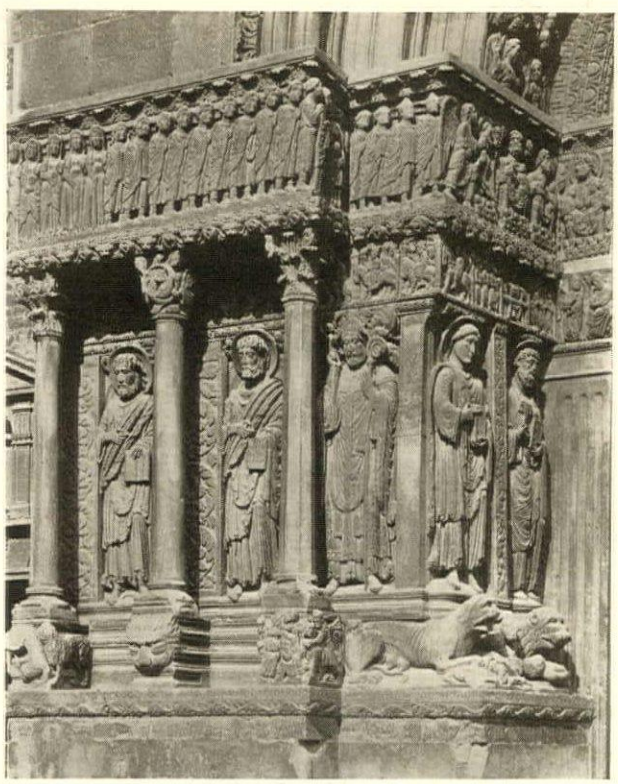


Photo from Thos. G. Machen, Balto., Md.

A closer view of the statues on the Porch of Saint Trophîme at Arles. This shows the left flank of the main doorway.

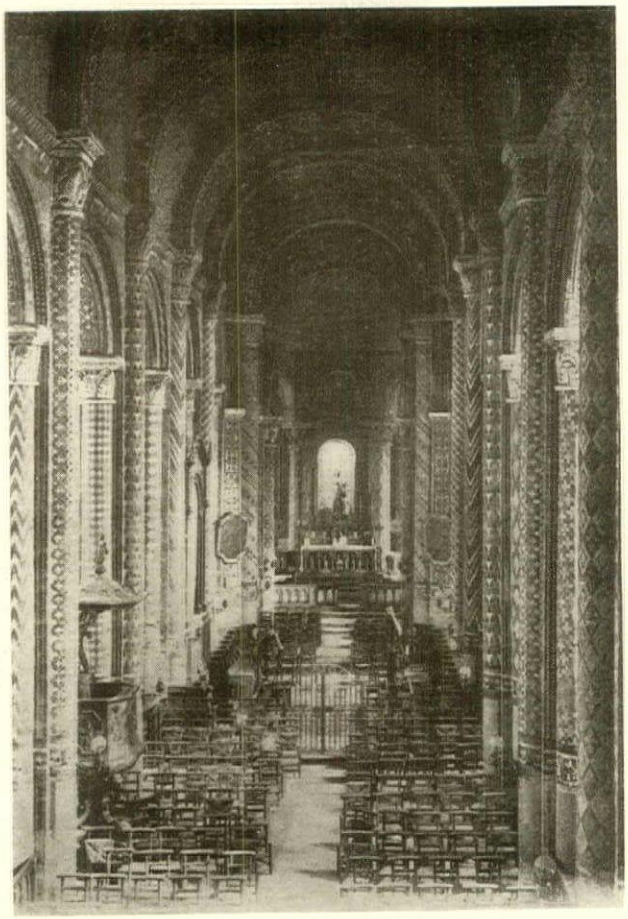


Photo from E. H. Glidden, Architect, Balto., Md.

Interior of Nôtre Dame la Grande, Poitiers. This shows the barrel vault often seen in Aquitaine Romanesque.

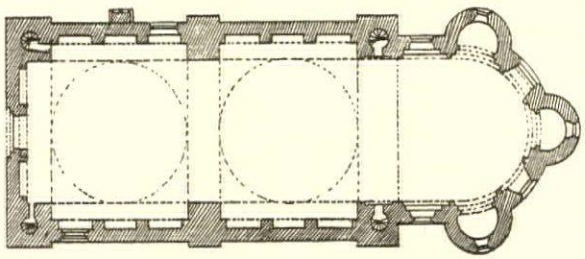
influenced by St. Front. Not all of them have the Greek cross plan nor even the domes on pendentives, as we see in the Cathedral of Angoulême where the dome vaults are arranged in the form of a Latin cross. In Nôtre Dame la Grande at Poitiers we have the barrel vault. Among other structures of this district is the domical cathedral of Cahors (1050–1100) and the Fontevrault abbey (1101–1119).

The powerful duchy of Burgundy contained the important monastic centers of Cluny, Cîteaux and Clairvaux, each the origin of a distinct order which influenced districts far beyond the borders of the province. Cluny abbey (1089) is now in ruins, but it was five-aisled, the nave covered with a barrel vault and the aisles with groin vaults. Its transepts were double, similar to the form common in English Gothic. Round the ambulatory were five absidioles, and others were added on the eastern face of the transepts. Before the nave was an elaborate narthex of five bays. There was a lantern over the crossing, towers over the transepts and at the west end.

