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CONTENTS

EVERY architect, and every one who has the good of his fellow citizens at heart, must mourn the loss of Colonel R. T. Auchmuty, who died at Lenox, in consequence of an amputation made necessary by a painful disease of the leg, from which he had long suffered. Colonel Auchmuty was a grandson of one of the first rectors of Trinity Church in New York, and was throughout his life identified with that church and with the charitable and religious undertakings connected with it. He served in the army during the Civil War, retiring with the rank of colonel. He was educated to the profession of architecture, and was for some time a partner of James Renwick, the architect of Grace Church, but, being possessed of an independent fortune, and finding ways in which he could be of more use to his fellow men than in the practice of his profession, he came of late years to devote himself entirely to his various charitable works, of which the greatest was that of the establishment of the New York Trade Schools. From the time of his first acquaintance, through his professional work, with mechanics of the old and new schools, Colonel Auchmuty had observed the unfavorable effect upon the younger men of the limitation or abandonment of the old apprenticeship system, and the substitution, for the instruction and control of the masters, of the tyranny of trade-unions. In New York, as in other large cities, the unions are almost completely under the control of foreigners, who favor their compatriots, to the exclusion of the native-born, and Colonel Auchmuty found his young fellow-countrymen not only shut out of employment in New York, to make room for foreigners, but prevented from learning a trade which they might practice elsewhere, by the limitation of the number of apprentices in the shops, rigorously enforced by the unions, and the absence of any other provision for training them. Finding that the same difficulty had been met abroad by the establishment of schools, under Government patronage, for teaching the manual arts, Colonel Auchmuty determined to see whether something similar could not be done in this country by private effort, and, securing a small building in New York, he employed instructors and opened a school where young men could be taught carpentry, masonwork and house-painting. The school was not free, a small tuition-fee being charged, and there was every year a deficit to be met, which Colonel Auchmuty and his wife paid. The first year the school was small, but it grew rapidly. Not only was practical workmanship thoroughly taught, but theoretical instruction was given in the properties of materials and elementary statics, and drawing was taught to all the pupils. Very soon, the school increased so much that it was necessary to erect new buildings, which were constructed by the pupils. New courses were added, and the school now has about six hundred pupils, of the best type of American adolescence. It is hardly necessary to say that an institution which taught young men to work and think excited from the first the hatred of the organizations which look upon anarchists as the true labor-reformers, and the walking-delegates tried open violence, as well as their arts of secret terrorism, to destroy the schools. Finding that the schools could not be closed by these means, they closed the shops against the graduates of the schools, ordering every shop "struck" that employed one of them. Colonel Auchmuty met this step by resuming his old profession, and making plans for a considerable number of buildings, which were carried out by the school graduates. After this, the labor organizations, finding that they had aroused a public feeling which it was advisable to allow to subside, ceased active hostility, and the relations between them and the trade schools, though far from cordial, are not now belligerent. On being attacked by the ailment which finally caused his death, Colonel Auchmuty was obliged to leave the work of managing his schools mainly to others, greatly to his regret, but, as he himself said, this has proved a certain advantage, as their continuance is in that way better assured, so far as the system of instruction is concerned, while they were recently firmly established financially, by the generous endowment of half a million dollars, presented them by Mr. J. Pierpont Morgan. Before his death, Colonel Auchmuty, with his wife, added one hundred and sixty thousand dollars to the endowment, this being outside of the seventy thousand dollars which they had already devoted to the schools.

IT will be remembered that, a few years ago, a certain Dr. Cogswell, of San Francisco, we believe, made to the City Government of Boston, as he already had to other municipal bodies, a proposition to erect on the Common, and present to the city, a fountain, consisting of a bronze figure, sheltered under a classical pavilion of granite, and furnished with an appropriate pedestal and inscriptions. No conditions were annexed to the offer, and the gift was accepted, and the fountain and pavilion duly erected on the Common. The site assigned to it was not a happy one, and the structure itself, although tolerably well executed, did not please the educated taste of the citizens, while, the name of the donor being rather conspicuously displayed on it, an idea became current that it was intended as an advertisement of the donor's business. However that may have been, the popular dislike to the affair became so marked that, after four or five years, the City Government appropriated money to have it removed.

THE connection between this story and another which we are about to relate will not at first appear, but a careful comparison of the circumstances will, we think, disclose certain curious coincidences. The second story is this: Some sixty years ago, great preparations were made for the erection of a monument over the grave of Mary Washington, at Fredericksburg, Virginia. The pedestal was in place, and an elaborate work of art was in course of execution, portions of it, indeed, being actually on the ground, when the proceedings came to a sudden halt, and were never resumed. Occasionally, a traveller visited the Fredericksburg cemetery, and was astonished to find the grave of the mother of Washington marked by some dilapidated masonry, and a piece of a monument, lying on the ground, and overgrown with weeds; but nothing was done about it until 1874, when the State Department at Washington sent an engineer to examine the condition of the structure. He reported that it was a hopeless ruin, and of no practical value. The State Department did nothing further, and the matter rested fifteen years longer, until, in 1889, some influential people in Washington proposed the formation of a National Mary Washington Memorial Association, to raise funds for commemorating the mother of the greatest of Americans by something better than an unfinished ruin. The new Association, of which the wife of Chief Justice Waite was, and still is, the President, while many of the highest officials of the Government are members, went to work quietly, but efficiently, and raised in four years something like fifteen thousand dollars. With this sum it was resolved to commence the work, by erecting a granite obelisk, fifty feet

high, on a rather simple pedestal. This could be done for eleven thousand dollars, and it was decided that further subscriptions should be solicited, until the total sum raised should amount to twenty-five thousand dollars, and that the balance remaining, after paying for the monument, should be invested, as a permanent fund, the income of which would provide for the care of the monument and the surrounding ground. About the time of the formation of the National Association, the people of Fredericksburg itself became fired with a sudden zeal, and formed a local Mary Washington Association. It does not appear whether they had raised any separate fund before it became evident that the two bodies could work best in harmony, and the Fredericksburg Association became an auxiliary to the other, each doing its best for the common purpose.

EVERYTHING went on smoothly until very lately, when the design for the obelisk, which had been approved by the National Association, was sent to the Fredericksburg auxiliary. Architects know well that a sketch is apt to act the part of a firebrand in a body previously peaceful, and the present case seems to have followed the general rule. The design was characterized as "cheap and insignificant," while the obelisk on its pedestal was likened to "a lead-pencil stuck in a biscuit," and the Fredericksburg people held a meeting and formally asked for a year's delay, in order that they might increase the fund to one hundred thousand dollars. Pending the collection of this sum, they had a design prepared for the monument on which it was to be expended, consisting of a column supporting a colossal angel, and surrounded by fountains and other ornaments. The National Association consented to wait a year, while the Fredericksburg people were taking in the extra eighty-five thousand dollars, but suggested, very innocently, that, so long as there was an assured prospect of doing something at the end of the year, it might be well to improve the time by clearing away the decayed remnants of the previous abortive attempts at a monument. The authors of this proposition evidently forgot that Virginians depend more upon soaring eloquence than on local applications of such base mechanical tools as lawn-mowers and trowels to impart the proper charm to their decrepit gravestones, but their oversight was immediately corrected by a burst of indignation from the Fredericksburg newspapers. "A thousand historical associations," they were told, "cluster about the base" of the old monument "and swarm around its summit." "It has been baptized amid the fires of war, and has brooded over the death of heroes." "And now," they were told with bitter scorn, "comes an association of ladies, in the name of the women of America, and proposes to tear away the vestige of this classic ruin, and to replace it with a garnished monument, built avowedly more for their own glorification than as a tribute to the memory of her who sleeps beneath it." A critical examination of the metaphors in this fervid passage will show how deep must have been the pain inflicted on the editor of the Fredericksburg paper by the heartless suggestion of the Washington Association, but there is an inconsistency between the complaint of the Fredericksburg meeting that the monument proposed by the National Association was "cheap and insignificant," and the subsequent agony of the local editor over its "garnished" design, that even mental distress does not account for, while the much more "garnished" structure that the Fredericksburg people professed to be raising money for is not mentioned at all. Keeping in mind the various Cogswell fountains, it will be found interesting to hear some more Fredericksburg eloquence. "No stone of this ruin," the editor went on to say, "should be touched. No vandal hand should remove one piece of it. It should stand forever as it is, a memory of her whose virtues it commemorates. Over it should be erected, from the beautiful granite of the hills around it, a temple open on four sides, of simple design and graceful structure." "On its walls should be hung a tablet, reciting that the women of America or of Fredericksburg have in that enclosure enshrined those ruins as they have preserved in their hearts the memory of the virtues of her who sleeps beneath." "The National Mary Washington Association should be notified that these ruins will not be touched, and that if they see fit they can erect their monument for their own glorification elsewhere. Then let the home association accept the offer of the gentleman who proposed to give ten thousand dollars if he be permitted to be the sole contributor. With that fund put up some such structure as we suggest, and cease to vex the ghost of the sainted dead with unseemly controversies over her tomb." We need hardly add that the National Association, dumbfounded at the reception accorded to its proposal, has abandoned the field, and will probably erect its monument near the tomb of Augustine Washington, at Wakefield, where the early married life of Mary Washington was passed, and where her husband and infant daughter are buried, leaving the Fredericksburg people and their benefactor to deal with her actual grave as they like.

