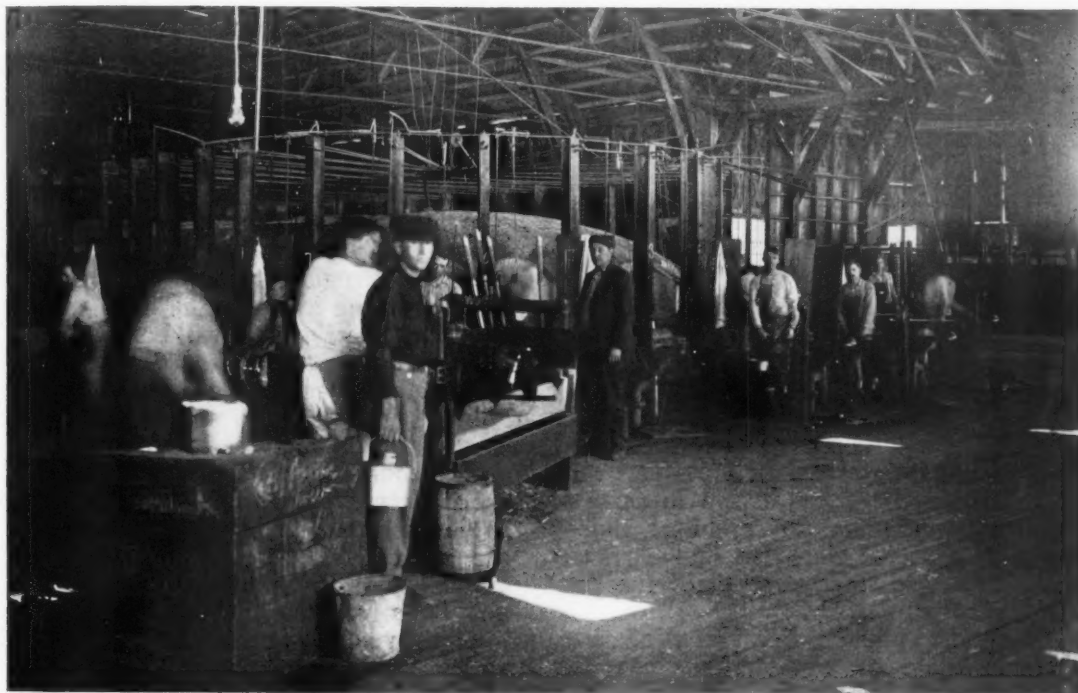


THE AMERICAN ARCHITECT

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No. 1872



A WINDOW GLASS FURNACE

GLASS IN BUILDING OPERATIONS*

By E. H. BOSTOCK

PART I—CLEAR GLAZING



WHEN one considers glass in building operations, the clear glazing is the usual first thought and, while the architect may not be an expert in this material, he should possess a sufficiently accurate knowledge of it to be able to recognize difference in kind and quality and to choose intelligently that which is appropriate and economical for the purpose for which it is to be used.

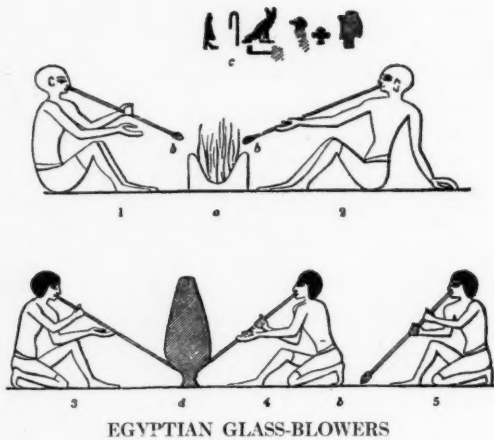
*This is the first of a series of articles contributed by Mr. E. H. Bostock, treating of glass with particular reference to such details as may be useful to architects in selecting and specifying.

If a special problem arises the disinterested expert must, of course, be consulted, but it is for the ordinary problems of architectural practice that architects should be better acquainted with the material they are to use and in this matter of clear glazing be able to specify in other than the vague and ill-considered terms so often used.

Quite often the architect who writes the specification has not the quality of glass he desires to use clear in his own mind, and so leaves it very much of an open question between himself and the glazing contractor

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THE AMERICAN ARCHITECT



and often leaves it open for the substitution of an inferior grade.

Unfortunately it has always been hard to define an absolute standard in clear glass for the different commercial qualities and the substitution of an inferior quality is hard to prove, except by the expert, who is not apt to be called except in cases of special importance; the architect indeed must often accept glass that he feels is defective because he cannot place the particular faults.

The most common defect in clear glass, whether plate or window, is "blisters"; by this generic term is understood any kind of air bubble; though they may assume an infinite variety of shapes, sizes and

colors. The worst are those caused by air adhering to the pipe when the glass is first gathered; these leave the pipe and are forced into the sheet in the process of working, forming very large blisters quite often four inches or five inches in length or diameter, and broken up sometimes into patterns almost as if intentional. These are rarely seen now as they are so very unsightly, but are quite often seen in old glass.

