THE AMERICAN ARCHITECT

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ROLLED GLASSES. PART III

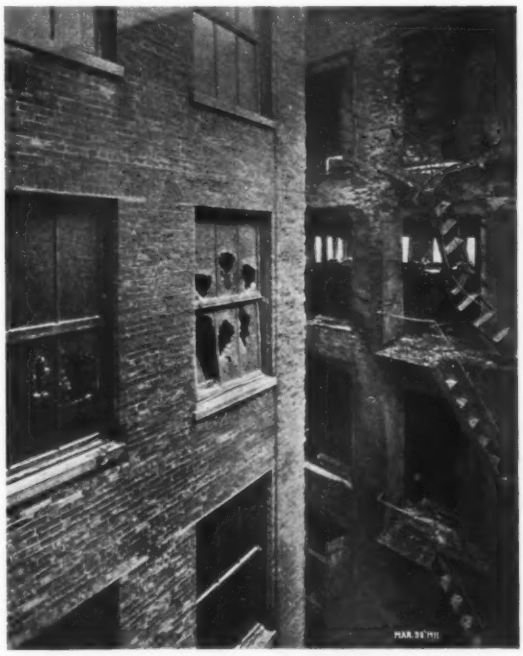
By E. H. BOSTOCK

THIS is the third article of a series of four by Mr. E. H. Bostock on Architectural Glass. The first article, on Clear Glazing, appeared in our issue of November 8, No. 1872. The second, on Blown Pattern Glasses, in issue of January 31, No. 1884. The concluding article, to appear shortly, will treat of Glazing Methods. The series will present the subject of Architectural Glass in a comprehensive manner and contain information that will be of value to architects in selection and specification.

WE have spoken thus far of blown glasses, but so rapid has been the development of rolled glass since St. Gobain first led the way that to-day about one-half the footage of glass must be one or the other of the varieties of rolled. This is brought about sometimes by its superiority for its intended use, and sometimes because it is cheaper, for on the average the same type of glass is cheaper in a rolled than blown form, due to the elimination of the blower, gatherer and other high priced workmen.

It is understood that if rolled glass does not go through a polishing process its surface is more or less dulled and marked by the table and rollers used in its manufacture. Some makers, taking advantages of its poor light conducting qualities, have turned this into a thing of beauty.

After the casting, rolling and polishing of glass had developed it was a perfectly legitimate and easy step to roll glass in colors, from which came the making of the well known "Cathedral" glass. This is a plain rolled glass, now made usually with a hammered surface, the object being to cover up the usual defects in rolled glass. Cathedral glasses seem to have developed from the original form of rolled glass, as mechanical means of handling larger sheets became known, until in its present form it is usually made in sheets 90 inches long by 30 wide, being only about one-eighth of an inch thick, though it cannot be glazed with safety in any size above 30 x 60.

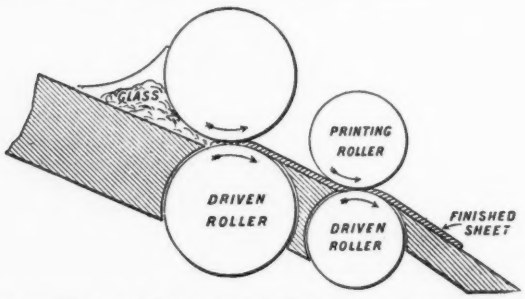


THE ASCHE BUILDING FIRE
Holes made by firemen by pushing nozzles of hose through wire glass, which served as a shield to fight fire across the court

Almost all of our American cathedrals are made with "hammered" surface, for all the attempts to make it as good in surface as the foreign seem to have failed, as it usually turned out to be badly scratched and disfigured, supposedly because of our use here of the patent continuous lehr rather than the

slower, surer methods of the European makers.

The English Double-rolled Cathedral, which is rolled with an extra roller while still plastic, is well and favorably known. Contrary to expectations, the double rolling seems to produce a smoother surface, supposedly, by preventing buckling, and also produces greater density of texture.

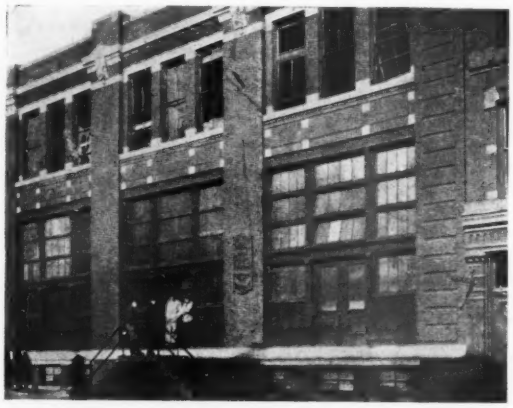


SECTIONAL DIAGRAM OF MACHINE FOR RULING "FIGURED" ROLLED PLATE GLASS

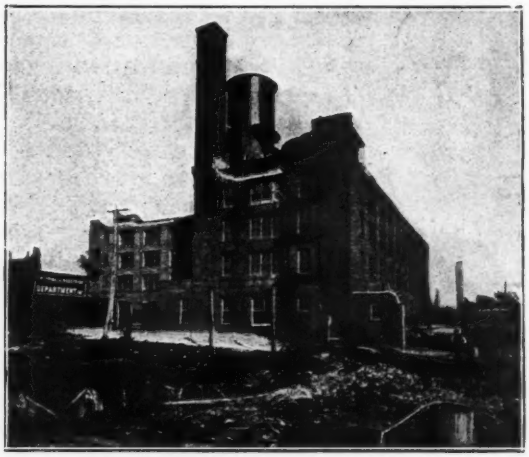
Particularly is it recommended for ornamental dome and skylight work and for all sunny exposure, as its density helps it take the glare out of the sunlight and let in a very full, soft tinted light.

From the making of Cathedral glass in plain colors, the next development was the mixing of two colors, and finally three or even more in the sheet. In doing this, it was found that the introduction of opal glass brought the other colors into relief, and thus gave rise to the Opal Cathedral glass so largely used a few years ago and still used where colored glass of this type is wanted in large lights. It is advised in using this glass that the colors be selected with discretion, as quite often the glasses have strong surface colors which may not harmonize with their surroundings.

The matter of rolling simple patterns upon the surface of the glass was soon solved and a series of glasses variously known as Etruscan, Moss or Granites evolved, the patterns of which were a series of indentations in the surface, the raised parts of which catch and refract the light at different angles, causing the glass to assume more life and sparkle than if flat. These have been applied to all colors and types, thereby creating a whole family of clear and colored simple patterns, as Etruscans, Ripples, Mosses, Opal Cathedral Moss and Rippled and Opalescent Granite. Almost solely, however, they seem to belong to the leaded glass field, as only occasionally is there a place where a bright colored variegated glass of this type can be used.



An instance where wire glass in lower floor remains intact, while plain glass in upper floor was completely blown out by force of explosion



SAN FRANCISCO CONFLAGRATION
A notable example of wire glass protection. All the surrounding buildings were destroyed

One most interesting American development along this line is the Opalescent.