PERHAPS some of our readers who know a little of photography may be inclined to amuse their leisure hours by experimenting in color-photography. The most recent process, and one which promises important results, is that first suggested by Professor Lippman, but since greatly improved by others. In this process, unlike the Ives and similar methods, one plate only is used. This is made sensitive to rays of all colors, and the picture is reproduced upon the plate itself in iridescent colors, which, according to Professor Lippman, are due to interferences of the rays reflected from the film, the thickness of texture of which is modified by light of different colors. According to *Le Génie Civil*, the brothers Lumière, of Lyons, manufacturers of a well-known brand of dry-plates, and chemists of great skill, have reduced the new process to definite formulas, by which good results can be obtained with tolerable certainty. As treated by them, the chromatic plates give admirable copies of water-color drawings, as well as beautiful photographs from nature. To produce these pictures, a long exposure is necessary, varying from two to thirty minutes, where a thousandth part of that time would probably be sufficient for an ordinary photograph; but there can be no doubt that further experience will show how the rapidity may be increased.

THE LUMIÈRE BROTHERS prepare their plates in the following manner: Three solutions are made, one containing 20 parts by weight of gelatine in 400 parts water; the second containing 2.3 parts bromide of potassium in 25 parts water, and the third containing 3 parts nitrate of silver in 25 parts water. Distilled water only should be used. The nitrate of silver solution must be mixed with half the gelatine solution, and the other half of the gelatine solution is added to that containing the bromide of potassium. The two portions of liquid are then mixed, in a perfectly dark room, adding a small quantity of erythrosine, cyanine or methyl violet. After thorough mixing, the emulsion thus formed is filtered, and spread upon glass plates. As the precipitated bromide of silver is filtered out, the emulsion, when ready to spread on the plates, will be transparent. The temperature of the emulsion should not exceed 40° Centigrade, or about 100° Fahrenheit. When the emulsion on the plates has stiffened to a jelly, the plates should be dipped for a moment in alcohol, and then washed in a current of cold water. As the coating is very thin, the washing takes very little time, and the plates may then be dried. The plates will keep unchanged for an indefinite period, but, before using, they should be dipped for two minutes in a solution of 1 part nitrate of silver, and 1 part acetic acid, in 200 parts of distilled water, and again dried. This dipping greatly increases the sensitiveness, and the brilliancy of the image, but makes the plates liable to change, so that it is only applied just before use. The plate is exposed in the usual way, but for a long period, and is then developed with pyrogallic acid and ammonia. The proportions of the developer affect greatly the brilliancy of the image. Three stock solutions should be made, one containing one part pyrogallic acid to 100 parts water; the second containing 10 parts bromide of potassium to 100 parts water, and the third consisting of strong ammonia, of density 0.960 at 18° Centigrade. To make the developer, 10 parts of solution 1 must be taken, with 15 parts of solution 2, and 5 parts of the ammonia, and the whole mixed with 70 parts water. An ammoniacal solution of chloride of copper may be used for development, with good results, but the solution is unstable. After development, the plate is fixed by ten or fifteen seconds' immersion in a 5 per cent solution of cyanide of potassium. To obtain the best results, it is advisable to reduce the action of the blue rays of the image by placing, either in front of or behind the lens, a color-screen, consisting of two pieces of plate-glass, cemented at the edges, and containing between them a solution of primulin.

PORTALS.[1]—I.

Fig 1. Church of Chadenac (Charente-Inférieure.)

THE French term *portail* (portal) is applied both to the main façade and to the important entrances of Catholic churches; but we shall confine ourselves in this sketch wholly to the latter use of the word.

It was really the Christian architecture of the Middle Ages that created the finished monumental type of church doors, with special dispositions, complete in themselves apart from the decorative motives around them, and deriving all their magnificence from their bays and embrasures. Down to the reign of Charlemagne, the entrances to religious edifices were scarcely distinguishable from those of civil monuments; they were generally square bays with mouldings, casings and sometimes with pediments. As they were often pierced beneath an arch forming a part of a portico or porch, the arch was gradually incorporated into the disposition of the doorway and at length came to be its chief feature; the casing and its pediment, flattened under the semicircle, became the lintel and the space between this and the arch formed the tympanum. As a survival of the pediment, the top of the lintel was, until the end of the twelfth century, often cut with its upper edge cut to form an obtuse angle [*en dos d'âne*] at the centre.

From the beginning, or rather the middle, of the eleventh century, there was a tendency to deepen the embrasure in order to form a genuine frame to the door. Thereafter, it often happened that when the wall was too thin to give the embrasure the desired amplitude the thickness was so increased as to make a mass of masonry in which the doorway was cut, as it were, in rock itself. In this way as many as four or five concentric covings were obtained, supported on the same number of columns or pilasters. With this increase in depth there was a corresponding increase in breadth, entailing sometimes the division of the bay by a central pier or trumeau, and thus relieving the lintel, in cases where it was not deemed expedient to replace the latter by two secondary arches.

Whether Burgundy was or was not under the dominating influence of Cluny, it seems to have taken the initiative in this development of the portal; and it was probably here that the trumeau originated, which, in its turn, became the point of departure for new decorative motives, at the close of the Romanesque era.

Nothing at any period has surpassed the variety, elegance, grace and wealth of conception and ornamentation displayed in Romanesque church portals. Every school exhausted its entire resources upon them; but there were few local types, so far as the general disposition was concerned. The poorest of all the schools was that of Auvergne; its doorways are of elegant and correct proportions obtained at the expense of impressiveness. In Poitou, Angoumois and Saintonge, the church entrances are sumptuously decorated, but they lose perceptibly in value because the ornamentation is carried over too much on what is around them, and because historic subjects are introduced that should be limited to the tympanum; the latter was even suppressed at that time (Fig. 1); this absence of the tympanum, not arising from the same causes there, was purely accidental in the other schools (Fig. 2). In Burgundy (Fig. 3) on the contrary, all embellishment was confined to the tympanum and the embrasure, the outer archivolt having a slight prominence; this prominence was more pronounced in the Provençal school. Here we have to count with Roman survivals, sharply indicated in the covings by decorative motives borrowed from ancient arches and entablatures, and in the jambs by the use of channelled pilasters, or of columns, channelled, twisted and intertwined or covered with divers patterns. In the Provençal school we sometimes find a rudimentary entablature, as in Roman times, between the columns and arches, and the colonnade is carried along on the flat of the wall without detracting at all from the importance of the embrasure. In Saint Trophime at Arles [See "Religious Architecture," Fig. 13, *American Architect* for July 26, 1890] and in the abbey-church at Saint Gilles [See "*Eglise*," Fig. 32] this disposition was taken advantage of in a marvellous fashion. The trumeau rarely occurs in Norman structures and the lintel is replaced by an arch, the convexity of which gives the tympanum a peculiar shape [See "*Eglise*," Fig. 40.]

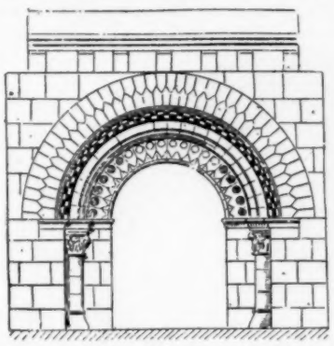


Fig. 2. Doorway at Sérignac (Lot-et-Garonne.)