The abbey church of Vézelay (1089) is intact. Here a groined vault replaces the barrel vault. Even the great bays of the nave are covered with groin vaults. The groins lack ribs and the problem of satisfactorily vaulting an oblong space was not solved, however, until the thirteenth century.

At Autun, the cathedral has a nave covered by a pointed barrel vault, and an elaborately ornamented narthex.

In northern France, the district of Normandy produced some remarkable churches between 1046 and 1120, in which a high clerestory was secured in conjunction with a vaulted nave, by the use of six-part vaulting. This awkward expedient made it possible to resist the thrust by high side-aisles,



Plan of Cahors, consecrated in 1119. It is an aisleless church of two domes with regular pendentives and slightly pointed arches.

and yet to open windows above these under the cross-vaults.

The Abbaye aux Hommes (St. Etienne) and the Abbaye aux Dames (Ste. Trinité) at Caen were among the most magnificent churches of their time, both in size and in

the ingenuity and excellence of their construction. In the Abbaye aux Hommes are numerous passageways in the thickness of the walls, which give access to the clerestory windows and other parts of the church, and an open lantern over the crossing. These features are almost surely Norman innovations.

The Abbaye aux Dames, smaller than the above, is more compactly composed, and more profusely and delicately ornamented. It possesses one feature of the greatest significance—the elimination of all the portions of the half-barrel vault where it was not needed to abut the thrusts of the nave vault. The result was a series of arches, hidden under the lean-to roof, which carried the thrusts of the nave vaults over to the pier buttresses set against the outer walls of the aisles. These members are really embryonic flying buttresses, a forward step that proved of utmost importance. The details of French Romanesque varied considerably in the several provinces. The round arch was universal, however, except in a few of the Aquitanian churches. The walls were heavy and built of rubble between facings of stone of moderate size dressed with the axe. Windows and doors were splayed to lessen the obstruction of the massive walls, and had jamb shafts and recessed arches. They were usually formed of cylindrical mouldings, and carved with leaf ornaments, zigzag and grotesques. Within, the piers were more often clustered than single. The division of the nave into bays was accentuated and the triforium between the pier arches and clerestory was emphasized. Cloisters and refrectories were incorporated into the plans of the church. Many of these buildings have disappeared, demolished to make way for the more elegant structures of the Gothic period.

Photo from E. H. Glidden, Architect, Balto., Md.

One of the grotesque capitals at Vézelay. This shows the meeting of Saint Anthony and Saint Paul.

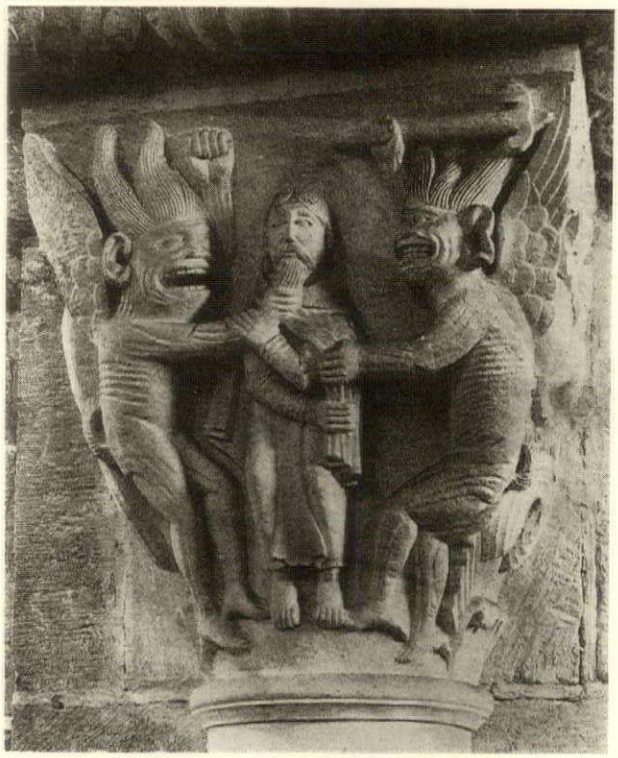


Photo from E. H. Glidden, Architect, Balto., Md.

Romanesque capital from Vézelay. This depicts the temptation of Saint Anthony in the desert, with the devils tormenting him.

The elevator lobby contains both foreign and domestic marbles. The lighting fixtures were made by Tiffany, of New York.