The first grew primarily out of the desire of the late John La Farge to have a more plastic material to work with than the Cathedrals and Opal Cathedrals procurable in the late '70's, and with the imagery of the artist he could see no reason why colors could not be made and combined in glass even as he was mixing his palette. With such glasses in view he finally persuaded an old glassmaker in Brooklyn to attempt the rolling of many colors in all manner of com-

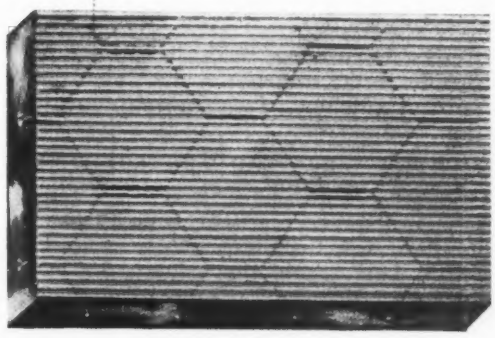
binations in sheet form. This industry, remaining to this day almost solely an American one, has grown wonderfully, both in size and the beauty of its products, and the archi-

COBWEB WIRE GLASS

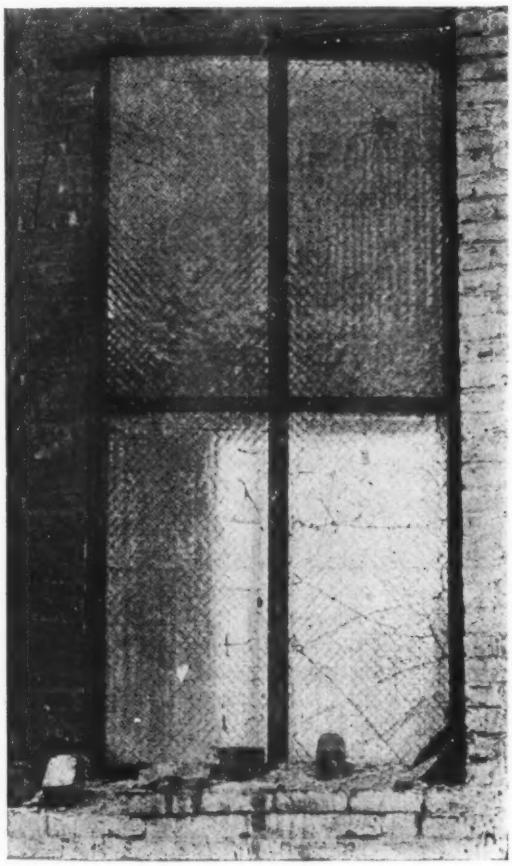
tect and artist can procure anything he may desire in color in glass of this form.

Iridescent glass is a process developed originally by a well-known American firm in blown form for decorative vases and kindred objects. It was extended to sheet glass, and is now procurable in the open market applied to various colored glasses; it obtains its particular beauty when used in a dimly lighted position, as in inside vestibule doors. In a full light the iridescence becomes visible at an acute angle.

In the beginning, the rolling of the simple patterns, as Etruscans and Ripples, were accomplished by cutting the pattern into the



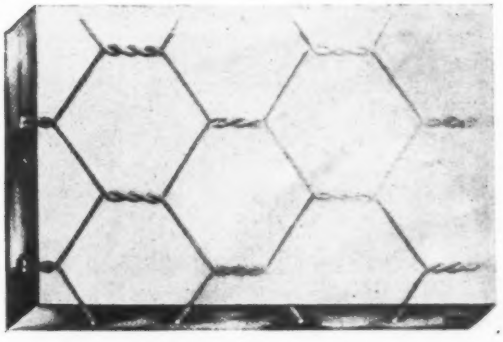
RIBBED WIRE GLASS



A PRACTICAL DEMONSTRATION AFTER THE FIRE

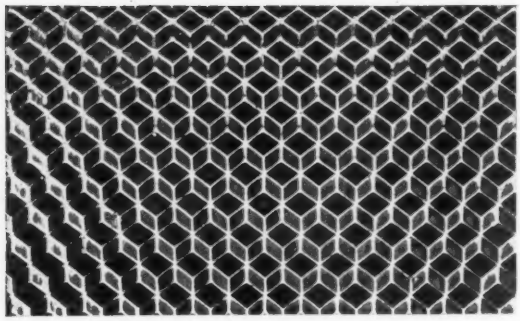
cast-iron plate of the rolling table in intaglio, but it was found that the cutting of any elaborate pattern over the area of the bed plate of one of these tables would be considerable, and as these bed plates are very heavy, they could not readily be interchanged; so that only patterns of which large quantities are required could profitably be produced.

This was overcome by double rolling. In



POLISHED WIRE GLASS

this process, the glass is rolled out the thickness and size wanted by two plain driven rollers, to pass directly into two other rollers while still soft, and the upper roller of the



HONEY COMB GLASS

second set carrying any desired pattern which may be imprinted upon the sheet, somewhat as shown in accompanying illustration.

This process gave rise to an enormous and ever-increasing number of pattern glasses, the most useful of which are shown, the concern of the architect being to find the one that best meets the scheme he has in mind; some of them have a little more light-giving-power than others, and as the concern of the architect with this type of glass must be to get brilliant results, so he must insist that they are rolled of "colorless" or "crystal" glass, and he should so specify.

Unpolished rough plate one-eighth, three-sixteenths and one-fourth of an inch in thickness find use in very considerable quantities for skylight and rough glazing; very much of it is rolled with a very fine rib upon the surface, this is supposed to increase the interior lighting a little, and also, when glazed as it should be with the ribs running perpendicular, to clean itself by having the rains wash down the channels. These tendencies make it a very desirable glass for skylight purposes and many thousand feet are used in factory windows on account of the qualities mentioned, in connection with the fact that it breaks vision.

Thicker rough plate is usually the rejected sheets from the polished plate factories, to be gotten any thickness up to one and a half inches, when wanted for sidewalk lights, basement glazing, port and deck lights and such uses.

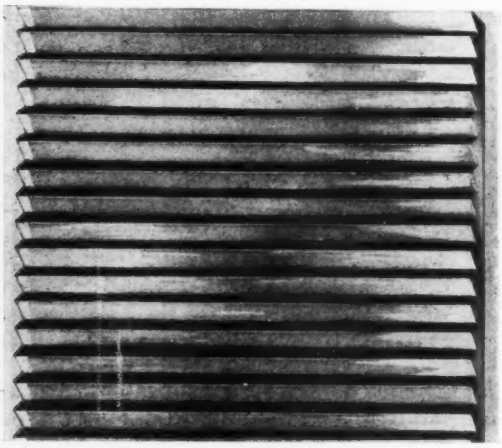
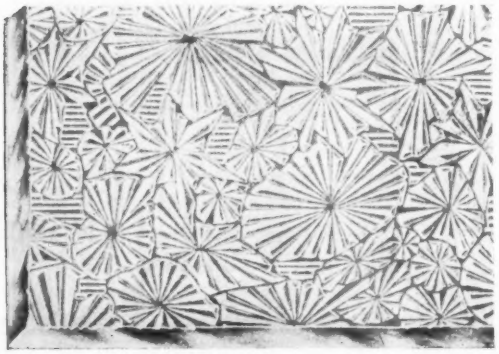
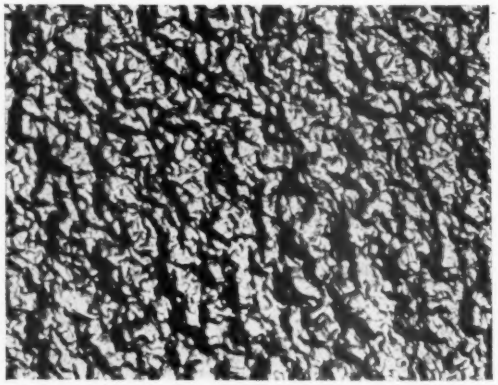