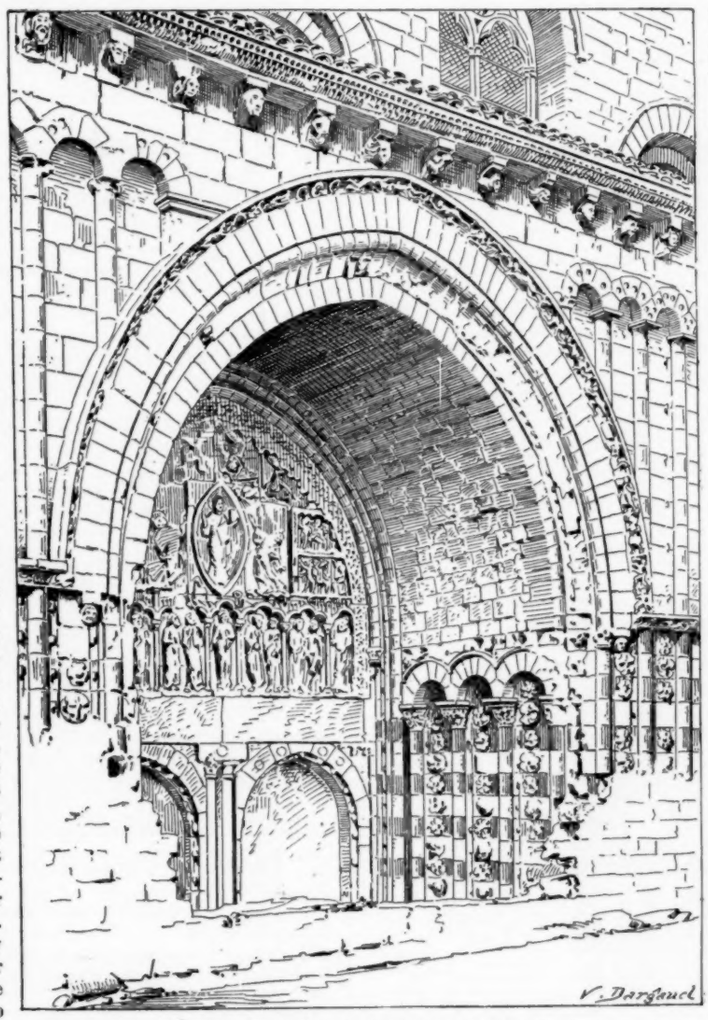


Fig. 4. North Door of the Cathedral of Cahors.

Limousin was the only province that created a type of portals distinctively its own; this has already been described under the heading "*Mixte (Ecole)*." See also the accompanying Figure 4.

The portal, which is necessarily the most conspicuous part of the church and in which everything is arranged for the eye,

[1] From the French of A. Saint-Paul and H. Nodet, in Planat's *Encyclopédie de l'Architectu reet de la Construction.*

was the place especially selected by mediæval artists for depicting the historical or allegorical scenes that seemed best calculated to instruct the faithful or to produce the deepest impression upon their minds. The tympanum was admirably adapted

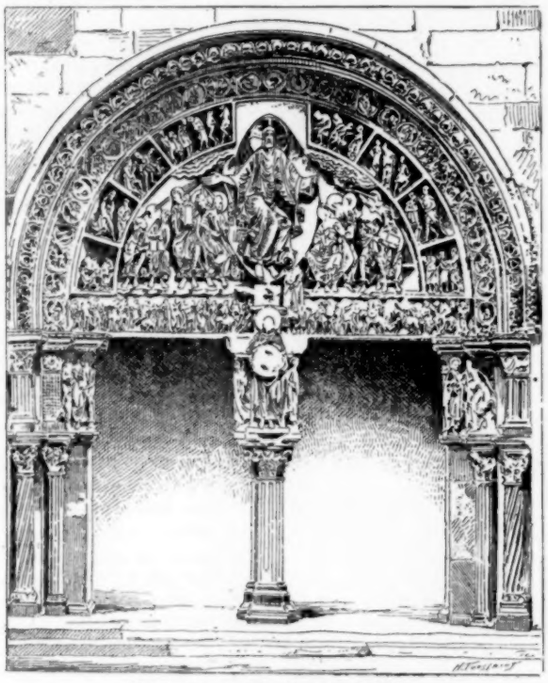


Fig. 3. Portal of the Church of Vézelay.

to the sculptor's needs; here he chose to portray Christ presiding at the "Last Judgment" or enthroned in the midst of the Apostles, or the four and twenty elders of the Apocalypse, or the celestial court. Often he was content with representing Christ and the Tetramorph.

From the second quarter of the twelfth century, there was a tendency in the different figures, whether connected with the central subject or not, to invade the covings and later, under the form of statues, the jambs themselves. The introduction of large statues into the portals seems to have been due to the use of trumeaux; possibly, however, it came about in quite another way; they may have originated in the effigies which, in Auvergne for example, sometimes accompany the jambs without penetrating them; it is nevertheless probable that the trumeau, early carved as a statue, demanded complementary works of the same kind on the sides.

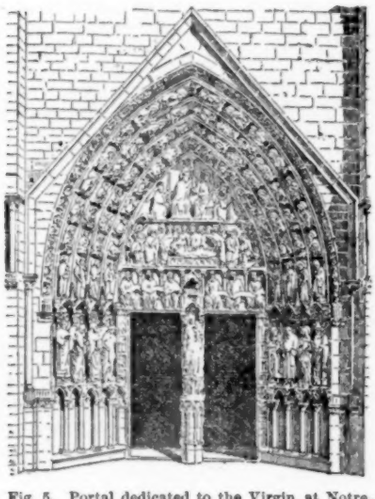


Fig. 5. Portal dedicated to the Virgin, at Notre-Dame, Paris.

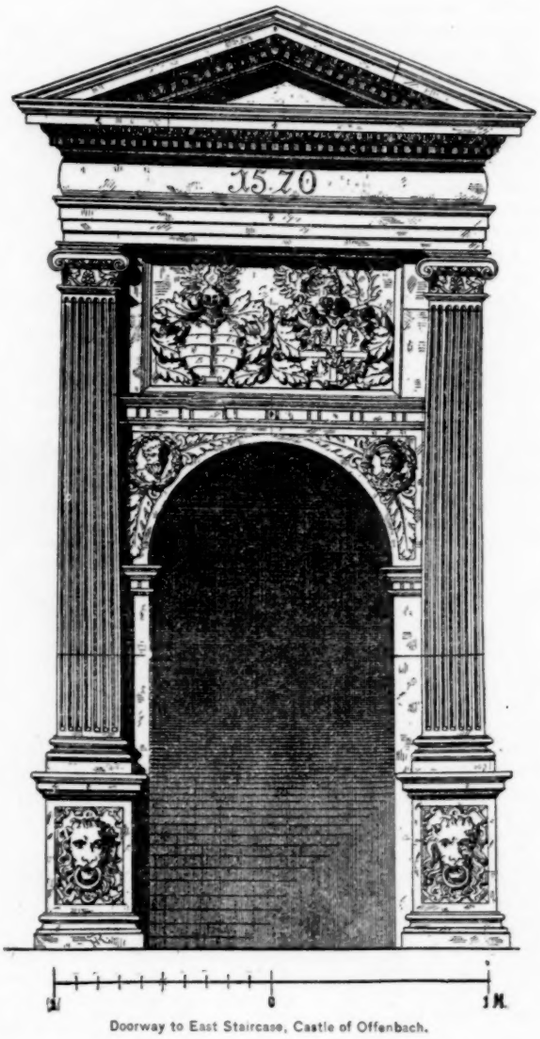
It is not absolutely certain that the complete Romanesque portal, with trumeau, statues and statuettes, preceded and paved the way for the primitive Gothic portal; it is not impossible, on the contrary, that the former borrowed largely from the latter. For the Romanesque portal was maintained during a century — according to the schools — in conjunction with the Gothic. We find the Gothic type constituted as early as 1146 or 1147, on the north transept of the church built at Saint Denis by Suger; but here the statuettes of the archivolts do not yet stand out from the masonry, as we shall see them doing shortly after at Notre Dame de Paris (Fig. 5) and elsewhere. In the Paris church the capital spreads out as a canopy over the heads of the large statues, and this disposition was maintained until toward the middle of the thirteenth century.

The broken arch, already adopted for this reason in a great number of Romanesque portals, furnished a more extended tympanum surface, which sculptors took advantage of and which often even seemed insufficient for their purposes; the space was then enlarged by pointing the arch as much as possible or by stilting it. Carving, on the other hand, had made advances: the details of the "Last Judgment" could be brought out more minutely, and for other subjects the surface could be divided into several pictures. An important addition was made on the extrados toward 1225; we refer to the gable, which gradually assumed its characteristic disposition.