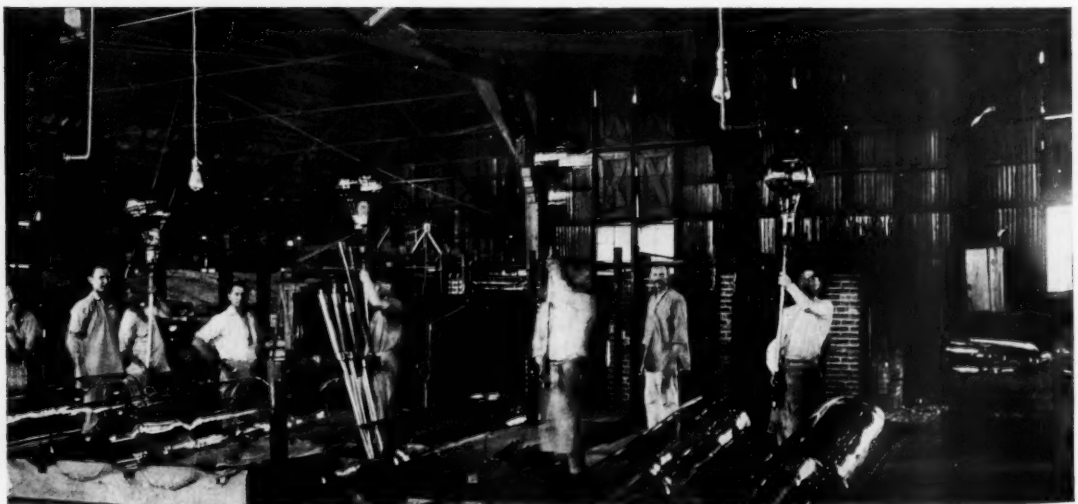
The most usual cause of an air bubble is of course the catching of a small quantity of air in a fold of the glass and a bubble so made may assume any size and shape.

Quite often, too, small blisters caused by dust having been blown upon the surface of the molten glass while in work are seen; these must be looked at closely as usually the whole sheet or light will be covered with them.

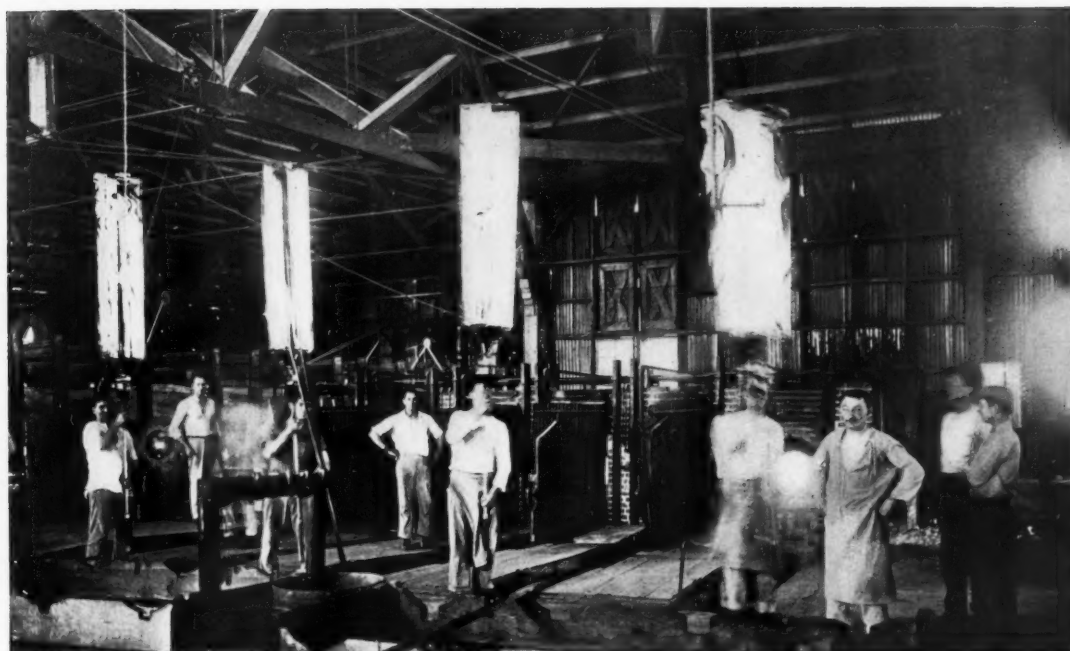
Sometimes, too, are seen blisters of a milky white color generally from a carbon spark or excess of alkali.

The condition of glass usually known in the trade as "cordy" or "stringy" is hard to describe though the names here given it are expressive; these conditions arise in various ways, but mean that the glass is not homogeneous and does not refract light as a whole, but breaks it up as the various layers or cords of glass may lie.

Quite often "cordy" glass is deceiving if viewed at an angle of 90 degrees, but a glance at a sharper angle where the differ-



THE "BALLS" BEFORE REHEATING AND LENGTHENING INTO CYLINDERS, AS SEEN IN THE FOREGROUND



FINISHED CYLINDERS STILL ATTACHED TO PIPES

ence in refraction is apparent reveals the truth.

Stones, the name under which is known almost any foreign substance in glass, are a frequent defect; these are usually chips of clay from the furnace wall, or foreign matter in the material.

While it is now unusual to see "ambitty" or devitrification spots, these are an interesting problem and used more often to be seen when furnaces were run at low temperatures, as they are a problem in crystallization caused by the fact that if glass is held any length of time at the point of crystallization of any of its constituents then any excess of that constituent crystallizes if present; these resemble "stones" in appearance, but are not so apt to break.