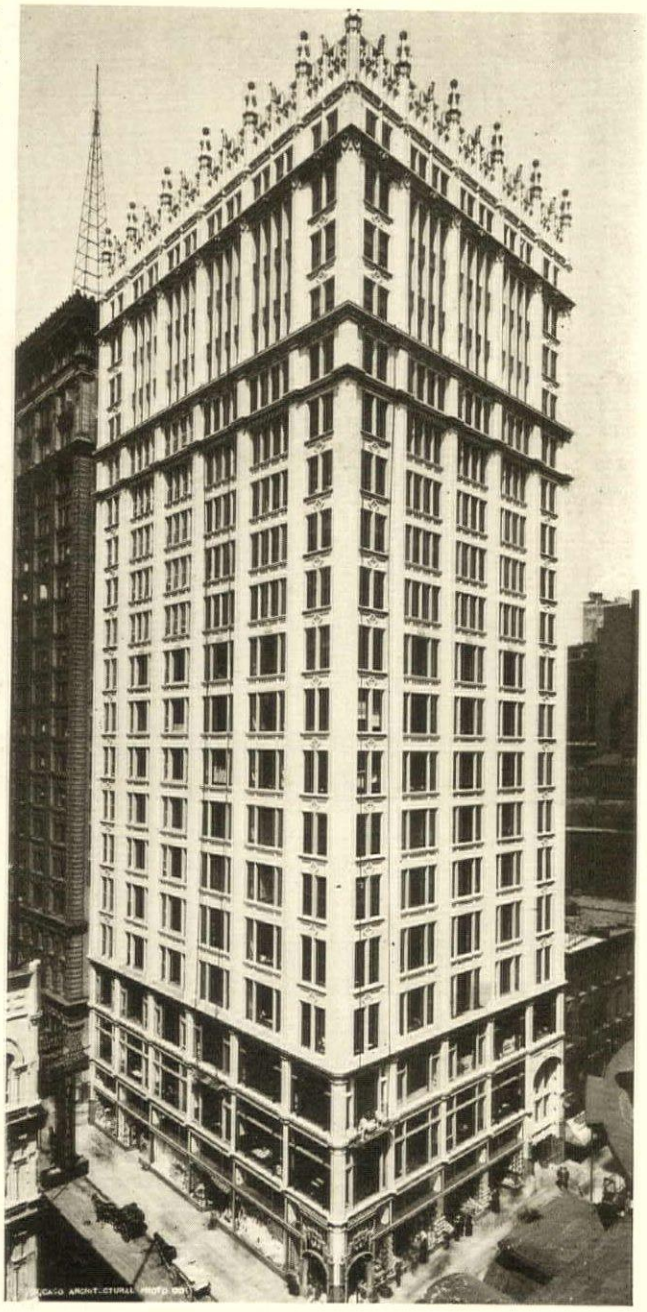
A GOTHIC OFFICE BUILDING

A Commercial Building that is Beautiful as well as Useful

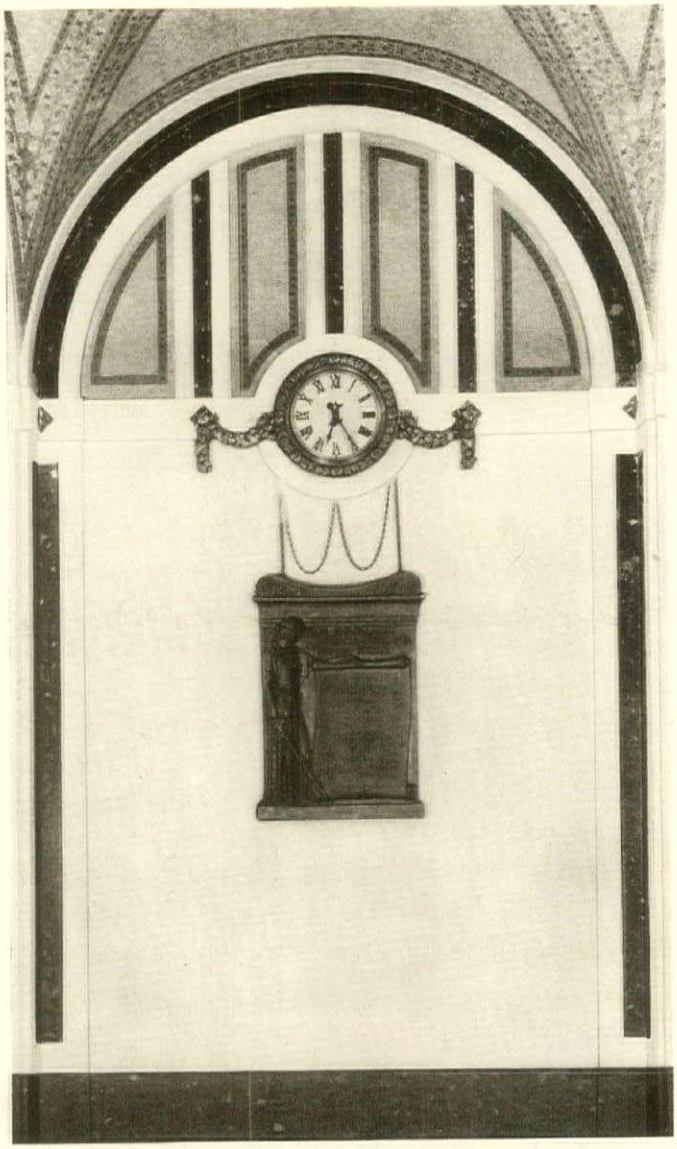
CHICAGO contains many world-famous buildings, some distinctive because of their beauty, others prominent because of unusual design or huge size. There is one office building in the city that is excelled by none for the striking beauty of its graceful architecture, and the effect of lightness unusual in a structure of such proportions. This is the North American Building, which stands like a white tower at the corner of State, Chicago's principal retail street, and Monroe, the gateway to the financial district, lifting its white façade in quiet dignity to the crowning glory of its crenellated cresting, rhythmically relieved by crocketed pinnacles.