PLATE PRISM GLASS



FLORENTINE GLASS



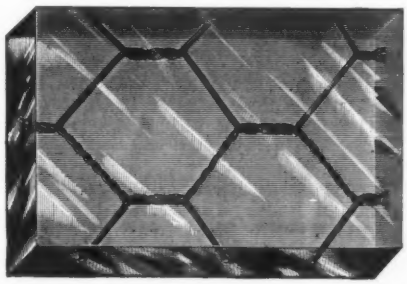
FIGURED ROLLED GLASS

Sheet prism is made principally in the factories making rough and ribbed glass and is made in two thicknesses 3-16″ and 1-4″. It is made in sheets up to 60 inches wide by 110 inches long.

This is almost a new glass, born first of the germ of prismatic lighting that was in fluted glass, and worked out by the makers of pressed prisms for this purpose.

Certain limitations to the use of all kinds of plate glass, whether rough rolled, figured or polished, were formerly set by the fact that under the influence of fire partitions of glass were liable to crack, splinter and fall to pieces, giving egress to the fire and causing destruction of their own; and a very obviously dangerous place for glass under old conditions was in the roof of large train sheds, where the fall of broken glass often caused serious accidents.

To overcome these disadvantages the manufacturers' thoughts turned to the development of a process to make wire glass, that is plate glass with a wire mesh embedded in the metal, so that in the event of breakage from any cause, such as fire or a violent blow, while the glass would still crack, it would be held together and in place by the wire network. Even in the early '70's wire



ROUGH WIRE GLASS

glass was produced at Tacony, Pa. While its merits were at once apparent and a great deal of it used, its manufacture presented so many difficulties that its first makers abandoned it to others.

The principal causes of their failure seem to have been to get the wire embedded in the glass quickly enough to be able to get the covering layer of glass homogeneous with the rest and the fact that the strain put upon the glass by the different cooling points of the wire and the glass caused an enormous amount of breakage.

Its manufacture was resumed under the Schmertz patents at Brownsville, Pa., with more success, though this plant also has disappeared and the site now traversed by the Pittsburg and Lake Erie Railroad tracks. Subsequently a French company which managed to procure American patents upon improved processes, established a plant at Port Allegany, Pa., in 1895, and this was operated successfully and merged with the other companies owning other process patents upon wire glass manufacture. Its merits were so apparent that it found instant favor in its field as a fire retardant, until now its consumption is measured in millions of feet annually.

It is made as Rough Wire 3-16″, $\frac{1}{4}$″ and $\frac{3}{8}$″ thick commercially, Ribbed Wire $\frac{1}{8}$″, 3-16″, $\frac{1}{4}$″ and $\frac{3}{8}$″ thick, Polished Plate Wire $\frac{1}{4}$″ thick, Prism Wire $\frac{1}{4}$″ thick, and has been rolled with one of the popular patterns upon one face.

On account of its obvious merits it is fast taking the place of rough, plain and ribbed rolled, in all classes of buildings for skylights, windows and doors, especially in factories, mills, warehouses, train sheds, etc.

The process of pressing or stamping glass has not been generally called into use in making glass, as necessarily a pressed article has a dulled surface from the mould and must be of small size. The most frequent use made of the process has been in producing jewels, plaques and tesserae, the one great exception being railroad car decklights. These lights must necessarily stand great shock and extreme weather conditions, and for such use the present light, being cast and annealed in one piece, and as thick as may be necessary, has been found the best form to use, as they successfully resist shock that would destroy ordinary glasses.

An interesting hybrid process is that for which patents were issued in 1905, and producing glass as shown in accompanying illustration marked "Pressed Design for Window." These plates are made by so distributing the glass upon the table that the pattern to be produced is marked upon the sheet by the following roller, and after passing beneath the roller, the table with the sheet upon it is carried beneath a pressing die bearing projections exactly similar to those on the roller. The action of the die is to finish the grooves partly formed by the roller; when this operation is complete the glass is divided along the lines of the base of the groove formed by the roller and die, leaving the margins with beveled edges and the body of plates with a deep cut pattern.

Made first for decorative windows in Pullman cars, they open an interesting field. Being pressed and annealed in one piece,

they resist shock and can be easily cleaned, having no lead seams to catch the dirt. They can only be made and used economically where a large number of lights of one size and shape are needed, as in the instance quoted, for which purpose they are ideal.

(*To be continued*)

A PUBLIC BATH AND GYMNASIUM IN THE CITY OF NEW YORK

MESSRS. WERNER & WINDOLPH, *Architects*

THE Public Bath and Gymnasium erected by the City of New York on East 54th Street embodies many new improvements.

In order that the purposes of the building might be properly expressed, the exterior has been treated in brick in a strong and simple manner, using engaged brick Doric columns and stone trimmings, with brick arched openings between the columns and the order, finished with an attic and lattice iron roof cage.

The interior walls, as well as the encasing of interior iron columns with moulded brick caps, are of buff color impervious pressed brick, the ceilings are of timbrel arch Guastavino construction, the staircases of iron and slate and the doors are covered with metal, thus making a thoroughly fireproof structure.

The first and second story are used for shower baths, the men's baths with waiting room in the first story occupying the East part and the women's baths with waiting room in the first story occupying the West part. Staircases in both the men's and women's waiting rooms lead to the second story baths, the gymnasium in the third story and to the roof playground.

The third story with its mezzanine story (running track) is used as a gymnasium. Off the gymnasium on either side are toilets, shower baths and dressing room space with lockers.

The roof above the gymnasium is used as a roof playground, has a tiled floor and is enclosed with a wire cage. Should it be desired to use the roof in Winter, it can easily be arranged so that it may be flooded with water which, when frozen, can be used as a skating pond.

In the cellar is located the electric, heating and ventilating plant. The building has been so planned that all heating and ventilating is done from this point, thus centralizing the plant in this part of the building.

A HOUSE ON BREAK NECK MOUNTAIN, NEW YORK

MESSRS. WERNER & WINDOLPH, *Architects*

THE estate of some eleven hundred acres lies in a rough and strikingly beautiful country, extending from the boundary line of Cold Spring to the north gate of the Hudson River. In the centre of this extensive track is a gorge extending from the Hudson and running almost at right angles to it, up to a ridge parallel to the river which terminates in a large mountain lake a thousand feet above. The gorge is enclosed by Break Neck Mountain on the north, and Mount Taurus on the south and directly facing it, across the river, is Storm King, blotting out the Western highlands.

The slope of this gorge from the river is fairly uniform at an angle of about 40°. Extending from the ridge of Break Neck clear across the valley and to the upper levels of Mount Taurus is a series of broken and serrated ridges offering scarcely a square yard of absolutely level ground.