(To be continued.)

MODERN ASYLUMS FOR THE INSANE.[1] — III.

INFIRMARY WARDS.



Doorway to East Staircase, Castle of Offenbach.

THE best general arrangement of an asylum has been found to be one that provides for a central administrative block, containing accommodations for the staff of officers and servants, as well as the kitchens, laundries, general bath-house, store-rooms, etc. The wards for the males and females should be placed respectively to the right and left of the central or administrative block, and the architect in arranging his plan must give due consideration to the desirability of securing a position adjacent to the workshops and laundries for the wards in which those working patients may be lodged, near the scene of their labors, while the non-working portion of this community may be located at a distance from the shops; these

[1] By George H. Bibby, F. R. I. B. A., F. R. Hist. S., and Ernest A. E. Woodrow, A. R. I. B. A. Continued from No. 913, page 198.

remarks refer with equal force to the male and female sides of the asylum and an arrangement on these lines may be seen in the plans produced to illustrate the second chapter of these papers. (See issue for June 24, 1893 of the *American Architect*, page 197).

As we are of the opinion that it would elucidate matters, to treat with detailed portions of the general scheme of an asylum before dealing with it as a whole, we propose proceeding with a description of the arrangements of the various blocks of buildings devoted to the different classifications of patients, who may be treated for relief or cure within the walls of the asylum; by adopting this course we deem it easier to grasp the ideas that must be formulated in order to create a complete scheme for a lunatic asylum. For the present our text must be "Infirmary Wards."

An infirmary ward will contain all kinds of patients, the bedridden, the aged and the young, those suffering from accidents that occur casually within the asylum, such as broken bones (by no means an uncommon incident in large asylums), and those under medical treatment for various ailments, all suffering concurrently from varied forms of insanity. It will be easily perceived, how such a portion of the building should be within easy access to the medical superintendent and his officers, whose attendance may be required at any hour, day or night.

The infirmary blocks should be placed, without doubt, so as to command a good southern aspect, and it may be well on both the male and female sides, to locate these buildings nearer than any others to the central administrative block, conveniently near the medical officers' and attendants' quarters; it should also be borne in mind that "recent cases" also should be placed in a position which is easy of access for the officers of the institution. It is a good principle to adopt that no ward should be designed for a less number of patients, than would, under ordinary circumstances, require the services of more than one attendant; an area of not less than seventy feet superficial should be provided per patient in the dormitories of the infirmary.

The "day-rooms," of which there should be at least one in each ward, should afford not less than forty feet of superficial area for each patient; in making this calculation, corridors which are of a less width than ten feet should not be reckoned, but when corridors are ten feet or more in width they may be looked upon as affording such a relief to the day-rooms, that a superficial area of twenty feet per patient may be deemed sufficient, provided that the corridors and the rooms together afford an area of not less than forty superficial feet per patient; mere passages of communication are not to be considered as corridors. The "day-rooms" should be so arranged as to afford ready access to the grounds, and it is desirable that those apportioned to the aged, sick, infirm and excited patients should be on the ground-floor level.

Bedrooms should be provided for two or more attendants to each ward, unmarried attendants' rooms not being less than of one hundred feet superficial area; such rooms should, wherever practicable, be placed between two dormitories, and have the doors of communication glazed. Where married men and their wives occupy the post of attendants, the rooms must be larger, but we shall have some remarks to make later upon the desirability of providing separate cottages for married attendants.

All infirmary wards should have a kitchen or "ward scullery" fitted with a cooking-stove for warming and preparing food for the invalids, without having to send to the main kitchens of the asylum for the purpose, which in even small asylums would entail a considerable journey and consequent serious loss of time.

Assuming that accommodation in an infirmary block is required for sixty patients, it would be wise to provide for say twelve of them in single sleeping apartments, each about one hundred superficial feet in area; two or three of these should be somewhat larger and fitted with fireplaces, for the benefit of cases suffering from pneumonia or any chest complaints. A padded room is also requisite, and attendants' rooms in proportion of one for every ten patients. There should also be four baths for each of such infirmary blocks, as the patients would in most cases be unable to make use of the general bath-house; in these matters, and the lavatory and water-closet accommodations, an asylum must be treated in a similar manner to an ordinary hospital, but always with special regard of affording sufficient opportunities of supervision, observation and control of the patients on the part of the attendants.

Although we have given twelve as the number of single rooms desirable for sixty patients in the infirmary ward, yet the proportion throughout the entire asylum need not exceed one-fourth of the entire number provided for in the institution. The English Commissioners in Lunacy require that single rooms should be chiefly in the wards appropriated to the excited and sick, and although sixty-three feet superficial is the least space allowable in the wards for chronic and other patients, yet the space for single rooms in the infirmary should be one-third greater. Many are of opinion that the infirmary wards (including the wards for recent cases) should provide for one-fourth of the whole number of patients.

To sum up: the infirmary ward must contain day-room, single rooms, associated dormitories, attendants' rooms, padded-room, bath-room (with movable bath), boot-room (with one or two lavatory basins), coal-cellar, dust-bin, soiled-linen closet, lavatory, urinals, water-closets, store-room, cleaner's cupboard for pails, brooms, etc., kitchen or ward scullery; it must, however, be borne in mind that it is not desirable to provide for each individual block for different classes of patients more than is requisite for the comfort and care of the patients and the necessities and convenience of the special attendants in charge, otherwise there is an unnecessary and continuing expenditure in maintenance and control. All matters that can be made common should be provided for in the central administrative building.

The English Commissioners in Lunacy require that the windows of the day-rooms and corridors should be large and not more than three feet six inches from the floor. In dormitories and single rooms as a general rule, they should be four feet from the floor with wooden sashes, double-hung and made to open easily, so as to allow a free circulation of air, but not so far as to expose the patients to danger; the walls below the sills of the windows in the dormitories may be splayed, but in the day-rooms and corridors they should be recessed to allow of a seat.

If not otherwise protected, the windows in all parts occupied by patients should be "stopped" so as to only permit of their being opened five inches top and bottom; the panes should be of moderate size, so as to be renewed at the least expense when broken. Strong solid shutters should be fitted and hung in the majority of the sleeping (single) rooms, and so constructed as not to admit of being forced open or afford opportunities for the patient committing suicide by hanging themselves therefrom; for that reason when the shutters are open they should fold back into recesses in the wall and be held there by a self-locking spring which would require the attendant's key to release them. In the day-rooms, bay-windows may be introduced with advantage.

The doors of the single rooms should open outwards and should also be so hung as to fall back close against the wall; doors, to the rooms occupied by excitable patients, should be specially strong; and those where epileptic cases are lodged should have an open panel, about four and a half inches wide, in the centre above the middle rail through which the attendant can observe the patient unseen by him.

In every block of buildings (for patients of all classes) there should be very ample conveniences for lavatories in which the inmates can perform their ablutions. In some instances the bath-rooms may be arranged so as to serve for two wards. The water-closets should be in proportion of one for every ten patients, and a separate one for ten attendants, it is a good arrangement to group them in an annex with a lobby of not less than five feet wide, with cross ventilation, separating the water-closets from the ward. The slop-room should contain a sink and space for brushes, and the store-rooms should be fitted up for the storage of clothing, bedding, crockery and other things in use in the wards. The boot-room or bonnet-room should always be placed quite near to the entrance leading to the grounds, that the patients may remove their dirty boots outside before entering the corridors or day-rooms.

A great authority upon asylum sanitary questions has stated that with regard to the position and arrangement of water-closets there must necessarily be a great difference in various asylums, for in some the patients can be trusted to a great extent, while in others they cannot. There is a class of patients known as the "dirty patients," and to provide against their distressing habits the architect must inquire into their peculiarities, unpleasant though the task may be. It has been known that some poor sufferers from mental disease will put their hands into the pan of a water-closet, to collect if possible, the soil or incrustation that may have accumulated there, and even, revolting as the idea is to the sane, try to eat it. Such sad cases must be met by the architect with special provision for their well being. Earth-closets also afford serious trouble with this class of the insane, as they are apt to smear everything with that which they can extract from the closet. In one case closets with ten feet drop and railings round the seats have been tried. It was found that a large consumption of water was requisite in order to cleanse this apparatus.