The application of the Gothic style to modern office building is not an everyday accomplishment and the architects of the North American, Holabird and Roche, were departing from customary ideas when they conceived the plans for its erection. That they succeeded in their efforts is beyond dispute. It is a style distinct from the plain, heavy types usually seen, with their weighty overhanging cornices. Its individuality and harmony of line dominate State Street, that thoroughfare of costly commercial buildings.

Built in 1912, the North American is a fireproof steel-frame structure covered with white glazed terra cotta. The spirit of the English Perpendicular Gothic style which prevailed in the fifteenth and sixteenth centuries was utilized. The main pier lines are carried up to terminate in pinnacles, giving the building an interesting skyline and subordinating the multitude of details to one masterful whole. This treatment also tends to exaggerate the tower-like appearance, since these perpendiculars reach upward directly from the sidewalk. The corner pylons buttress the building, giving strength where esthetically demanded, while the string



A new style of business architecture.



The memorial tablet on the stairway leading from elevator lobby to second floor

courses or horizontal bands bind together the perpendiculars, making the design complete in its unity and framing a perfect outward expression of its underlying and concealed structure.

Gothic architecture is a perfect expression of its construction; disclosure rather than concealment being the principle of design. Moreover, this Commercial Gothic style permits of an arrangement of fenestration that allows a maximum glass area, affording ample light without loss of structural dignity.

The massive archway which spans the main entrance, designed to harmonize with the general theme, is thirty feet high and is supported by two massive Vermont columns. Twelve bronze doors form a spacious vestibule, with bronze grilles at either side. Within, the main elevator lobby is ornately decorated with groined vaulted ceiling, inlaid with marble mosaic. The side walls are of white marble, inlaid with beautiful dark green Tinos, a marble from the Greek island bearing the same name, while the floors are of the same materials. At the right a white marble stairway leads to a spacious landing, above which is suspended a large bronze chandelier of artistic design and generous proportions.

The lighting effect of the elevator lobby is admirable. The Tiffany-made lamps and garlands are unusually handsome and the soft glow of the diffused lights reflected against the vaulted ceilings and lustrous marble walls, give an impression of richness, almost of grandeur, comparable to the effect received upon entering a Gothic cathedral.

Above, the center and side halls are very wide, with marble floors and wainscoting. The appointments of the building are of the very finest. The basements, of which there are several, contain storage space as well as the machinery necessary to supply power, heat, light and ventilation.

As the building has unobstructed light on all sides, the north, east and south windows overlooking Lake Michigan and State Street, the display rooms and offices are unusually well lighted, and many firms maintain showrooms the year round.

HANDBOOK OF 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 seventh installment and contains part of the second 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 II—The Production of Marble (*Continued*)

CAPACITY OF MACHINES, COSTS, ETC.

QUARRIES yielding rather high-grade marble, but in proportions as small as 20 per cent of the blocks as quarried, have managed to survive, but that is all that can be expected under such circumstances; it requires very close management.

The selling price of American marbles for interior use varies from $1.50 cubic foot to $6.00 per cubic foot. At the present time the average is probably around $3.50.

The selling price for exterior marbles is probably from $1.00 to $2.50 per cubic foot.

The cost of selling is generally about 10 per cent of the selling price.

Overhead and fixed charges vary, but with an average cost of quarrying of $1.00 and an average net yield of 50 per cent, the direct cost of production is $2.00 without overhead and fixed charges.

By the time a deposit is developed on a scale to insure stability and permanence, the fixed investment apart from the original cost of the property is likely to be not less than $5.00 per cubic foot of annual capacity, and it may run as high as $10.00.

If it be assumed that a Quarry will yield all sound blocks of the highest grade, a calculation can be made that will show a large margin of profit; but average results as to yield, considered with average prices and the size of the market, will indicate very clearly that a marble Quarry is almost sure not to be a bonanza, has many chances of failure, and is an enterprise not to be rashly and lightly undertaken.

On the other hand, the men who have succeeded in it are among the most independent and contented of successful business men. They have two safeguards against new competition, which are very real and very effective: (1) There is a great deal of good marble in the world, but only the older and better developed Quarries are regularly dependable. (2) The marble producer's success is, to an unusual degree, dependent upon his own highly specialized experience. The record indicates that he cannot transmit this to his prospective competitor in usable form, even if he is willing; or, rather, the competitor must acquire it for himself, by repeating the mistakes of others. As a rule, he makes a few other mistakes of his own.

The records of the Marble Producing Industry indicate that it generally takes from fifteen to thirty years to get a Quarrying property developed to a point where it can be regularly depended upon for a given amount and percentage of merchantable stock without the investment of new capital; that is, where its own earnings will surely be sufficient to meet all necessary expenses, such as maintenance and renewal of plant, development work necessary to maintain the output, etc., in addition to ordinary operat-

ing expenses of all kinds. Until a property reaches this stage of development, it is not an investment, but a speculation.

It is not possible to appraise a marble property in the same way as a mine, based upon ore "developed," "proven" but not "developed," etc. It is easy enough to prove the presence of the marble and to calculate its approximate volume as it lies in the ground. But no analysis to which marble cores can be subjected will give any definite information as to the net yield to be expected. The only reliable basis for such an estimate is the record of actual quarrying operations covering a period of years, and a development sufficiently extensive to give an average of all the variations of unsoundness, color, etc., in the deposit as a whole. Even then, the estimate must contain a considerable margin of uncertainty.