The only feasible site was afforded by a small stretch of gentle rising ground in the main valley forming a plateau some three hundred yards in length. This plateau was enlarged by a series of cuts to the east and to the north facing Break Neck and by extensive filling toward the river. The cut to the north formed a site for the stables and outhouses and the fill to the south and west formed a site for the house and gardens, this eventually made a complete site one third of a mile long facing the river and some five hundred feet above tide water.

Enclosed by the mountains the site became a natural basin for several water courses and streams which formed raging torrents in the Spring and it became a serious problem to divert this water successfully, as well as to hold the numerous retaining walls in position; sluice ways were constructed and auxiliary catch basins were placed in the gutters of the roadways, and from these points the water was taken through a series of drain pipes to a main

(*Continued on page 228*)

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ARCHITECTURAL ACOUSTICS

PROBABLY no subject connected with the practice of his profession has caused the architect of auditoriums, or in fact, any type of buildings in which large numbers of people assemble for purposes of instruction, entertainment or worship, greater anxiety than has that of acoustics. This is due first to its very great importance and second to the fact that until recent years the matter seemed to be practically beyond control of the designer, who frankly admitted his lack of knowledge concerning the phenomena of reverberation, interference and resonance. Due almost wholly to the experimental investigation and research of Professor Wallace C. Sabine of Harvard University, this situation has been entirely changed within a decade, and it is now possible and feasible to determine with complete accuracy the acoustical properties of a given auditorium in advance of construction. Moreover, it is ordinarily possible to apply remedial measures to existing halls that will greatly improve imperfect acoustical qualities without materially altering either the form or architectural treatment of the room. Doubtless instances exist in which this latter statement would not be strictly true, where in fact very material modifications of form or architectural treatment might be necessary to accomplish the desired results, but they may be considered exceptional instances.

The result of Professor Sabine's original work, undertaken with a view to correcting the Lecture Room of the Fogg Art Museum, was published in a series of articles which appeared in THE AMERICAN ARCHITECT in 1900. The next five years were devoted by him to the extension of this study over the range of the musical scale, and results were published in the *Proceedings* of the American Academy of Arts and Sciences for 1906. Since that time, investigation has been carried forward with reference to interference and resonance, the effects of peculiarities of form and the causes of variation in audibility in different parts of an auditorium with results that appear to be of first importance.

An article contributed by Professor Sabine to the *Architectural Quarterly of Harvard University* for March is devoted to the correction of acoustical difficulties. Concerning its scope, the author states: "It is the purpose to discuss here medicinal rather than surgical methods. Such treatment properly planned and executed, while not always available, will in the great majority of cases result in an entire remedy of the difficulty." A half dozen specific examples where correction has been made are shown and described in a manner that carries conviction. Perhaps the only case cited in which the facts differ somewhat from popular impression is that of The New Theatre in New York. This building has been the object of so much ignorant criticism on the part of the public press, and the architects the recipients of so much unmerited censure, that it seems a simple act of justice to quote Professor Sabine's authoritative statements concerning this enterprise in some detail. They should serve to correct erroneous impressions and place the matter properly before the profession. The statement reads:

> Had it been a commercial proposition, its acoustical quality would have received but passing notice. As an institution of large purpose on the part of the Founders, it received a correspondingly large attention. As an institution of generous purpose, without hope or desire for financial return, it was appropriated by the public, and received the persistent criticism which seems the usual reward for such undertakings. The writer was consulted only after the completion of the building, but its acoustical difficulties can be discussed adequately only in the light of its initial program.
>
> It was part of the orginal program submitted to Messrs. Carrère & Hastings, that the building should be used, or at

least should be adapted to use for opera as well as for drama. This idea, with its corollary features, influenced the early design and shows in the completed structure.

It was also a part of the initial plan that there should be two rows of boxes, something very unusual in theatre construction. This was a prodigal use of space and magnified the building in all its dimensions. Later, but not until after the building was nearly completed, the upper row of boxes was abandoned, and the gallery thus created was changed to foyer chairs. As the main walls were by this time erected, the gallery was limited in depth to the boxes and their ante-chambers. It thus resulted that this level, which is ordinarily occupied by a gallery of great value, is of small capacity. Notwithstanding this, The New Theatre seats 2,300, while the usual theatre seats but little more than two-thirds of that number.

The necessity of providing twenty-three commodious boxes, all in the first tier, of which none should be so near the stage as to be distinctly inferior, determined a large circle for their front and for the front of all the galleries. Thus, not merely are the seats, which are ordinarily the best seats, far from the stage, but the great horizontal scale this necessitated leads architecturally to a correspondingly great vertical scale. The row of boxes and the foyer balcony above not merely determined the scale of the auditorium, but also presented at the back of their shallow depth a concave wall which focused the reflected sound in the center of the auditorium.

Finally, it should be borne in mind that while the acoustical demands in a theatre are greater than in almost any other type of auditorium, because of the great modulation of the voice in dramatic action, The New Theatre was undertaking an even more than usually difficult task, that of presenting on the one hand the older dramas with their less familiar and more difficult phrasing, and on the other the more subtle and delicate of modern plays. The conventional type of theatre construction is fairly, though only fairly, well adapted to the usual type of dramatic performance. The New Theatre, with a very difficult type of performance to present, was forced by the conditions which surrounded the project to depart from the conventional type far more radically than was perhaps at that time realized.

Here, as usual in a completed building, structural changes and large changes of form were impossible, and the acoustical difficulties of the auditorium could be remedied only by indirection. The boxes were changed from the first to the second level, being interchanged with the foyer chairs, while the excessive height of the main body of the auditorium was reduced by means of a canopy surrounding the central chandelier. This ingenious and not displeasing substitute for the recommended lowering of the ceiling was proposed by Mr. Hastings, although, of course, only as a means to an end. Its effective lowering of the height of the ceiling is 20 feet. The improvement brought about by this was pronounced and satisfactory to the Founders. The distances, however, were still too great, even visually, for the type of dramatic performance for which the theatre was primarily intended, and such use was therefore discontinued. The New Theatre is much better adapted to opera than to dramatic performances, and it would be a matter of great regret if, with its charming solution of many difficult architectural problems, it is not restored to such dignified purpose.

The entire paper can be read with great profit as one treating of a subject whose interest is scarcely less than its importance. Further discussions devoted to various phases of the general subject of architectural acoustics, particularly as affecting the design of buildings in order to avoid the necessity of applying correctional methods after erection, are promised in the not distant future.

A HOUSE ON BREAK NECK MOUNTAIN, N. Y.

(*Continued from page 226*)

trunk line, thus diverting and then utilizing it for the supply of the swimming pool on the lower level. From the pool the water was wasted into a spillway and eventually found its way into the Hudson. While it was considered desirable to have a certain continuity in the landscape plan, the main features of this plan were determined in almost every instance by the nature of the ground and various considerations of drainage, this positively fixed the location of the swimming pool, sunken garden and kitchen gardens; the pergola has been placed to emphasize the axis of the Main Hall and the crown of Storm King.

Field stone from Break Neck and rough natural boulders were used for the exterior walls of the house and the retaining walls, the intention being to conform as far as possible to the natural character of this rough and mountainous country. The lines of the house were studied with this in mind.