A most common defect in sheet glass is "carbon" or "burnt" spots caused by the depositing upon the surface of small particles of fixed carbon from the fuel gas and then burning in during the process of flattening the sheet; analogous with this, too, is the "gray" effect on some sheet glass caused by the sulphur fumes that are also burnt in and impossible afterwards to remove.

This last "sulphur stain" is rather im-

portant to the builder inasmuch as it is one of the causes of the deterioration of glass, because the sulphur so deposited will by combining with atmospheric moisture etch or stain the surface in time, this more principally if the glass is made with soda ash base.

Glass that has been improperly flattened is often found and cannot be used on account of the distortion it gives all vision, and sometimes also in the "oven" small scrap pieces of glass become attached to the surface and cannot afterwards be removed and are very unsightly, besides the danger they cause in cleaning.

Furnace scratches and block marks are defects almost invariably cut away at the factory and never should be seen nowadays.

In the matter of specifying window glass to suit his needs the architect may make choice from the following list procurable at all times in large jobbing centres:

American Single Strength...	4 qualities
American Double Strength..	3 "
American Car Glass.....	1 quality
French Single Strength....	3 qualities
French Double Strength....	3 "
German 24 oz.....	2 "

THE AMERICAN ARCHITECT

English 17 oz.....	Usually about 2 qualities of each.
English 21 oz.....	
English 26 oz.....	
English 32 oz.....	
English 36 oz.....	

and by insistence should be able to get any one of these he may need.

American glass is divided according to list into AA, A, B, and C qualities and the

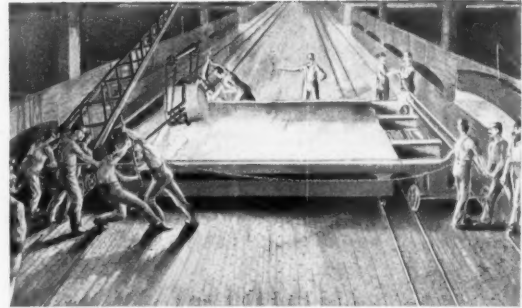


STARTING TO BLOW THE CYLINDERS

original packages should be so branded; most manufacturers also enclose a slip inside box stating the quality it contains.

The ordinary jobber's stock of American window glass generally consists of about 75 per cent. B quality and 25 per cent. A, and about the same proportions in single and double thickness and the usual building specifications fall within these limits.

American window glass is only on the market usually in two thicknesses, single and double; the single strength averages about one-tenth of an inch in thickness, and requires about 18 ounces to the square foot to be figured upon when calculating the counterbalance and is safe to use in ordinary wind pressures up to 28x34 inches; double strength glass runs about one-seventh of an inch thick, requiring a counterbalance of 24 ounces to the square foot and procurable up to sizes whose sum makes 120 inches, that is 60x60 inches, 40x80 inches, or anything within those limits.



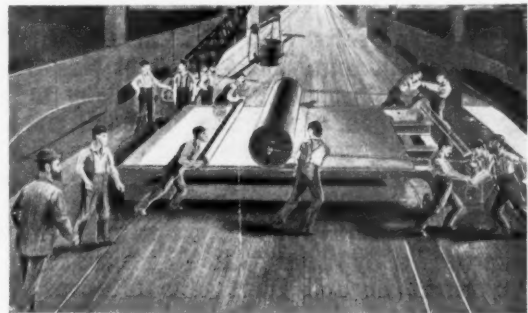
CASTING PLATE GLASS

It is hardly safe to use double strength above 40x44 inches in exposed situations or moveable sash. If it is desired to economize on the cost of plate glass in a front, the larger sizes of double strength window glass may be used, but only in stationary lights and protected situations.

An architect sometimes has occasion to specify where the quality of glass is of no importance, as in cheap mill construction, mushroom cellar, steel mill skylights, etc.; in such cases he may save his client money by calling for "C" glass, this is the factory rejects that otherwise would be remelted and buyer must be prepared to accept any quality at all saving "stony" glass, this being used would cause great breakage and consequent reglazing, and never be accepted.

This quality cannot be so readily procured, as the factories, finding a very limited market, have preferred either not to save or to remelt all glass of such quality, except such as could be sold for sand-blasting.

It was formerly the practice to use this glass in green or hot-house construction,



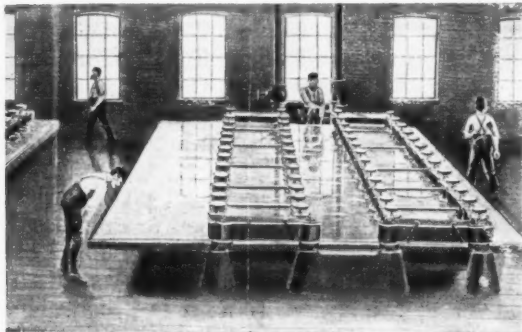
ROLLING PLATE GLASS

THE AMERICAN ARCHITECT

but this was a mistake as the numerous defects served to carry intense spots of light to the detriment of the plant.

The price of C quality will usually average about 10 per cent. below B, enough to make an appreciable saving on a large contract.

B quality such as usually glazed in all ordinary low cost construction, is allowed to contain in a minor degree some of the faults apt to be found in all blown glass, viz.:—cords or strings if these are of the type that do not show upon the surface, small blisters not over one-fourth of an inch or so in diameter, small burnt or carbon patches, that is where carbon from the gas flame of the flattening oven has adhered to the sheet. It should never be passed



POLISHING THE GROUND AND SMOOTH PLATE GLASS

if any of these defects are too pronounced, nor if the sheet contains stones, surface cords, furnace scratches, pipe blisters, or if improperly flattened to the extent that it distorts the vision.