The only safe plan of operation is to keep development work far ahead of operations; otherwise a local and temporary increase in unsoundness or other undesirable qualities may cause serious embarrassment if not financial disaster.

PLANS FOR FUTURE DEVELOPMENT, ETC.

Before going into this subject in detail, it seems advisable to review for a moment the preliminary studies that should precede the opening of a Quarry. The marble industry has never been large enough to develop a body of independent consulting experts like the mining engineers. The only real experts are all commercially interested in one or more actual operations and are not available to advise prospective investors in new properties. The training of a mining engineer should be an admirable preparation for a marble expert; but without special experience in marble Quarries, the mining engineer is not qualified to make the final and decisive recommendations.

His experience with mines causes him to be suspicious on points that can be safely assumed in a marble property, and too optimistic on others which can never be taken for granted.

A very few well-distributed cores are quite sufficient data for final conclusions as to the presence and continuity of the body of a marble deposit. But the mining engineer, having to do mainly with veins and secondary deposits, is not satisfied with this, and will, if not restrained, drill a wholly unnecessary number of holes into the marble. Every hole is just as objectionable as a crack, but the mining engineer cannot get rid of the fear that "the vein may pinch out," or that the material he is after may otherwise suddenly vanish, so he wants to be sure it is there. Small faults, not apparent from surface indications, may interrupt coal seams and ore bodies or veins, but a fault that cuts off a marble deposit can almost always be discovered without drilling, and no marble deposit ever "pinched out" suddenly nor within such short distances as is often the case with veins and ore bodies.

On the other hand, the mining engineer, finding the marble in place and yielding fine cores, is likely to take too much for granted in other ways, and to be too optimistic. However, his experience in extending his underground workings through all kinds of folded and fractured rocks, ought to enable him to do some good guessing as to whether such conditions are locally present in any kind of rock.

The geologist, the mining engineer and Quarryman with experience elsewhere, all have something of value to contribute. But all of them together cannot give any final and conclusive answer to all of the important questions.

The prospective investor or operator should get the geologist and mining engineer

to throw all the light they can upon whether the marble was much deformed while in the "zone of flowage"; whether it was probably subjected to severe stresses later, when it was in the "zone of fracture"; how and where it lies, etc. He should get from the Quarryman all he thinks about prospective qualities and defects from an examination of the outcrop. Then, having in mind the nature of marble as a material, he should use his own common sense, and do for himself the guessing which will finally determine whether he will go ahead with his proposition or not. All of this is stated at this place, for when the question of future development is under consideration, these things, together with the experience acquired in the first opening constitute the data upon which conclusions must be based.

As already stated, the general rule is to open a Quarry on the outcrop. That is almost always not only the easiest plan, but the best one. Subsequent development may be along the strike, or down the dip (and underground), or both.

There are a number of possible cases:

FLAT DEPOSITS

(1) The marble may lie flat under an overburden consisting entirely of earth or of earth and other rocks. One case is known of a large isolated mass which lies on the slope of a mountain, near the top, without overburden of any kind. The marble has a dip, but it is entirely uncovered. In such cases, there is nothing to do but to follow the beds.

If the layers or beds are of different quality, the development should, as soon as possible, be made so extensive that several large working spaces or "floors" may be available at different levels, so that, having established a market for each grade or kind of marble in the deposit, the necessary supply of each may be continuously maintained. This condition attained, the operations should be so conducted as to make it permanent. If, as often happens, the deposit contains zones that are sound and zones that are quite unsound, it is better to follow the sound zones, even though it means handling a much heavier overburden. This is a matter requiring careful study and accurate records of cost, net yield, etc., in each case.

If the deposit is covered entirely by earth, there is no objection, usually, to filling up a Quarry space that has been "bottomed" with the overburden from extensions. But if the marble must be followed under overlying rocks too thick to be bodily removed, care must be taken not to block the opening of any prospective tunnel. In any case, this method of disposing of overburden should be handled with care, to avoid slides from the old Quarry into new extensions. Where a zone of unsound rock intervenes, forming a thick wall which can be left in place, the old Quarry is the most logical dump for the waste from neighboring extensions.

Sometimes the edge of a marble deposit, which lies flat or nearly so, where it projects out from under other rocks, has been eroded by the ground water until it is reduced to a mass of separate boulders, buried in clay. This is the case with the famous "Boulder Quarries" in Tennessee, where this condition is widespread. To the uninitiated, these Quarries present a hopeless and chaotic appearance; but many of them have been quite profitable, while they lasted. It is a safe guess that the marble which has disappeared by solution was more unsound than that which remains; probably it was fatally unsound. If so, then Nature has made profitable operation possible where otherwise it might not have been so. It costs very little to remove the clay so as to get at the bould-

ers. It would cost ten times as much to remove the same amount of unsound marble and to separate it from the sound. It may well be that the edge of the ledge, before erosion, would have cost so much to operate and would have yielded so small a percentage of good marble, that it could not have yielded a profit; whereas the boulder Quarry that has resulted from it may be very profitable.