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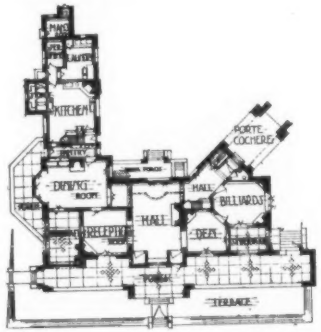


COUNTRY HOUSE OF J. STERN, ESQ., BREAKNECK MOUNTAIN, N. Y.

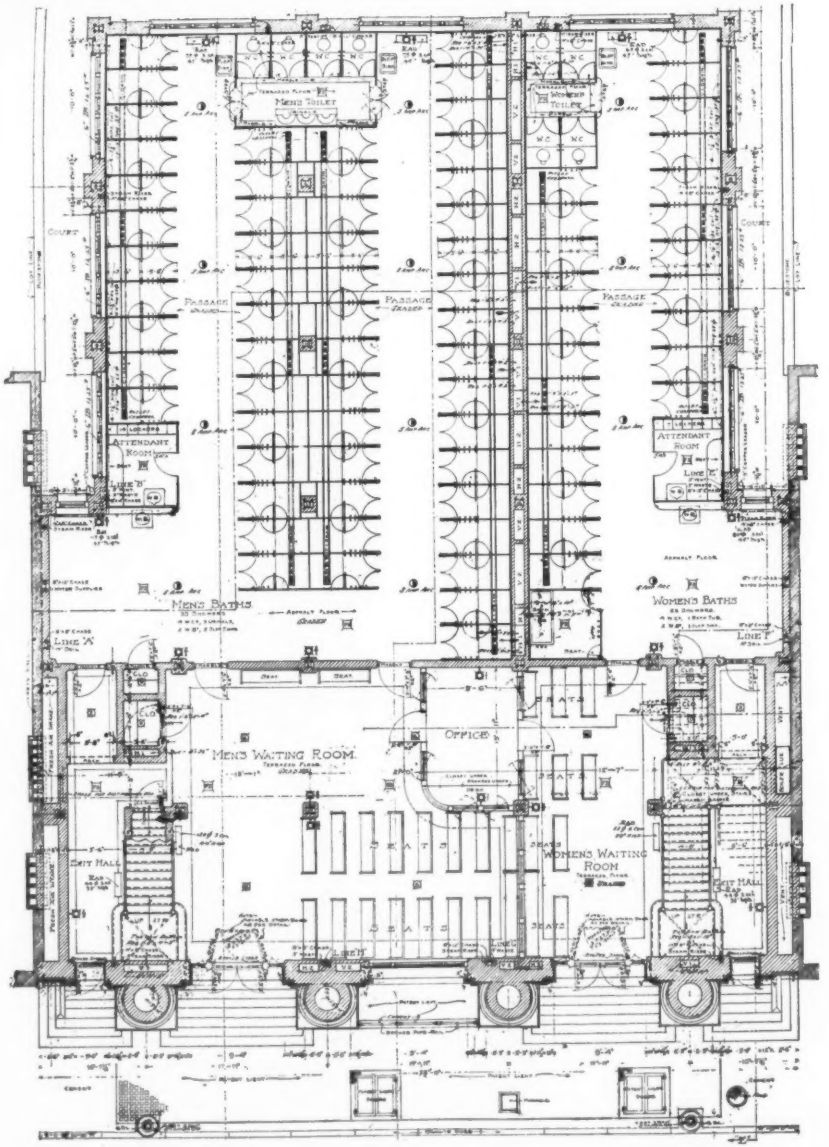
MESSRS. WERNER & WINDOLPH, ARCHITECTS

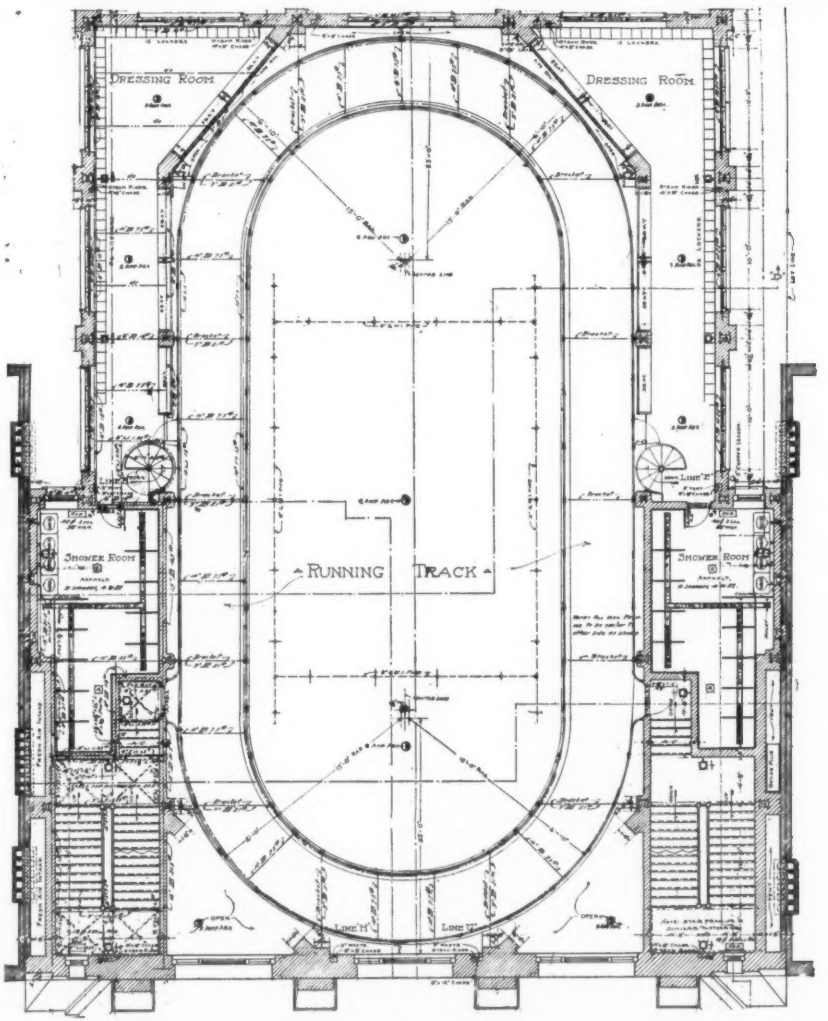
COUNTRY HOUSE OF J. STERN, ESQ., BREAKNECK MOUNTAIN, N. Y.