In illustration of the great care that must be exercised in designing closets we draw the attention to what occured some years ago at Wakefield Gaol in England, where the prisoners were treated on the separate and silent system. There was a serious outbreak of typhoid fever, and Sir Robert Rawlinson was instructed to inspect the building and report upon the case; after a very brief examination he found, on each side of one end of a dividing wall, a pan-closet, each closet being connected with the sewer by the same four-inch drain pipe running straight down the wall into the sewer, which was never cleansed or flushed. The prisoners found out that by lowering the trap or pan, and holding their heads down over the container, they could converse through the closets with one another; while doing so they were, of course, inhaling sewer-gas, and hence the outbreak of typhoid fever. We quote this instance to show, that if criminals in their senses require such close watching, the poor insane inmates of asylums must need most careful protection against the inclinations resulting from their distressing infirmities.

The staircases in all wards should be so arranged that the inmates may not necessarily have to pass through other wards. Access should also be easily obtained to the main corridors and airing-courts by each class of patients without having to pass through portions of the building not set apart for their particular use. There should always be two exits provided for each day-room and dormitory, one at either end.

Staircases which lead from floor to floor should be of ample dimensions, not less than six feet wide with handrails on both sides; they

should be constructed of fireproof materials and be easy for ascent or descent, no winders should be permitted, and the landings should be square on plan; means should be provided for preventing the patients throwing themselves over the balusters, and to this end, it is well to carry up the walls on both sides and the centre wall where necessary.

It is requisite to have all day-rooms and corridors thoroughly warmed by means of either open fireplaces or open-fire stoves: in large rooms two fireplaces should be provided; they are also desirable in the general dormitories, but additional means of warming will be found necessary in the corridors and large rooms, this subject, however, will be dealt with by us in a later article.

As a general rule, corridors or passages should not be wider than necessary to connect the several parts of the building, or the upper stories. Corridors, especially wide corridors, should be particularly avoided, as far as possible, but it has been found, however, of great advantage to have on the ground floor of the male and the female side of the building one good corridor to the south, with large bay-windows, to afford a promenade for the inmates to take exercise in wet weather: a seat in the bay-window is always appreciated by the patients.

With regard to the general height of each story (of which it is well not to have more than two), twelve feet should be the minimum, and there is no necessity to exceed this. The upper floor of an infirmary ward should be utilized for the quieter patients, and it is most advisable in England that a southern aspect should be obtained for some of the dormitories, in order that those who cannot leave their sleeping-apartments may have the benefit of the brightest outlook and each ray of the sun. The dormitories should have windows on both sides, for the sake of cross ventilation, and the cubical contents of those in the infirmary should be greater than for those in any other portion of the asylum for very obvious reasons.

In the foregoing we have endeavored to point out that each ward should be absolutely self-contained and separate, with a full complement of attendants' rooms and conveniences of all kinds; in arranging the attendants' rooms it need hardly be insisted upon that due regard should be observed as to economizing labor and giving every assistance to facilitate supervision of as much of the ward as possible.

Figure 1 shows a ground-plan of an infirmary ward which we have chosen to illustrate certain points which should be avoided. It is undesirable to have the dormitories arranged with more than two rows of beds, and there should be at least one exit at each end of these apartments. The plan is so arranged that none of the single rooms and one of the associated dormitories would be without the benefit of the direct rays of the sun during the greater portion of the day. Two of the attendants' rooms are badly placed, as they do not command a view of two apartments: they are not planned with due regard to economy of labor in supervision.

Fig. 1. Sick and Infirm A.

A. Attendant.
B. Bath-room.
C. Corridor.
D. Day-room.
D I. Dining-room.
D O. Dormitory.
D R. Dressing-room.
L. Lavatory.
P. Porch.
S. Single Room.
S C. Scullery.
S T. Stores.
V. Visitors' Room.

In Figure 2 we illustrate what has been considered a good workable plan for the infirmary block; the rooms are spacious but without waste, they are arranged so that the officers of the asylum can pass through the whole of the rooms without having to retrace their steps, a most important consideration, when it is borne in mind how much ground has to be covered in a day by the officials. There are two exits to each associated dormitory and day-room, and the beds are placed in two rows only; the attendants' rooms are located with a view of facilitating superintendence and supervision of the exits from the wards, the water-closets are in an isolated annex. With regard to the aspect it will be noticed that one of the dormitories has windows facing west, south and east, in this the bedridden and helpless patients would be placed; of the single rooms, two look towards the west, and if it were not for sacrificing light to the day-room and other

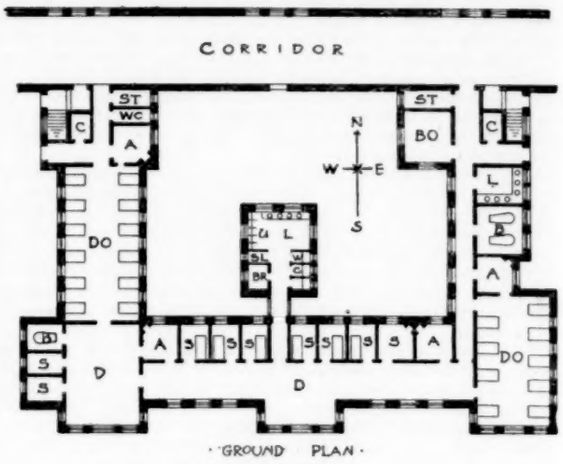


Fig. 2. Sick and Infirm B.

A. Attendant.
B. Bath-room.
B O. Boot-room.
B R. Brushes.
C. Coal.
D. Day-room.
D O. Dormitory.
L. Lavatory.
S. Single Room.
S T. Stores.
U. Urinal.

portions of the ward, it would be better to give a more cheerful aspect for the other single rooms.

Notwithstanding the great progress that has of late years taken place in the perfection of the arrangements for the care of the insane, and the revolution that has come about in opinions and practice of the treatment of mental diseases, there are many people, who, if invited to visit a lunatic asylum, would regard the proposal in somewhat a kindred spirit to that they would entertain in reference to a wild-beast show: they would certainly expect to see something very different from their daily experience of humanity, but would come away not a little surprised at the result of their visit, and wonder where the insane patients were. It is related of Mr. Burke, the great philosopher, orator and statesman, that after going through the wards of a large lunatic asylum, he turned to the gentleman who had conducted him, and remarked that he had not seen one person whom he considered mad. Thereupon his conductor called to him, one of the patients, who had particularly interested Mr. Burke by his ingenious political theories, and by a question touched upon the subject of the poor man's delusions, when the patient began immediately to talk of the porcupine-quills which he imagined to grow from the skin after eating each meal and became so incoherent that Mr. Burke was convinced that madmen were not all like the picture Hogarth drew of them.

We might, to illustrate the great difference in affairs between the time of this great painter, and the present age, here reproduce his famous picture "The Rake in a Mad House." There we should notice a number of "single rooms" with a row of small rooms opening into what appears to be not only a "day-room" for the patients, but a promenade and "show" for the curious sightseer who, it is related, paid the "keeper" for this doubtful privilege. There appears to have been no attempt at classification of the patients, as now practised; the beds are of straw and chains the order of the day, and one need not draw on the imagination to depict the utter foulness of the sanitary arrangements (or lack of arrangements). The prospects in such a room of a patient recovering mental power, or of maintaining a healthful state of body must have been extremely limited. Even at such a recent date as 1831 there were 295 patients admitted to Hanwell Asylum; 210 died that year and on the 31st of December there were 254 still in this asylum, whose record of recoveries for the same year was only 69.

In the same asylum 423 patients were admitted in 1870. The deaths were 182, while the average number accommodated that year was 1776. In 1891 the numbers admitted increased to 481,—177 died during the year. The average number in residence was no less than 1892 patients, of whom 169 recovered and 102 were relieved. In considering these figures it must not be forgotten that many cases are now treated as insane which in years gone by seldom obtained admission to a public asylum. From these figures it will be seen that the structural improvements in the building and the varied treatment of the patients since the year 1831 have not been without good effect.

In the infirmary wards, it is self-evident what are the advantages of a sufficient cubical contents which should always exceed what is provided for rooms occupied by healthier patients. There should be, at least, two cheerful and comfortable day-rooms in each infirmary ward, one of which should be especially arranged as a dining-room, as it is better for the sick or convalescent not to mix with the other patients in the common dining-room.