"A" quality will be specified when the better class of residences, the upper floors of office buildings and such type of work is to be done; the A quality of American glass means in effect all the factories' output above B grade, as very little further selecting is done; in "A" glass no defect of any prominence should be allowed to pass; the one most apt to be and therefore to be looked for the closest is "body string," not always apparent unless the glass is viewed at a sharp angle.

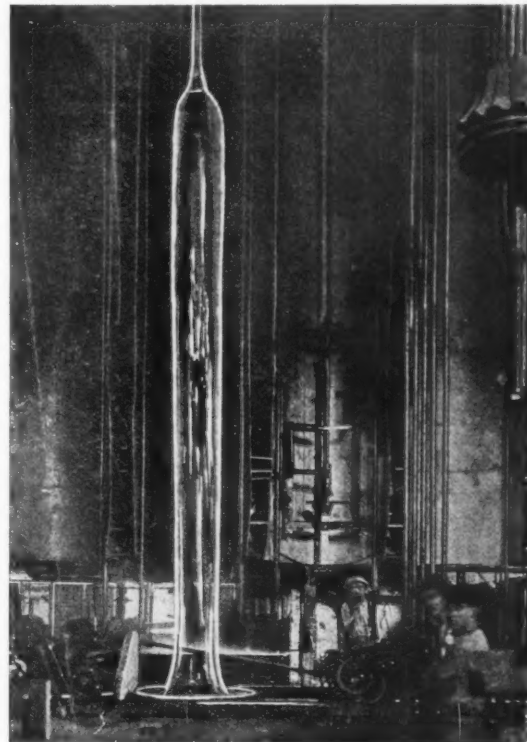
There may arise occasions when the architect feels he wants the best American glass he can get for high grade work and

will call for "AA" quality; it must be remembered that the jobber carries no AA glass in stock and to be sure of getting it the order must be placed with the factory; if a jobber gets it, it usually means that he will open "A" quality and select from this glass all that he feels will pass as AA.

AA glass should be perfect as far as the casual examination goes, the very small defects that are in all glass being such that they are hard to find.

In specifying any quality or thickness of American glass it is well to require a tank made, hand-blown, natural-gas, and dipped brand.

Hand-blown glass is to be preferred to the machine drawn, because of its proven ability in better withstanding the strain due to changes of temperature. A year or so ago the quality of the machine drawn was also below the standard, but at this writing it would seem to be about as good as the hand-blown and the only proven point of inferiority would seem to be that spoken of.



GLASS ROLLER COMPLETELY BLOWN, READY FOR SEVERING

THE AMERICAN ARCHITECT

Tank-made glass is preferable to that made in pots, because it is now made almost solely upon a salt-cake or sulphate of soda base, whereas, to be able to melt fast enough in pots to maintain the high producing rates set by the tanks, manufacturers resort to soda-ash, in varying quantities, as a quick melter and soda-ash glass is apt to contain some small percentage of "free acid" which in time and especially in moist atmospheres will cause the glass to stain and become iridescent, as is often noted in all buildings.

"Dipped glass" means that the sheets, hot from the tempering lehr, are dipped in hot water and acid, thus removing from them all traces of sulphur and smoke. Glass made with natural gas is to be preferred because it carries so little excess carbon, it is not likely to be burnt, that is, have the small particles of unburnt carbon adhere to the surface of the sheet.

The next step in quality higher than the American is the so-called French, which is almost invariably Belgian-made, and runs fully 25 per cent. better than corresponding American qualities, though it is lighter in weight than the corresponding thickness, the single strength being about one-tenth of an inch thick and weighing 17 ounces to the square foot, the double one-eighth thick and weighing 21 ounces to the foot; in small sizes up to 15 x 15 inches the French glass usually sells in New York at the same price as American, and the difference is never very great up to 16 x 24 inches. Above this freight charges, breakage and tariff make a difference of four or five cents a foot.

On account of its superior quality and light weight it is very much used for picture framing.

German glass is of about the same quality as the French, but is of a lighter color, and for glazing a picture gallery or some such building where it is desired to preserve the full value of light it is to be preferred.

If the best blown glass is to be desired, the English must be specified. Only the best grades are imported, and, as the price is very high, it pays to use them only when the very best is needed. The two large English producers date their existence back into the eighteenth century and,

having made it a point all this time to maintain their quality to the highest standard, the goods can be depended upon to run uniform and true to quality brand. Some of the best of this cannot be told from plate glass except by the expert, as it contains none of the wavy appearance of sheet glass and no defect except an occasional small blister. The English produce so many thicknesses from 13 ounces, or Dry Plate glass, to 40 ounces, or British Plate, that it is usual to designate them by the weight per square foot, therefore the expressions 15, 17, 21, 26, 32 and 40-ounce glass.

When it comes to specifying plate glass, which will be done by the architect whenever he desires the best glass procurable for his purposes and for any opening of large size or exposed position where the weight is desired to withstand shock, his position as to quality is a little better than on blown glass, for there are not so many distinctions as to quality, though in thickness it is procurable from one-eighth up to one inch.