MESSRS. WERNER & WINDOLPH, ARCHITECTS

PUBLIC BATH AND GYMNASIUM, EAST 54TH STREET, NEW YORK

MESSRS. WERNER & WINDOLPH, ARCHITECTS

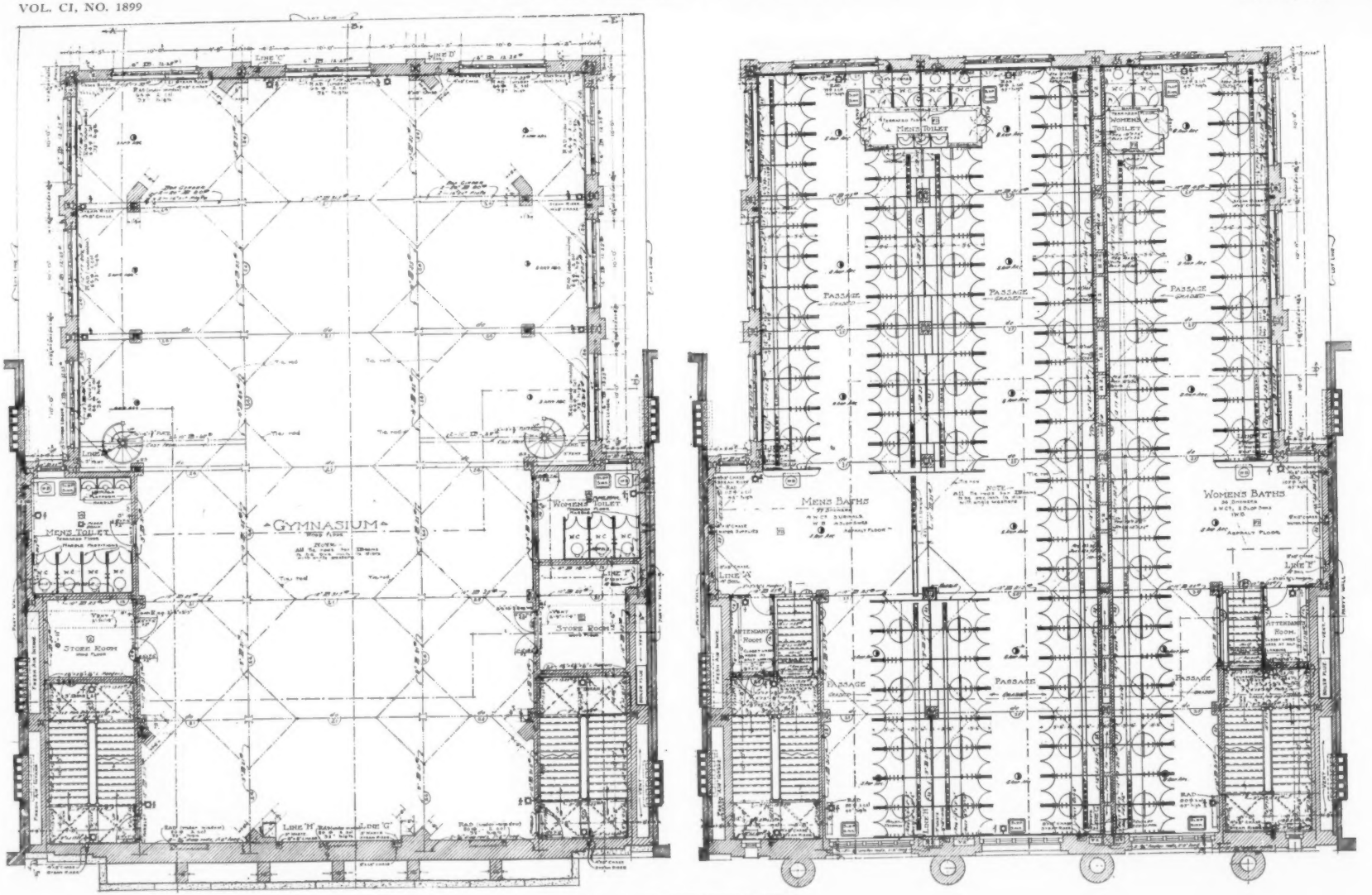




FIRST AND MEZZANINE FLOORS

PUBLIC BATH AND GYMNASIUM, EAST 54TH STREET, NEW YORK

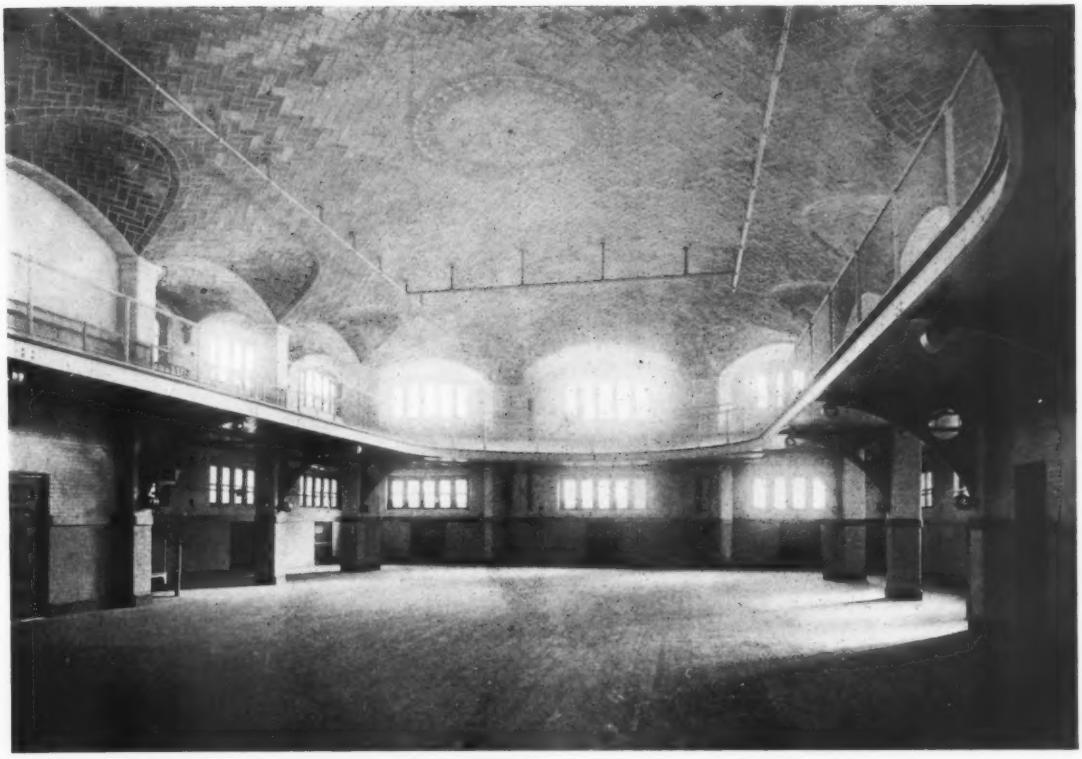
MESSRS. WERNER & WINDOLPH, ARCHITECTS



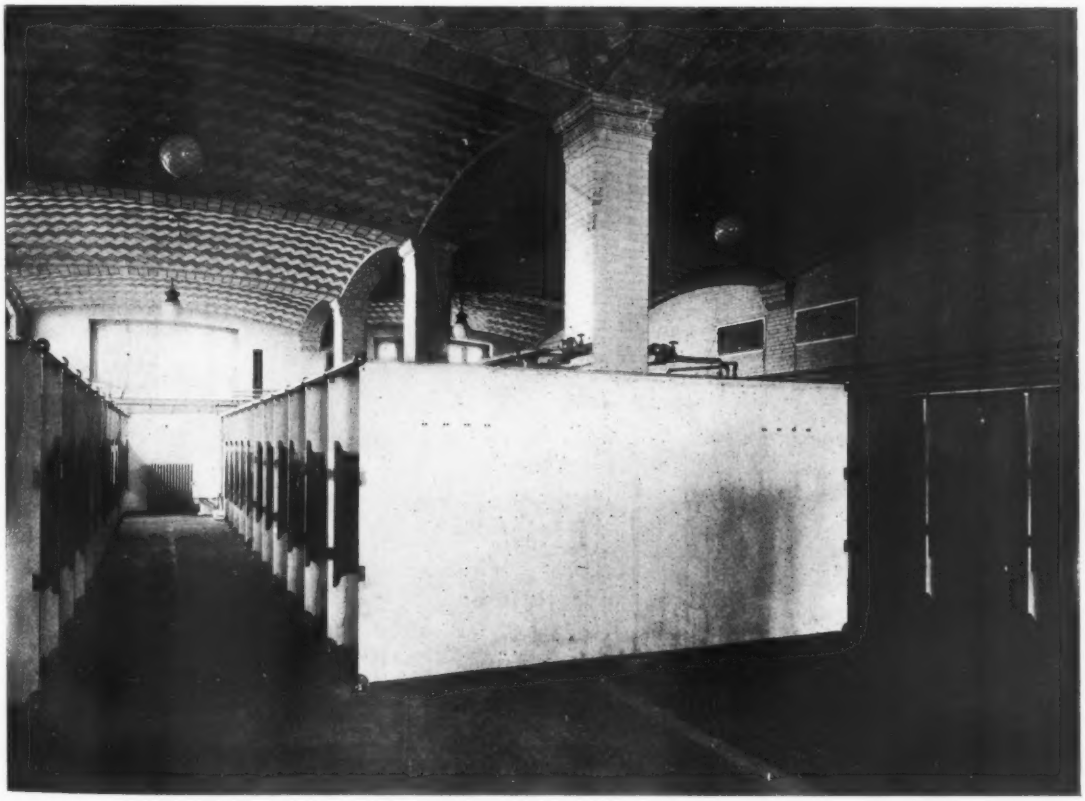
SECOND AND GYMNASIUM FLOORS