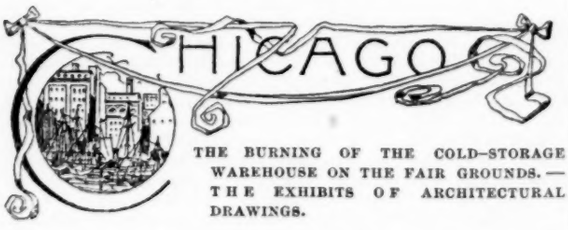
For the insane of "dirty" habits a certain proportion of beds of chaff or cut straw should be in use in each division of the asylum, but these should be strictly limited in number as they tend to encourage the faulty habits and to perpetuate and not to cure the disease. It has been recommended for feeble patients that low padded bedsteads should be used for feeble patients who are compelled to sleep near the floor. These should be made capable of being locked in position and easily removable for cleansing the floor. The whole subject of the treatment of the unclean class is one of the greatest importance, and one in which the experience of the architect can facilitate the management of an asylum in the due execution of the unpleasant duties which devolve upon the attendants of this section of the inmates.

Attached to the infirmary is usually a ward for those newly admitted, with facilities in the arrangements for the study of the respective cases by the medical officers. The bath-room in this department should be fitted with a bath so arranged that the attendant can walk all round, for the convenience of bathing and controlling refractory or weak patients. With regard to the infirmary wards, it is well to let each floor be self-contained, and not be partly in use by occupants of either floor.

A number of infirm patients in every asylum are bedridden and helpless, and their care is always an anxious affair. They suffer from various kinds of brain disease, frequently suicidal in tendency. Pulmonary consumption is very prevalent in this ward, and during the recent waves of influenza both patients and attendants have suffered severely. It must not be forgotten that mechanical restraint is needed in some cases while others demand seclusion and constant watching.

All infectious cases should be isolated in a detached building, which should be erected upon the lines of a fever hospital, with special precautions in view of the mental derangement of the sufferers. This, however, demands an article to itself. We first purpose proceeding with the accommodation necessary for chronic, epileptic, acute and working patients and the administrative arrangements.

[To be continued.]

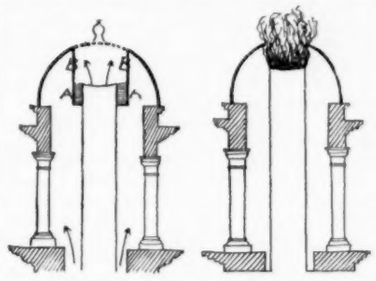


THE BURNING OF THE COLD-STORAGE WAREHOUSE ON THE FAIR GROUNDS. — THE EXHIBITS OF ARCHITECTURAL DRAWINGS.

IT is with regret that we have to begin this week's letter with an account of the disaster at the World's Fair, so harrowing and distressing in its consequences. This catastrophe, as is known, was the burning of the Cold-storage Warehouse, in whose destruction many people lost their lives. The list of mortality lies chiefly among the men in the fire-department, though at present writing it is not known how many of the employés may have failed to escape from the buildings. The Cold-storage Warehouse has been described before in these letters. It was about a hundred and fifty by two hundred feet in area, and had in the centre a tower rising two hundred feet above the ground. The north end of the building was used for cold-storage, while at the south were the ice-freezing tanks and the offices of the company. The building stood in the south-west part of the grounds, on Stony Island Avenue and Sixty-fourth Street, or near it. It was constructed of wood and iron covered over with staff. The Corliss engine operating all the machinery of the place was run by a battery of five boilers. Director Davis is reported as saying concerning the structure: "It was not one of the regular Exposition buildings. We have taken almost every possible measure of precaution against fire in the main buildings. I wish it understood, too, by the public that visitors may see all the exhibits in the buildings without going more than twenty-four feet high. That is the height of the galleries. Some of them are lower. We invite people to see exhibits, and all these may be viewed without risk from fire. If people desire to patronize roof concessions, that it is a matter for them to determine."

Wherever the blame may lie, this much is certain, that the assistant fire-marshal of the grounds, who lost his life in the flames, had condemned the place, as well as Chief Sweenie of the Chicago Fire-department, and at the time of the burning but a trifling insurance was being carried, as underwriters were unwilling to risk anything on the place.

The two-hundred-foot tower, which rose as a picturesque object in the centre of the building, was the death-trap of the brave firemen who were called to the scene when the fire broke out at its summit. This tower was, in reality, the chimney of the establishment. It was not constructed of brick, but simply was an iron smoke-stack encased in wood. This, according to the plans, was not so positive a fire-trap as it sounds. The stack stood in the centre of the high tower of the building, on a brick foundation ten feet in height. It was seven feet in diameter at the bottom and five feet at the top, and was lined with fire-brick about a third of the way up. The stack itself was of strong boiler-iron, and standing, as it did, in the centre of the shaft, which was twelve feet in diameter, it had ample air-space around it, this space being used as a ventilating-shaft from the boiler-rooms beneath. The wooden shaft terminated in a colonnade, while the stack passed through this and terminated just under the dome of the roof. Here, according to the plans, an iron thimble was to have been placed over the stack, six inches larger than the flue, the space between being filled-in with asbestos. The thimble was never put in place. The tower was lined with matched pine flooring, so when the woodwork at the top of the stack caught on fire the brands simply fell inside to the bottom of the tower, the strong upward current of air quickly fanned them into a blaze, and the building was doomed before the men working on the top of the tower realized the danger.



The Chimney as it was designed. A. Asbestos Packing. — The Chimney as it was used. B. Thimble.

The coroner's jury is at present at work on the case, and the papers are full of suggestions for a thorough investigation. First one, then another, is criticised, but it looks now as if the chief blame lies with the owners of the establishment.

One of the chief objects of interest at the Fair to the full-fledged architect, as well as to the architectural draughtsman, are the series of drawings displayed by different nations in the Fine Arts Building. To the draughtsman whose style has not yet been formed, these collections are of the utmost value, and, indeed, to any one it cannot help but be interesting to see how, through the entire work of a nation, certain characteristics prevail. It is to be regretted that not more enthusiasm has been evinced by our own architects to make this display more worthy of them and the splendid work which they have accomplished within the last few years. Russia has no work in this line, Italy's architects are conspicuous by their absence, and Austria is only represented by a small number of drawings. The display from France is very meagre as far as present-day work is concerned, their exhibit consisting chiefly of casts from the Trocadéro. England has not evinced greater enthusiasm than others in this display, while Japan has no plans, only a few elaborate models. Germany outdoes us all in conscientiousness in this exhibit, as she does in many others. She has models, elevations, perspectives, plans, all treated in various methods. America's exhibit is characterized by the greatest artistic skill in the handling of the designs. The three distinct ways in which our architects treat their drawings are here very clearly shown. First, the almost impressionist style, which is charming for office sketches, but hardly accurate enough for actual architectural drawings; second, the careful line-for-line draughting, which admits and permits but little artistic effect; and, third, a happy combination of the two extremes, which results in a most delightful style, accurate enough to convey to the client the entire finished effect of the work, yet a treatment into which some artistic element can be introduced. In the entire exhibit, these special studies of American architects stand out as a class. A fourth style might almost be said to find itself among these works, and that is such drawing as has been influenced indirectly by the French school training, but directly emanates from such schools as the Massachusetts Institute of Technology, Columbia College, etc.

The French work is especially marked by this style. Everything is technical with them, and, though much of it may be well done, is in itself extremely uninteresting. The French complain that to their architectural exhibits the public turns blind eyes, but how anything else could be expected it would be hard to imagine with what is made so extremely technical and uninteresting to the general public. When the question of working-plans is not involved, it seems wiser to produce something that would be of more interest to the professional eye, especially when that eye in the elevations and perspectives is the one to be appealed to. As soon as architecture becomes better appreciated and better understood, just so soon will better times dawn for the members of the profession, and it seems a pity to repulse public interest when it could quite as well be attracted. It is really surprising to see how many people do visit the galleries where the architectural display is chiefly located. At present, public culture in this direction is weak indeed. Before a very large elevation of the Ames Building, two distinct parties remarked within the same five minutes: "Oh, there's the Owens Building," and "There's the Masonic Temple." Both buildings are found in our city, and if anything could be more totally unlike than the two it would be hard to find. Plainly as this bespeaks a lack of intelligent observation, still the growing public interest in architectural subjects is very noticeable. All classes, those who know nothing and those who know a little, talk of the Fair buildings with more enthusiasm than they show for any of the actual exhibits, and there is evidently a tendency among those heretofore

indifferent to the subject to at last come to some realizing sense of the beautiful possibilities of architecture.