Of course, from the nature of the case, boulder Quarries in a marble for which there is a large market, cannot last forever. No outcrop of any kind, however extensive, can be said to be inexhaustible. If a permanent industry is to be maintained, the workings must, sooner or later, penetrate the solid (?) ledges. Undoubtedly the producers of Tennessee marble will be confronted with this situation sooner or later. Considering the amount of material removed from between the boulders, the question of the amount of unsoundness in the adjacent ledges, of which the boulders are a remnant, may well cause some anxiety. But it is not doubted that good ledge Quarries can be found and developed in Tennessee, and it must be done if this very desirable material is not ultimately to disappear from the market. The end of the boulder Quarries is not imminent, but the time has come to consider the problem of operating in the main ledges. It is likely to be rather complex and difficult, but by no means hopeless. There are a few good ledge Quarries already, and the ledges proper have hardly been touched.

Where the marble lies flat or nearly so, and is covered by other rocks, the question of a safe and adequate roof for a tunnel Quarry is especially serious. If a good roof can be obtained, the development is simple enough; but if the overlying rock is not strong enough to permit of tunnels at least 50 feet wide, or if the overburden is unconsolidated and very thick, the practicability of developing any part of the deposit, except the outcrop, at once presents itself. No case is known of marble being produced from underground Quarries where the roof has to be supported in any such elaborate manner as is common in many mines. It would be rash to say it could not be profitably done, but it is without precedent. If seriously considered in any case, the services of a good mining engineer should be secured.

It may happen that a marble deposit is very thick and the most desirable portion of it near the bottom. In such cases, the upper part of the deposit itself may make a good roof, even if the overlying material is unsuitable.

TILTED BEDS

(2) The beds of marble may have tilted until they stand vertical or nearly so. In such a case, if the Quarry is on a fault block, the beds may continue down without much change of dip until the marble is terminated by the fault; otherwise, they are sure to turn under to one side or the other, and become more nearly horizontal. If the facts are not apparent, a geologist can nearly always tell which way they will turn, and, generally, whether they will turn at all. But if it is a true fault block, only the drill can tell how deep the marble goes; and the drill can always reveal the direction of the underground fold, if there is one.

When the marble stands vertically or nearly so, there is nothing to do but to follow it down, taking out all the good layers. If there are good rock walls on either side, this is a simple operation, although it requires special care to anticipate and allow for the unsoundness that most nearly parallels the strike. A double core barrel drill for

exploration purposes may be a useful part of the regular Quarry equipment in this case, as it may enable the cracks in question, which are more or less horizontal, to be located before the Quarry operations reach them. The depths of channel cuts, and the consequent lengths of blocks, may be then so determined, within the limits of standard sizes, as to make such cracks, if they are at all regular, a real advantage in Quarrying, by serving as "floors."

In regions that have been subjected to glacial action, when the beds stand nearly straight up, there is pretty sure to be a good wall on one side, but there may not be on the other. One case is known where the marble stands up, outcropping on a hillside. The valley was scooped out by a glacier to a depth of several hundred feet, then filled with unconsolidated glacial drift, etc. The marble formed one wall of this glacial cañon of prehistoric days. Now, enough of the marble must be left as a wall on the valley side, to retain the loose filling of the valley. A good and profitable Quarry has been operated at the locality in question for many years. Sometimes the drag of a glacier where it slides over or against a marble deposit, produces a certain amount of unsoundness; but it does not always do so; otherwise, this Quarry would have been quite unsound. As a matter of fact, it has always been noted for its soundness. It is about 300 feet deep, but so far shows no sign of "turning under."

(3) The marble may dip at any angle intermediate between the horizontal and the vertical. In this case, the outcrop will be a long wedge-shaped mass, more or less affected by weathering, erosion, etc. It may yield a large amount of good stone from open Quarries, but it is never "inexhaustible." Sooner or later, Quarries in such a deposit must follow the marble down the dip, under the overhanging material, if a permanent industry is to be maintained.

While tunneling is ultimately unavoidable, it is well to work the outcrop whenever and wherever it is sound enough to be profitable; but the final necessity for tunneling should be kept in mind. The tunnel opening is pretty sure to be located in one or more of the open Quarries, and, of course, on the side towards which the marble dips. This side of the open Quarry should always be so located that it will include a reasonable thickness of the stone which will be wasted in developing the tunnel. In most cases the small wedge-shaped mass of this stone which is included in the open Quarry must be cut off and removed, so as to avoid much overburden.

A reasonable width—say 5 or 6 feet—of the upper layer of marble, should be left here, as a working bench, to facilitate tunnel development when the time arrives. If the dip of the beds is more than 45 degrees, it is better to begin tunneling at once; if it is appreciably less and the deposit fairly thick, there will be a considerable volume available for open Quarry working. Experience in open Quarries distributed along the strike will frequently indicate the best places for tunneling, and also whether the development should be straight down the dip, or in a diagonal direction because of prevailing unsoundness.

Tunnel Quarries have received their greatest development in Vermont, where the conditions often made them imperative at an early stage of the game. The precedent set in Vermont has been followed in Alabama, with some modifications to meet local conditions. In Vermont it is found that a clear span of 80 feet between the piers which are left to support the roof, is safe. Spans of 100 feet or more occur.