Ordinary "glazing quality" plate varies about one-sixteenth of an inch in thickness, either way from its assumed standard of one-fourth of an inch and weighs three pounds to the square foot; it is procurable up to any size that can safely be transported to where it is to be placed, even commercially it is listed up to 138 x 208 in size.

Architects somehow have seemed to assume that if they have specified plate glass in a building it needs no further looking after, as if plate glass were always perfect; this, of course, is not true, inasmuch as perfect glass seems to be almost an impossibility and plate glass is apt sometimes to have very palpable defects which must be looked for, the most frequent being "striae" or "strata" of glass which are not homogeneous, and imperfectly polished places known to the trade as "grey spots."

Almost all of the glazing plate used in the country is of American manufacture, its only point of inferiority being its color—usually dark, but to balance which its surface is harder than the foreign and is not so easily abraded by the wind-blown dust.

Considerable German "Crystal Plate,"

(Continued on page 192)

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VOL. C NOVEMBER 8, 1911 No. 1872

CONTENTS

GLASS IN BUILDING OPERATIONS, PART I 185

EDITORIAL COMMENT - - - - - 191

ILLUSTRATIONS:

TOWN HALL, LANCASTER, MASS.
BERTRAM HALL, RADCLIFFE COLLEGE, CAMBRIDGE,
MASS.

FRONTISPIECE:

MONUMENT TO GUISEPPE GARIBALDI, ROME, ITALY

UNQUALIFIED JUDGES

IN referring to the testimony recently given by Mr. James Knox Taylor, Supervising Architect of the Treasury, before an investigating committee of Congress, we took occasion to direct attention to the apparent unfitness of the chairman of the committee to sit in judgment where questions of architectural practice, and the ethics which govern it, were concerned. Evidence that this lack of the necessary qualifications for the intelligent handling of similar problems is shared by other members of Congress is contained in a statement attributed to Chairman Fitzgerald of the House Committee on Appropriations. With evident satisfaction, this astute gentleman makes the announcement through the public press, that his Committee has effected a saving of a quarter of a million dollars each year by dispensing with the services of some eighty draftsmen heretofore employed in the office of the Supervising Architect of the Treasury. The manner in which this public service has been rendered is probably best shown by quoting from his alleged reply to a request for an

appropriation to continue the services of these draftsmen to the end of the fiscal year.

"There is nothing extra coming from Congress to meet such an expenditure and I suggest that since the Government has over 600 buildings, the draftsmen can be dispensed with and new buildings authorized built from plans already made use of."

We are not at this moment discussing the "cheese-paring" policy of the Committee on Appropriations in withholding from an important branch of the Government and one that has shown an exceptionally high standard of efficiency, the money necessary to continue its work, but we are led to suggest that if means could be devised by which it would be possible to place Congressional candidates in the Civil Service class, in order that the people might be assured in advance that their representatives would have sufficient knowledge of the subjects brought before them for consideration to enable them to take intelligent action, the country at large would be greatly benefited.

A WORTHY INNOVATION

WITH the object in view of keeping architects and the building public informed on all matters affecting their interests, the Bureau of Buildings of the Borough of Manhattan, under the direction of Superintendent Rudolph P. Miller, has introduced the practice of issuing a series of bulletins. In these are included all special orders, rules and interpretations made by the Superintendent and all modifications granted by the Superintendent and approved by the Borough President.

The value of this practice to architects is readily apparent. Heretofore, the information which these bulletins contain has reached those interested only by mere chance. Without it plans were frequently filed which did not conform to recent rulings, with the result that much friction, annoyance, and sometimes charges of discrimination ensued.

Unfortunately, the Bureau of Buildings has not been provided with the necessary funds to publish and distribute the information but has been dependent upon real estate and building journals for their circulation. In his annual report Mr. Miller urges the city to authorize the printing of

THE AMERICAN ARCHITECT

these bulletins for general distribution and render it possible for those interested to obtain them with accuracy and regularity similar to the manner in which legislative bills are furnished to the various interests concerned.

The suggestion appears to possess much merit and there is little doubt but that a sufficient number of architects, and possibly builders, would avail of such an arrangement to make the plan well worth adopting. If architects were advised immediately of every new ruling or interpretation affecting the drawing of plans, much useless effort

would be spared and plans would be more quickly approved at the Department, with a very material saving of time both to the architect and Department officials, even including that of the Superintendent to whom many matters are now referred by reason of disagreement caused principally by lack of information concerning recent rulings. We trust the suggestion will find favor with the city officials who have it within their power to bring about its adoption. A similar plan might with reason be advocated for other cities throughout the country.

GLASS IN BUILDING OPERATIONS

(Continued from page 190)

being a plate one-eighth thick, of very good quality, is imported for use wherever a lighter weight plate is desired, as for covering large pictures or to make a lighter weight sash.

It is possible to procure French plate at a slight advance even in large lights, and



THE DISTORTED VISION GIVEN BY BADLY FLAT-TENSIONED WINDOW GLASS

its quality and color are a little better than the domestic, but at the same time the American glass is a little harder surfaced and will stand wear and abrasion better than the foreign glass.

The very highest grade of glazing, of

course, is gotten by glazing "Silvering Quality" plate, but it is only the unusual operation that justifies the expense.