Germany's manner of working is curious. Always her drawings are made with scientific accuracy, but there is often combined with this a certain artistic handling of finish and surrounding which lends attractiveness to the whole. Of course, this is a difficult thing to do, and only with the most superior draughtsmanship is satisfactory. With those of less ability the result is devoid of freedom, and becomes neither technical nor artistic. It is a curious fact to notice that the examples of German architectural work are all pretentious or would-be pretentious designs of public or semi-public buildings, with almost no examples of domestic architecture.

The Austrian work, like the Austrian character, is a curious combination of the French and German.

England's work, considering the size of the exhibit, is really the least satisfactory, as a whole, of any found at the Fair. Though there are certain splendid examples of architectural drawing in this department, the general style is neither characterized by clearness, strength nor vigor, but looks now like the result of a hopeless plodding in a well-worn rut.

The United States exhibit, small as it is when compared with what it should be, contains some good specimens of work treated in water-color, pen-and-ink, India-ink and sepia washes, pencil and charcoal designs, and even some in oils. Of these last, the only ones are the preliminary sketches for the figures to adorn the ceiling of the ball-room of the Hotel Waldorf. Though naturally very sketchy, these are really charming. Not far from these colored figures are some clever little travelling-sketches in pencil by Joseph M. Lawlor, which seem almost too good to be actual travelling-work. In the same corner of the gallery Adler & Sullivan have a very good drawing of their Union Trust Building, while very near this, Bertram Goodhue, of the firm of Cram, Wentworth & Goodhue, has three sepia-ink drawings, which are both strong and refined in treatment.

The perspective of the New York State Building is a good deal of a shock, coming, as it does, from the office of men of such good standing. The drawing of the building itself is treated with but little refinement, while the blues and greens of the muddy, careless washes of the background are simply atrocious. Better the purely technical treatment than such work as this. An equally striking "State-building" drawing is that from the "glorious State of California." It is rendered entirely in opaque color, and is huge in proportion. From the gallery, where one would expect it to be fine, it is extremely poor; but get across into the gallery at the opposite side of the building, and it comes out strong and clear. The method of treatment is not advisable to adopt in all places, for there are States too small to be able to give such drawings the necessary distance.

Two houses, which bear the name of Rossiter & Wright, executed on gray charcoal-paper, on which have been laid thin washes of water-color and Chinese white, are especially good in treatment, while somewhat similar in style and equally good in rendering is a study by Walter Kimball on light-colored water-color paper.

One example of good honest treatment where nothing architectural is slighted and a certain amount of artistic handling is introduced is a water-color of a house by Little & O'Connor which bears the number 3,272 in the catalogue. Of the works belonging to the class, where neither technical excellence is sacrificed to artistic effect, nor vice-versa, a frame containing some office sketches of Peabody & Stearns's stands out as a shining example. They are really charming. In this class, another excellent example is the perspective drawing for the Hotel Waldorf. It is to be regretted that at the time of writing this letter the catalogue of the United States architectural department, as well as most for the other exhibits of this kind, is either entirely wanting, or most inadequate. For the superb Trocadéro collection the catalogue is ready, but no numbers are yet on the casts, and what might be a real treat results in only a confused searching among the out-of-way corners of one's memory for certain pictures of this Romanesque portal or that bit of frieze or capital.

Cope & Stewartson are represented by some very clever work, two designs for the Pennsylvania Insurance Company's building being unusually attractive.

Number 3,248 — not found in the catalogue, however, as the numbers only reach the twenty-nine hundreds in the United States portion — is an excellent little architectural sketch in color of the Arch of Titus, while there is charming pen-and-ink work by such well-known men as Gregg, Pennel and Harry Fenn all qualified to give high inspiration.

In our whole collection no plans or working-drawings are given, which seems rather a pity certainly, as owing to our own peculiar methods of construction a few of them would certainly have proved most interesting not only to our own students, but more especially to foreigners.

As said above, Germany, in the matter of enthusiasm and conscientiousness, leads in this exhibit all the other nations here represented. Taking the display as a whole the subjects are certainly not interesting and in the specimens of the buildings given there is a grievous monotony of style, the architecture being chiefly Classic or Mediæval German. The drawings generally are of large public or semi-public buildings, the perspectives for which are usually in black and white. Some water-colors are found here that are almost amusing in handling. The buildings are executed with the greatest care and precision, but nature in the background is indulged in to the largest extent. One curious specimen of a group of buildings for a sanitarium or bath-house, comprises in its background fully forty miles of excellently painted nature in the shape of rolling uplands, surrounding the very diminutive group of buildings.

Skjold Neckelman's University of Strasburg is more worthy of study than many of its companions in the immediate vicinity. Noticeable for excellence of execution is the business house of the Tucherer Brewery at Berlin, of the Opera-house at Frankfort-on-the-Main, a portfolio of miscellaneous drawings of Huber Neustadt, and a most finished piece of work of the German book-binder's house at Leipzig. The drawings for the Cathedral of Strasburg are here displayed, as well as the fine large crayon drawings of Bruno Schmitz, a *projet* for a memorial to Emperor William and some elaborate fountains — Bruno Schmitz, as may not at first be remembered, was the designer of the soldiers' monument at Indianapolis. There are also some fine drawings for the restoration of the Cathedral at Metz, and excellent pen-and-inks of the Cathedral at Altenstein by Professor Neumeister. Nearly every drawing has its place. Their pen-and-ink work as a rule is much less free and artistic than our own, and a different standard of excellence must be held up before their architectural draughtsmen than is given to ours.

There is here in this department a very excellent collection of photographs of a high grade of excellence, and here let it be stated that great as is the loss, no really first-class artistic work has so far been produced by the firm which has the monopoly of the photographs at the World's Fair. It is very much to be regretted that something really beautiful should not be caught of all this transient splendor. The time and place are not at all carefully chosen, so that there is little of the charm of light and shadow which means everything in a photograph. Neither is the grade of the photographs themselves far removed from the commonplace. Some good work might be obtained from amateurs if it were not generally the feeling that it is very difficult to obtain permission to take any camera into the grounds. Two dollars buys the right to photograph within the Fair limits for one day and a dark-room not very far from one of the entrances is furnished through the courtesy of one of the exhibitors of photographers' materials.

But to return to the German exhibit. One interesting feature is the models of which there are several excellent ones. The Imperial-Parliament House at Berlin in plaster is the largest and most noticeable. Near to it is the Gnaden-Kirche in Berlin, reproduced in wood, care being given to the Romanesque details, and the reproduction of stained-glass. The Imperial Patent Office Building, the Imperial Insurance Office Building and the Emperor William's Memorial Chapel are each represented by excellent models.

Our own nation has two models curiously chosen from all our architectural wealth, these being the Manhattan Life Insurance Building and the Vanderbilt house.

The only architectural exhibit which Japan makes is several very elaborate and beautifully executed models. But as they are not catalogued, and as the average student's knowledge of the history of Japanese architecture is somewhat slight, much interest is lost in this excellent work. The Japanese make an interesting showing in some models of their landscape gardening in Horticultural Hall, and these models with some French drawings in the northern gallery of the same buildings seem to constitute the exhibit in this especial department of landscape gardening.

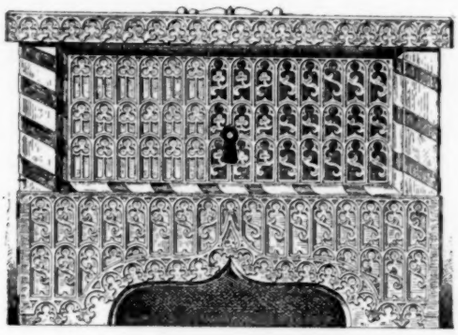
Austria's architectural exhibit is very meagre. She has a few water-colors of old buildings and several pen-and-ink drawings of actual present-day work. It would be hard to judge by these few specimens of the national characteristics, but certainly those shown display the careful school-training of the French, combined with the attempted freedom of treatment in background, etc., of the Germans. One curious set of drawings, quite apart by themselves, of some combination bath and concert-hall, are especially noticeable, inasmuch as their author has seen fit to patent them. After simply inspecting them, without the aid of any catalogue information, they seem no more worthy of being patented than any other set of drawings. Possibly towards the close of the exposition, when some of those things are catalogued, some light may be thrown on much which is at present hard to inspect intelligently.