LIST OF QUARRIES AND MARBLE MANUFACTURERS

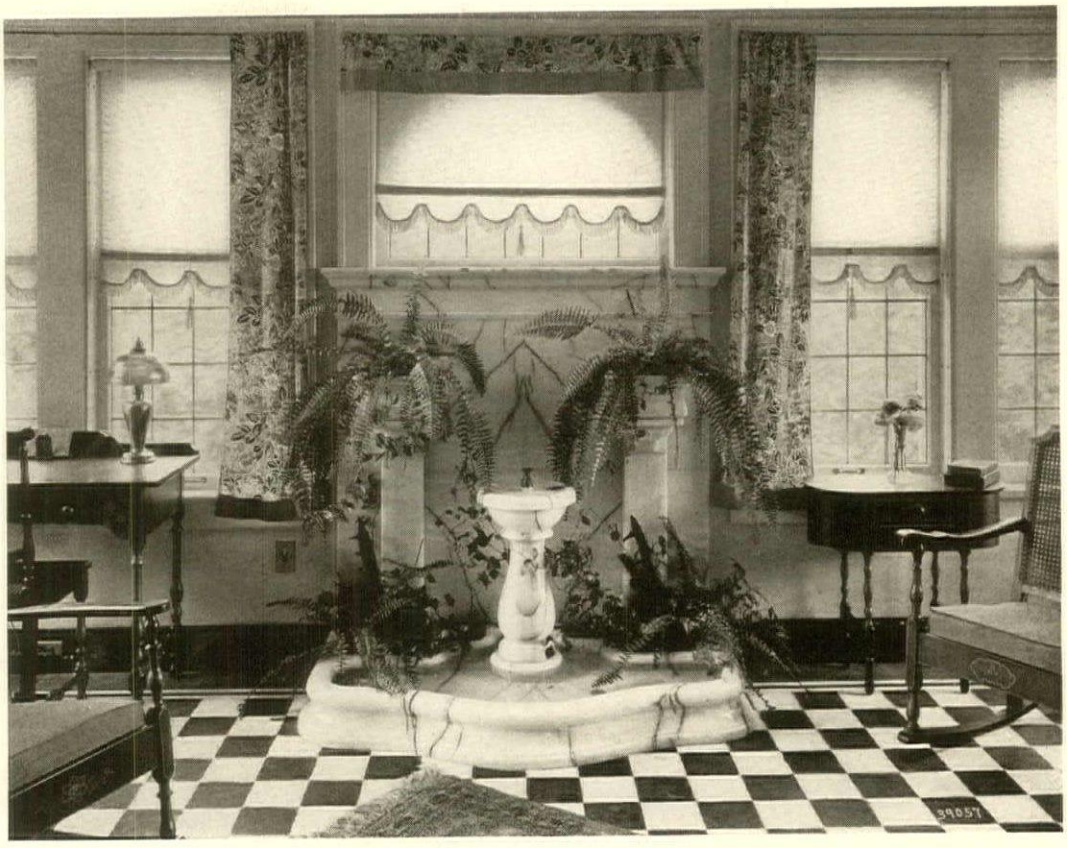
REPRESENTED IN THE MEMBERSHIP OF THE NATIONAL ASSOCIATION OF MARBLE DEALERS

City and State	*Company*	*Representative*
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
Brandon, Vt.	Middlebury Marble Company	Wm. T. Fleming
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	F. J. Lautz
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	Wm. P. Corley
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	H. K. Townsend
Chicago, Ill.	Jas. B. Clow & Sons Company	Jos. Little, Jr.
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. Bower
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	Frank C. Smith
Cleveland, Ohio	Haworth Marble Company	W. J. Haworth
Cleveland, Ohio	Interior Marble and Stone Co.	E. M. Fritz
Cleveland, Ohio	Prospect Mantel 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. C. Bruggen
Dallas, Texas	J. Desco & Son	J. Desco
Dallas, Texas	Southwest Marble Company	William Jessop
Denver, Col.	McElhinney Tile and Marble Co.	D. C. McElhinney
Denver, Col.	Denver Mantel and Tile Company	W. D. Watson
Des Moines, Iowa	Des Moines Marble and Mantel Co.	J. R. Golden
Des Moines, Iowa	Holbrook Marble and Tile Company	H. F. McAdow
Detroit, Mich.	Christa-Batchelder Marble Co.	E. L. Leavenworth
Detroit, Mich.	Detroit Marble Company	B. L. Cummins

City and State	*Company*	*Representative*
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	T. O. Couch
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. N. 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
Philadelphia, Pa.	John Hegarty Marble Company	John Hegarty
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 Interior Marble 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.



THIS illuminated mantel aquarium installed in a Milwaukee residence, is a combination of mantel, flower vases and fountain. Electric lights concealed in the fountain-stem furnish a soft light sufficient for ordinary use. It was made of Pedrara Onyx by the McClymont Marble Company, Milwaukee, Wisconsin.

McCLYMONT MARBLE CO.

TWENTY-SEVENTH AND CANAL STS.