PUBLIC BATH AND GYMNASIUM, EAST 54TH STREET, NEW YORK

MESSRS. WERNER & WINDOLPH, ARCHITECTS



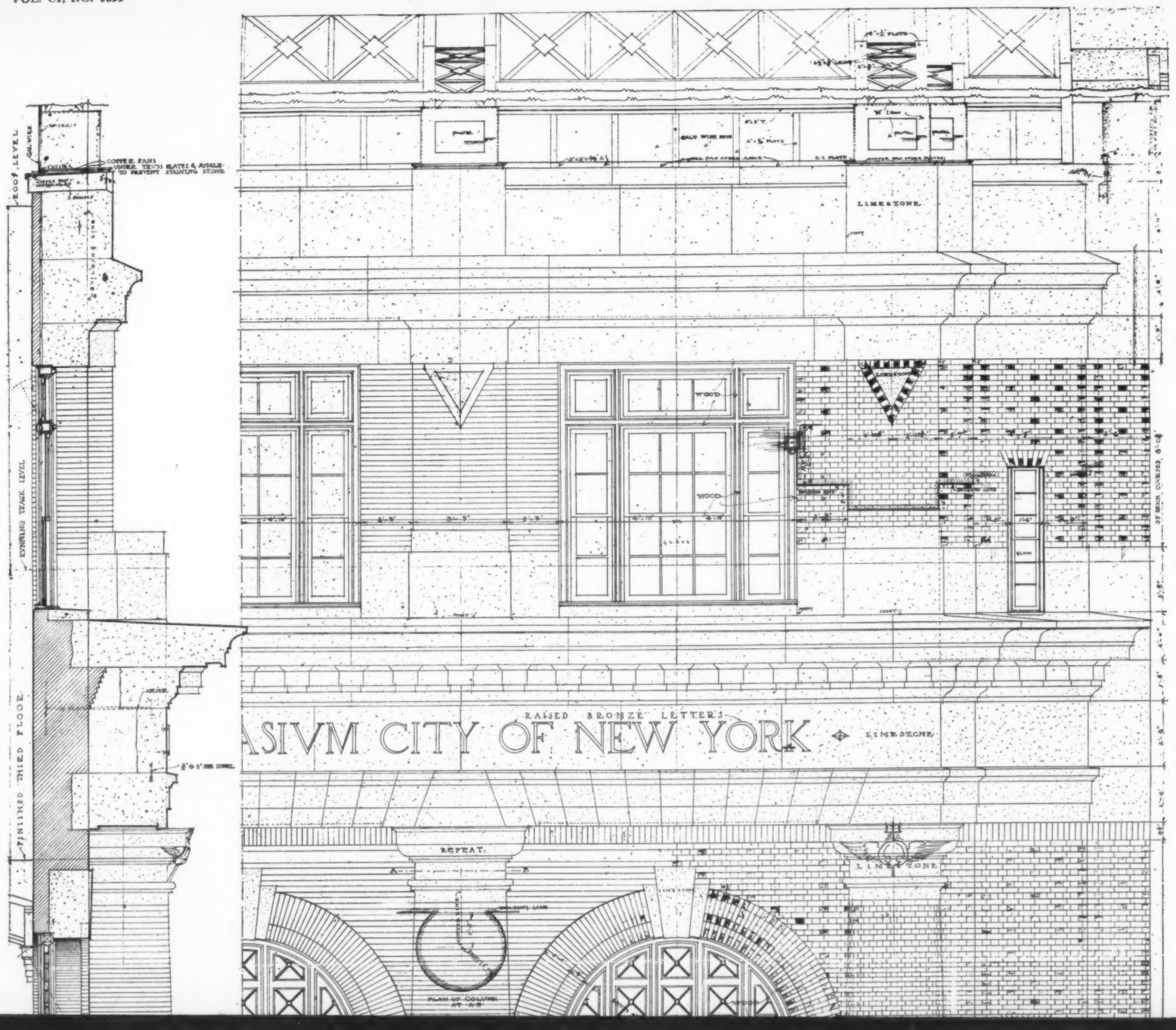
GYMNASIUM AND RUNNING TRACK

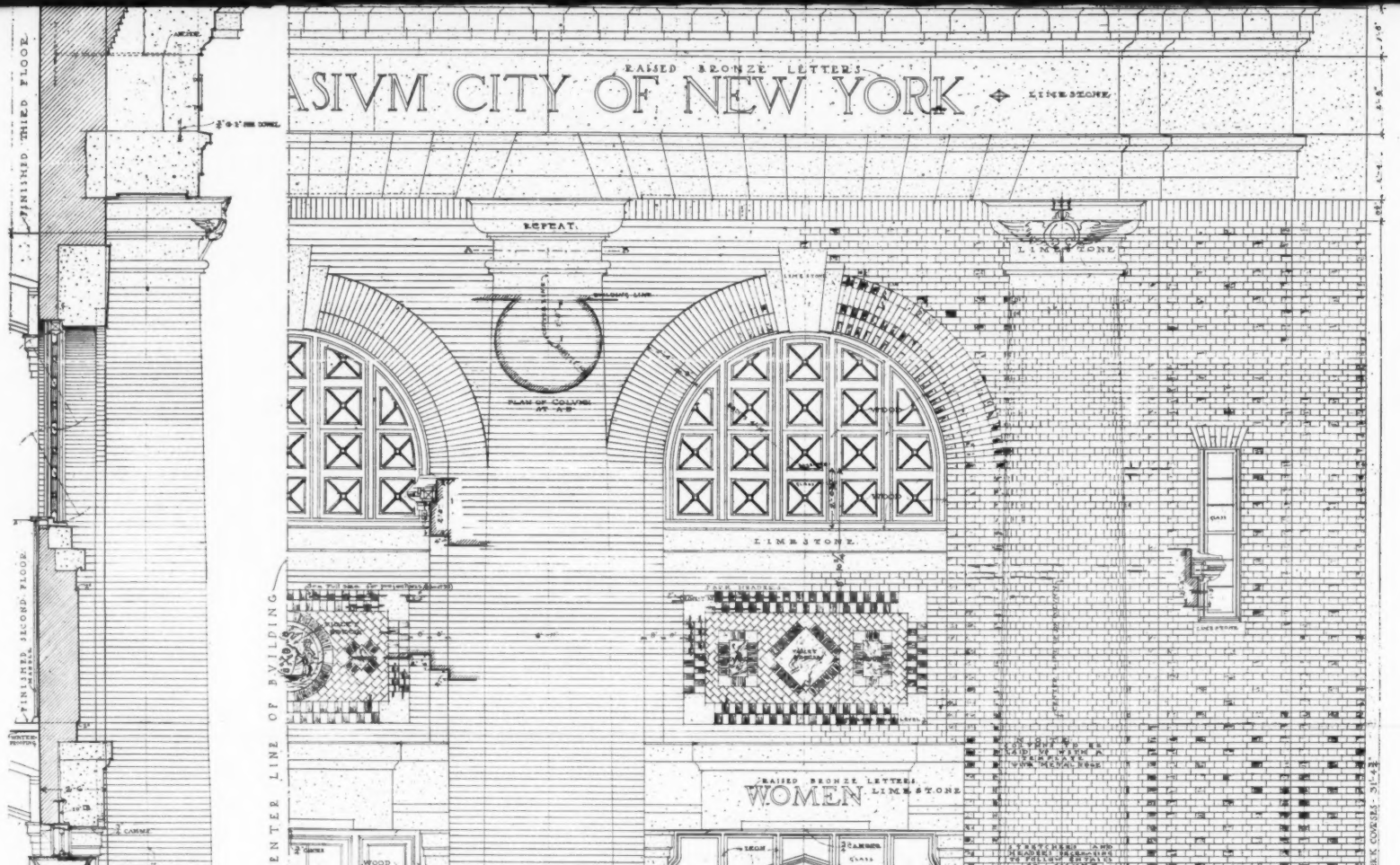


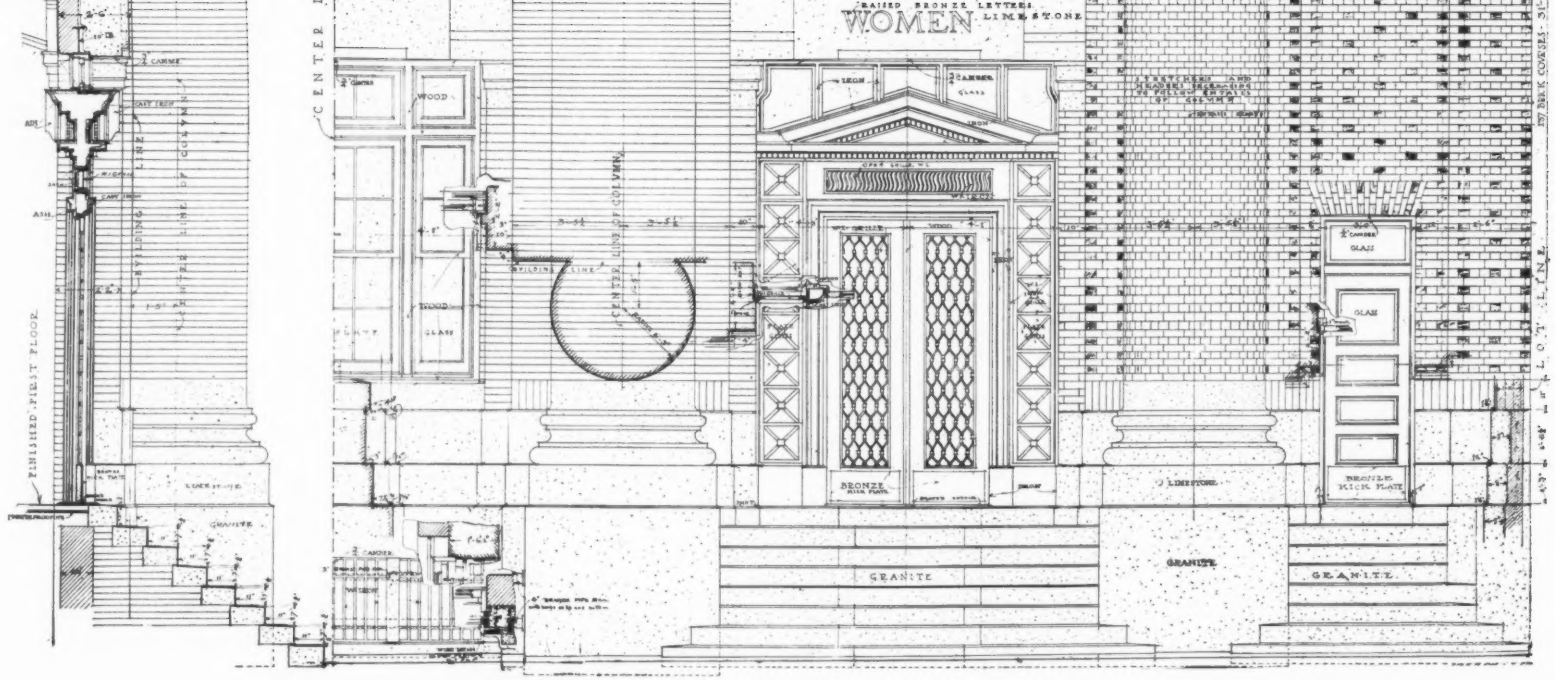
MEN'S BATH ROOMS, SECOND STORY

PUBLIC BATH AND GYMNASIUM, EAST 54TH STREET, NEW YORK

MESSRS. WERNER & WINDOLPH, ARCHITECTS


ROOF LEVEL
COPPER PANS
FINISHED THIRD FLOOR
LIME STONE
WOOD
WOOD
RAISED BRONZE LETTERS
ASIVM CITY OF NEW YORK
LIME STONE
REPEAT
LIME STONE
PLAN OF COLUMN AT A-B


RAISED BRONZE LETTERS
ASIVM CITY OF NEW YORK
LIMESTONE
REPEAT
LIMESTONE
LIMESTONE
RAISED BRONZE LETTERS
WOMEN
LIMESTONE
FINISHED THIRD FLOOR
FINISHED SECOND FLOOR
CENTER LINE OF BUILDING



A GYMNASIUM AND PUBLIC BATH FOR THE CITY OF NEW YORK

MESSRS. WERNER & WINDOLPH, ARCHITECTS

GALLERY IN THE CAMPOSANTO, GENOA, ITALY