In writing the specification and deciding the quality of the glass to be used the quality must be determined primarily by the character of the building; if the interior is a little dark the defects will not, of course, be so apparent and if silks or other fadeable goods are to be within its range it must be remembered that a "blister" of any size will so concentrate the light that it will fade the goods it falls upon.

American Single Strength	C quality	Weight per square foot, 18oz.
	B "	
	A "	
	AA "	
American Double Strength	B "	24 oz.
	A "	
	AA "	
French Single Strength	A "	17 oz.
	B "	
	AA "	
French Double Strength	A "	21 oz.
	B "	
	AA "	
German 24 oz.	A "	21 oz.
English 21 oz.	2nd "	
English 21 oz.	1st "	
English 21 oz.	Best "	26 oz.
English 26 oz.	2nd "	
English 26 oz.	1st "	
English 26 oz.	Best "	32 oz.
English 32 oz.	1st "	
Crystal Plate		24 oz.
Glazing Plate		3 lbs.
Silvering Plate		

As an aid to the specification writer possibly the above list would be of value, the glasses arranged in order of quality from poorest up with counterbalance weight shown.

(To be continued)



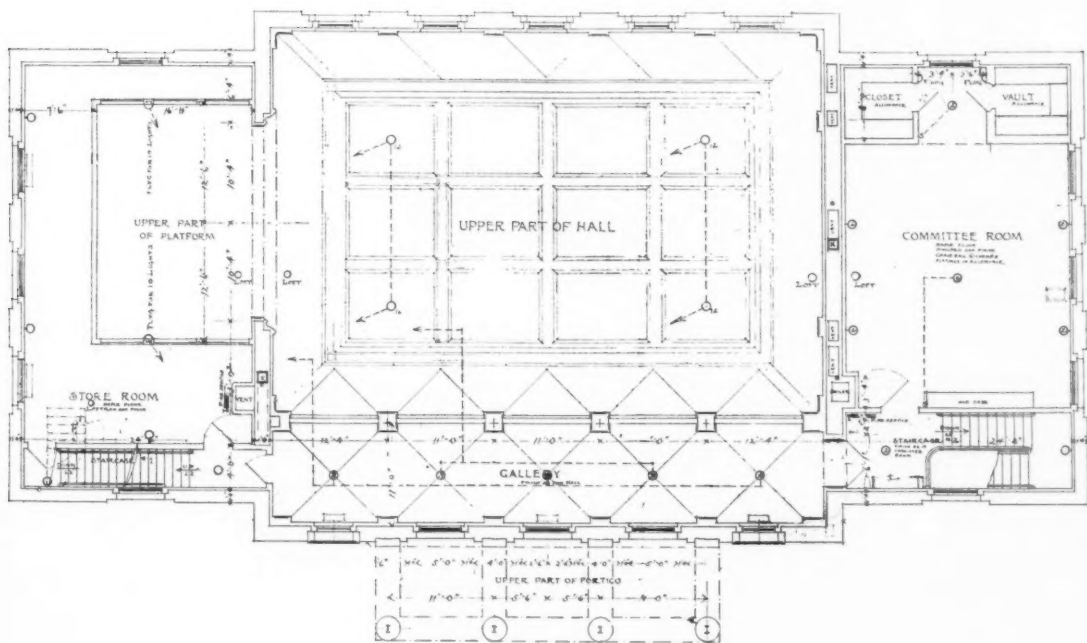
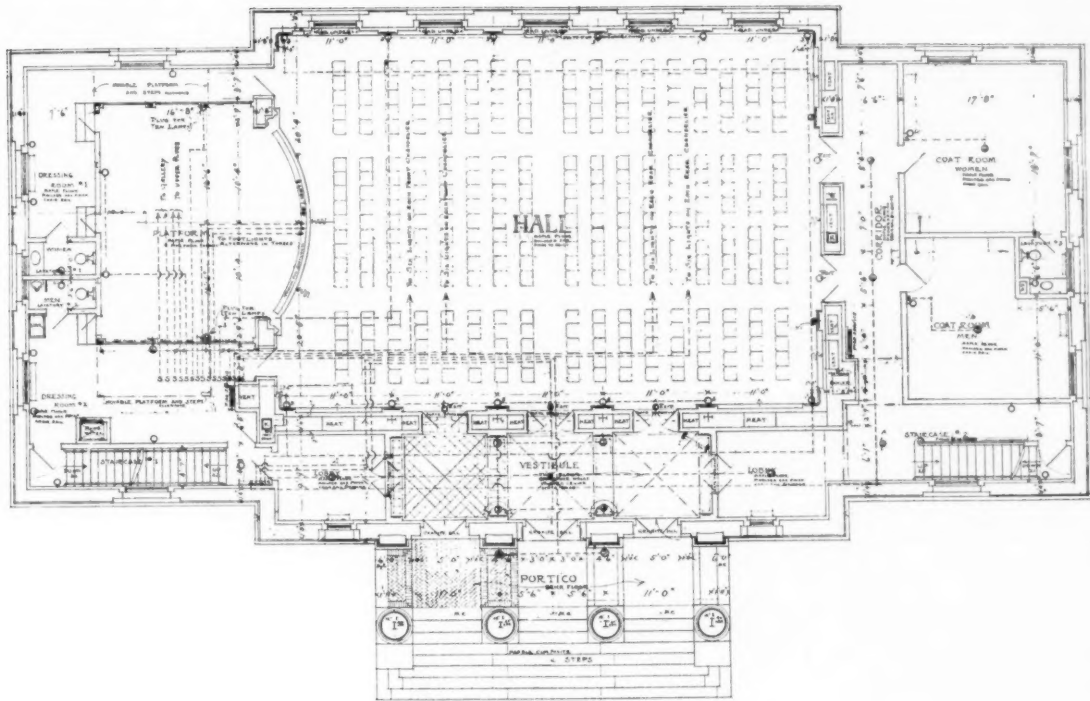
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FRONT ON THE YARD