MILWAUKEE - WISCONSIN

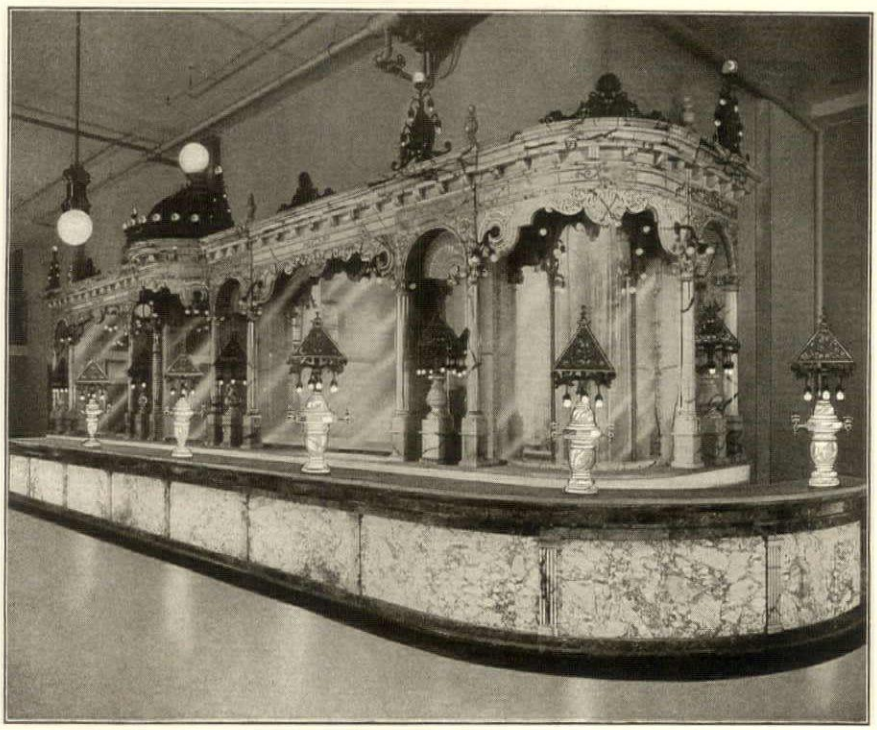
Boulevard Branch, Wayne County and Home Savings Bank Detroit, Michigan. Albert Kahn, Architect

A CLEANLY and dignified combination of Botticino, Tennessee and Verde Antique creates its own atmosphere.

CHRISTA-BATCHELDER MARBLE COMPANY
DETROIT MICHIGAN

LOBBY, Masonic Temple, Indianapolis, Ind. Rubush and Hunter, Architects. Italian Verde Antique and Tennessee Marbles.

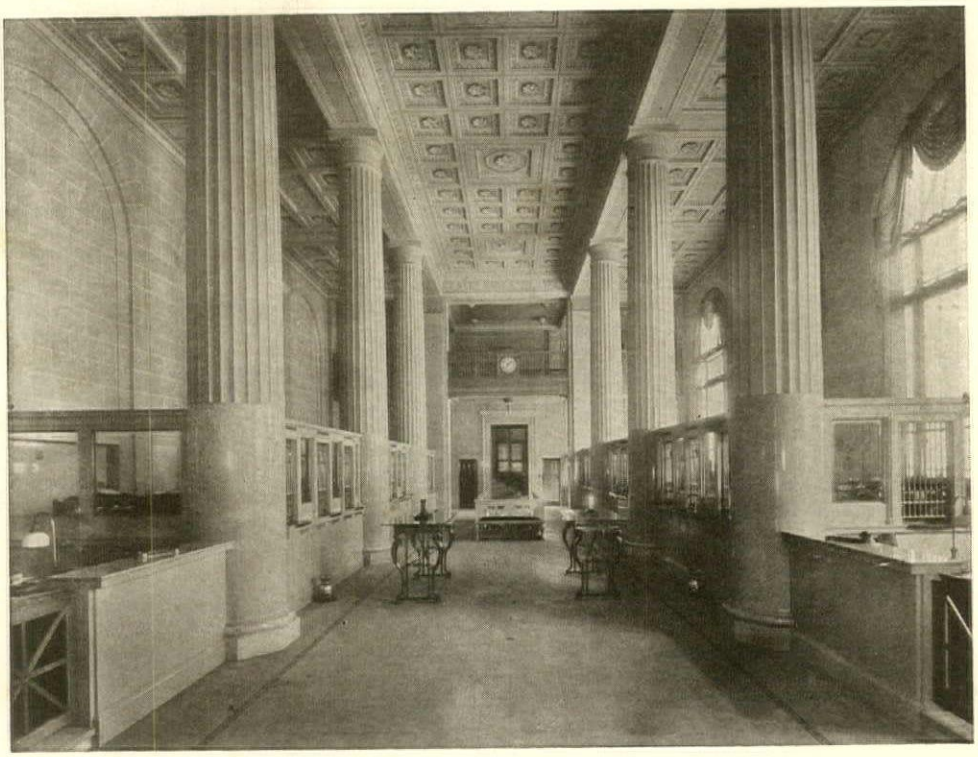
F. E. GATES MARBLE & TILE CO.
INDIANAPOLIS, INDIANA



MARBLES manufactured and furnished for interiors and exteriors of Banks, Office Buildings, Dwellings.

Also Soda Fountains.

THE PUFFER MFG. CO.
WINCHESTER, MASS.



FIRST NATIONAL BANK, TULSA, OKLAHOMA. WEARY & ALFORD CO., *Architects*

A magnificent specimen of an all Tavernelle treatment. One of many conspicuous contracts.

LAUTZ MISSOURI MARBLE CO.

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