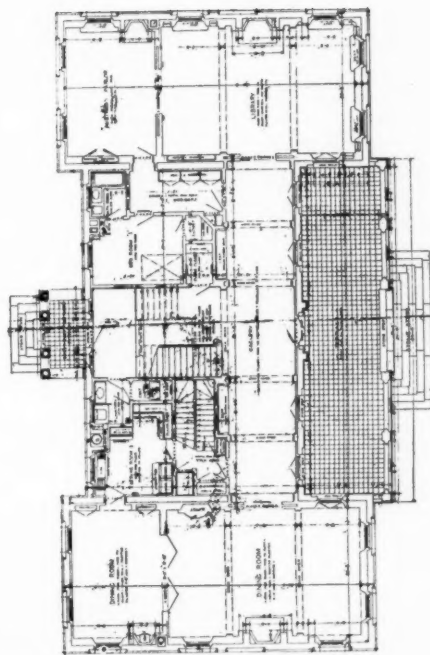
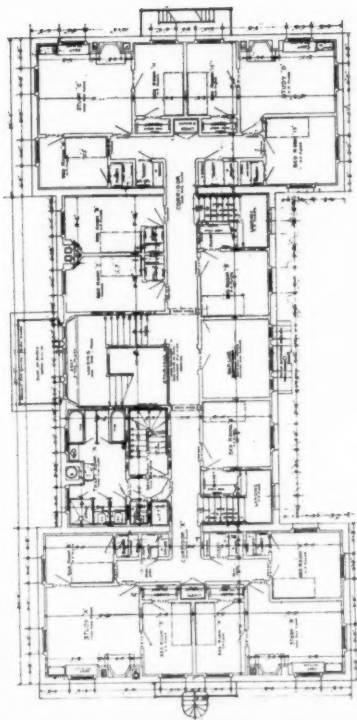
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AT TOP, MAIN HALL; BELOW, A STUDY; AT RIGHT, MANTEL IN THE LIVING ROOM
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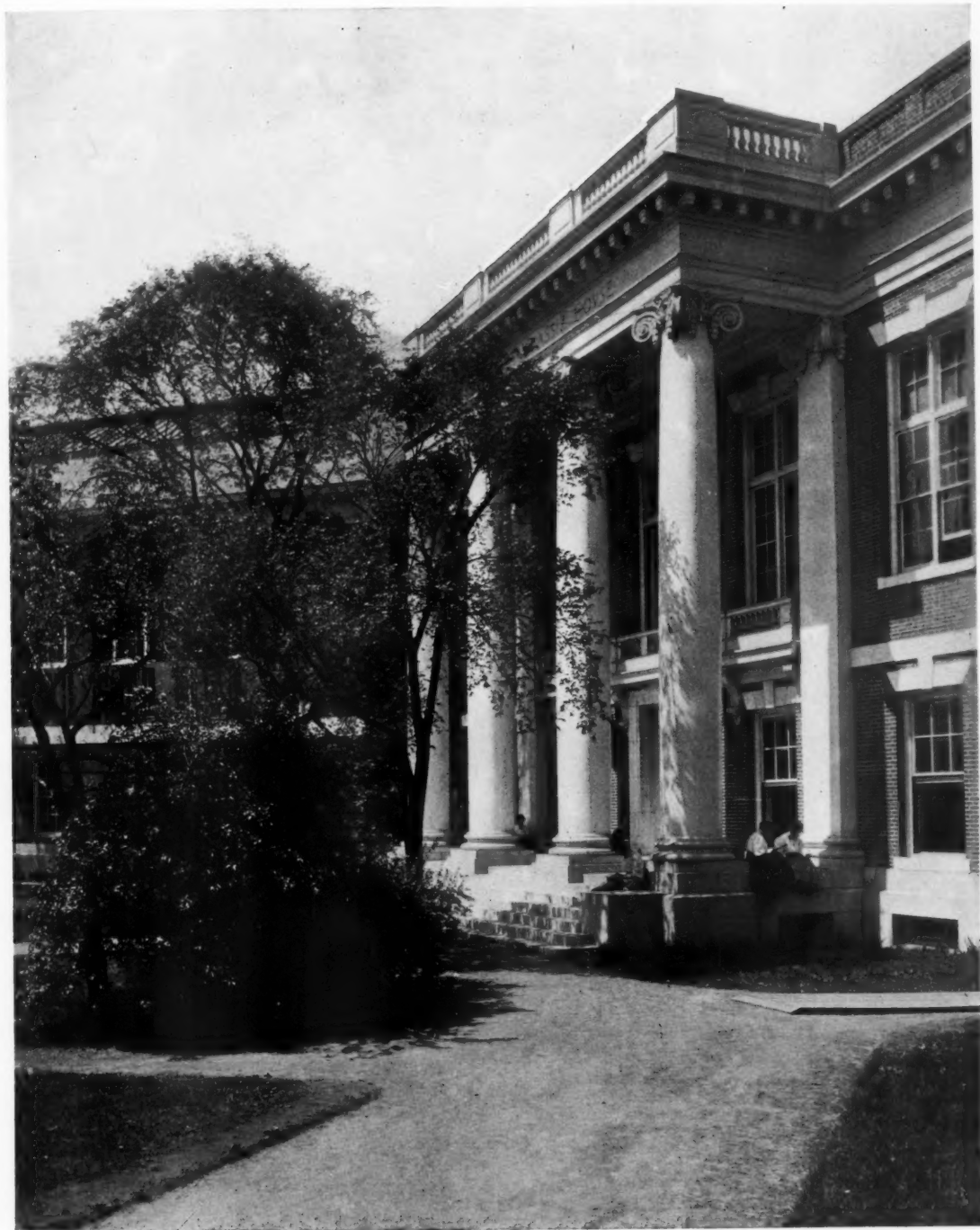


THE TERRACE



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MAIN ENTRANCE

ELIZABETH CARY AGASSIZ HOUSE, RADCLIFFE COLLEGE, CAMBRIDGE, MASS.

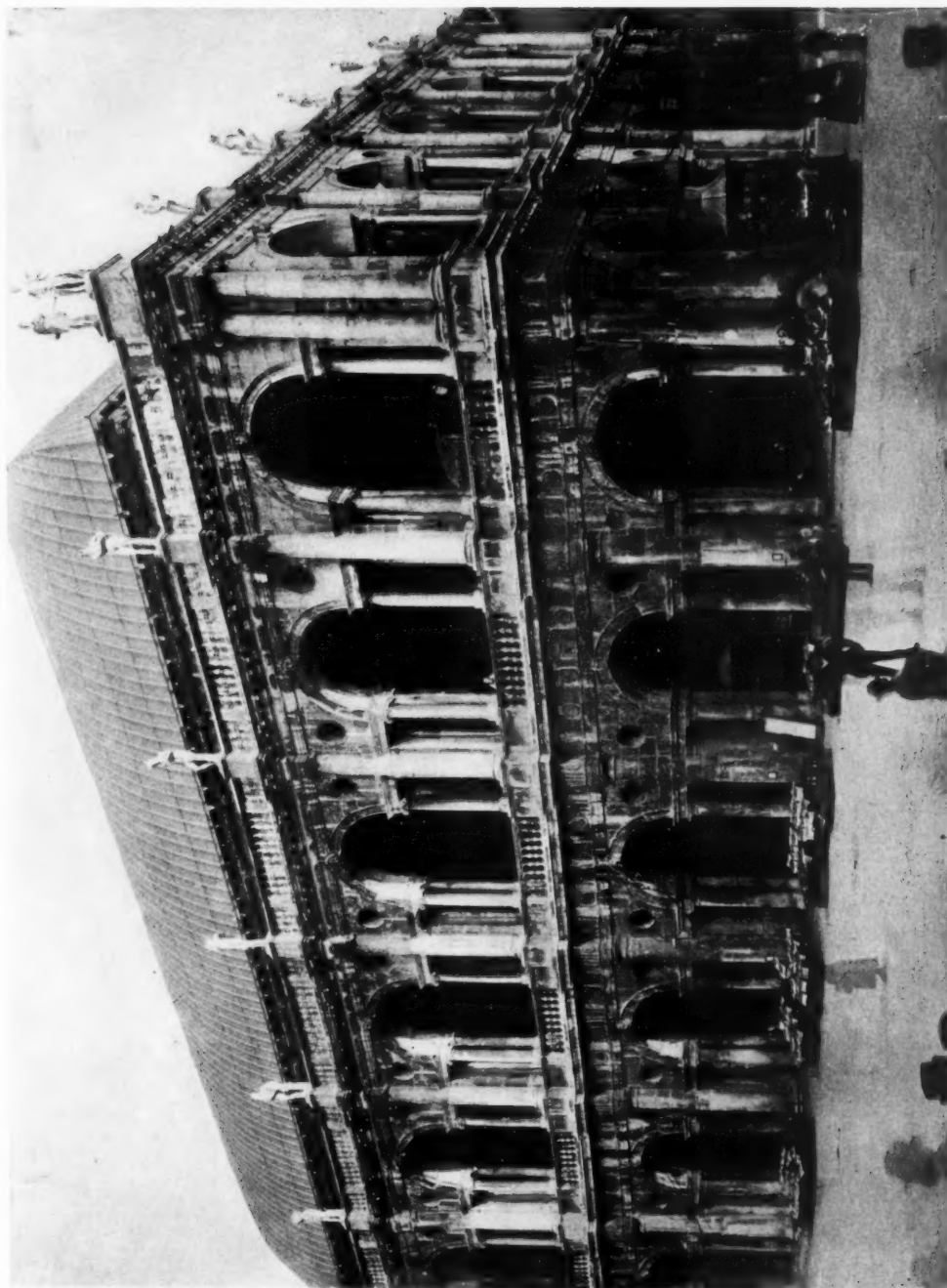
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LIVING ROOM

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THE BASILICA PALLADIANA, VICENZA, ITALY, ANDREA PALLADIO (1518-1580), ARCHITECT
Said to be the greatest work of Palladio and the finest secular building of the whole Renaissance period. The porticos surround an Italian-Gothic Town-hall.