As mentioned before, judged from our standard, England's exhibit is not as satisfactory as that of some other countries. Thomas Cutler's drawing of the Renaissance gallery at Avery Hill is charming while the proposed English church at Berne by Reginald Blomfield is almost as fine, so far as technical excellence is concerned, as anything in the whole collection. The work numbered 1009 in the catalogue from the office of Aston Webb and E. Ingress Bell, the completion of the South Kensington Museum, is an especially fine pen-and-ink, while Ernest George's exterior of Hall Shiplake on Thames, Basil Champney's "Moxley," R. W. Edis's Constitutional Club and Convalescent's Home are all worthy especial inspection, either from the well-known reputation of the men from whose offices they came or because of their own worth. A number of interior-decoration schemes are shown in this department, indicating that their architects give more thought to such finished work than ours do.

The French architectural exhibition is disappointing so far as the actual drawings are concerned. Aside from the fact that everything is extremely technical, the exhibit is in itself a poor one. Almost no drawings of recent work are given, but the display seems rich in restorations and various School *projets*. There are six or eight large

and fine drawings of the Restoration of the Château d'Écouen, but strange to say these original drawings are not as satisfactory as the reproductions published in the *American Architect*. Another Restoration similar in character is that of the Château de Tonquerer. One of the drawings for the School *projet* whose subject gave rise to so much merriment, an American sixteen-story building whose conditions were apparently that it should be "without form and void," is here as a sort of monstrosity. One small but pleasing feature in the drawing is a noble red-man in the foreground, nearly naked except for a few eagle feathers and similar light ornamentation. Some of the most interesting sketches are those of interior decoration, under which head would naturally come the sketch for the proscenium-arch the Salle de fête at the Trocadéro. The rest of the French exhibit of which it is indeed the chief part is the beautiful collection of casts from the Trocadéro, and which after the close of the Fair are to become the property of the architectural department of the Art Institute.

THE USE OF CONCRETE IN RAILWAY STRUCTURES.



Chest from Schloss Tratzberg. From Paukert's "*Zimmergotik*."

CONCRETE as a material for engineering works has, until within comparatively recent years, been chiefly confined to harbor works; but lately it has been used in the construction of railway works, both at home and abroad. The advantage of employing this material is apparent in districts where the absence of good building stone or clay for the manufacture of bricks makes the cost of masonry or brick structures very great. One of the early applications of concrete for railway works was in connection with the last section of the Callander and Oban line, from Dalmally to Oban, in the west of Scotland. In this case the material was largely used in the form of rubble concrete for bridges, arches, culverts, retaining-walls, platform-walls, turn-table and engine pits. Since the completion of that railway, Mr. John Strain, the engineer, has carried out the same methods of construction on a number of lines in Scotland and also in Spain.

Rubble concrete consists of large stones embedded in a matrix of Portland cement concrete. The Portland cement used in these works was very carefully specified and tested to secure its being of the very best quality. In every case it was required to be stored at the works at least one month before being used, being placed under cover in perfectly dry sheds erected for the purpose. During the fortnight prior to its use it had to be spread out on a wooden floor raised two feet above the ground and turned over every alternate day during the fortnight, or until it was sufficiently cooled and fit for use. The cement had to satisfy the following conditions: The residue on a sieve of 2,500 meshes per square inch was not to exceed 20 per cent; weight per cubic foot to be not less than 90 pounds; test bricks of neat cement, and of cross section 1½ inch square, to stand a tensile strain of 790 pounds when seven days old, during the last six of which they were immersed in water. After the cement was sufficiently turned it was refilled into bags, the contents of each bag bearing a direct ratio to the size of the gauge-boxes used for the ballast. The sand used was always of coarse sharp quality and perfectly clean, being washed in every case where it was necessary to do so. The usual mixture for the concrete on these works was as follows: One part by measure of cement to five parts by measure of clean ballast. The ballast consisted of clean broken stones or slag and coarse-grained sand — the stones or slag were angular and of hard quality, broken to pass through a screen two inches wide in the meshes — the proportion of sand to the stones being determined by experiment from time to time. The whole materials, after being carefully measured, were thoroughly mixed together dry by turning over at least four times, and then further mixed by turning at least four times while a proper quantity of water was added through a rose. The mixing was done on a timber platform in a systematic manner by four men standing in a row, turning over the material by shovels from one to the other.

The method of employing the materials in the construction of what is termed rubble concrete was as follows: A bed of concrete, at least six inches thick, was put in before each course of stones, and on this layer of concrete, rubble stones were laid, care being taken that no two stones were nearer one another than three inches, nor nearer the face boarding of any exposed surface than three inches. The stones were firmly bedded down to make a solid bed, and afterwards carefully rammed and probed all round with a trowel to leave no interstices. All stones were placed irregularly with their diagonals at right angles to the exposed surfaces. Over each layer of rubble stones a further layer of concrete was placed and levelled off at a height of six inches above the top of the stones, and on this again a further course of rubble stones was placed and beaten down as before. All the faces were carefully formed against close horizontal boarding made into frames or boxes the shape of the work, and the concrete against these boards was carefully worked with trowels so as to leave the face quite smooth without any rendering or dressing. At exposed corners wood was placed to form chamfers. This rubble concrete has been largely used for ordinary abutments and wing walls of girder bridges of different spans. It has been extensively used for the intermediate piers of long viaducts and also for arches.

The best examples of its application to piers are to be found in the viaducts over the principal valleys and rivers crossed by the Tharsis and Calañas Railway in Spain. These viaducts were constructed in spans varying from 40 feet to 45 feet, with piers which vary in height up to 80 feet. All the piers were made of standard dimensions at the top — 4 metres by 15 metres — and with the same batter, 1 to 30, to enable the moulds or frames of one pier to be used for all. Piers exceeding 10 metres were at that distance from the top battered out an additional half-metre at each side in a height of half a metre, below which the batter of 1 in 30 was continued. The frames or moulds were simply large boxes without top or bottom. The four sides could easily be taken apart and put together. The depth of the boxes was uniform, and they were numbered consecutively from top downwards. Thus the engineer in charge of the works, knowing the height of his pier, could determine the measurements at base, and knew which size of box to use as a mould. As each box was filled the next one smaller in size was placed in position by a steam derrick crane, and thus the construction of the pier was accomplished. The following Table gives some of the dimensions of the bridges and the time taken in building:

CONCRETE PIERS FOR BRIDGES ON THE THARSIS AND CALANAS RAILWAY.

Name.	Length.	Height of Piers.	Number of Spans.	Quantity of Building.	Time taken to Build.
	yards.	feet.		cubic yards.	weeks.
Tamujoso River	145	28	12	1,737	14½
Oraque	141	31	11	1,590	15
Cascabelero	160	30 to 80	10	2,680	21
No. 16 (Valley)	98	28 " 50	7	1,046	16½
Tiesa	55	16 " 23	8	420	4

It is quite evident from these figures that the question of time is an important element in this form of construction. The construction of some of these bridges in ordinary masonry would probably have taken nearly as many months as the number of weeks occupied. The system adopted also enabled the work to be carried out largely by unskilled labor, with great rapidity and economy. The rock available for rubble stones in these piers was not of such a class as to give great blocks, consequently the proportion of pure concrete to the total mass of rubble concrete was greater than would have been the case had larger blocks been got. The average proportion of pure concrete in the piers was 69.7 per cent, and in one case where the stones were smaller than usual the percentage was as high as 76.5 per cent. In other work the proportion has been as low as about 40 per cent in rubble concrete faced with squared rubble, and about 55 per cent in rubble concrete faced with fine concrete. The average quantities of the various materials required for one cubic yard of building of the average proportions was as follows:

.304 cubic yard of rubble stone (measured as solid).
.684 " " " broken stones (measured in heap after breaking) representing about
.342 cubic yard of solid stone.
.358 " " " sand.
.178 " " " cement (3.9 cwt.)

On the Lanarkshire and Ayrshire Railway this method of construction was very extensively employed. The heaviest bridges in which it was adopted were the bridge carrying the Ardrossan line over the Glasgow and South-Western Railway, near Stevenston, the bridge carrying the Irvine line over the River Garnock, and the bridge carrying the Kilbirnie line over the Glasgow and South-Western Railway at Glengarnock. The first-named is built on a very heavy skew, 28°, and consists of two spans of 34 feet and 107 feet respectively (measured on the angle). The quantity of rubble concrete used was 1,650 cubic yards. It is a through bridge for a double line of railway, the floor consisting of cross-girders and troughing carried by two massive lattice girders. The second-named bridge, that over the River Garnock, consists of two central spans of 51 feet, and two side spans of 26 feet 6 inches, and is built on the square. The pier in the middle of the river was built within a coffer-dam and carried down to a depth of about 10 feet below the river bottom. The quantity of rubble concrete used was 1,400 cubic yards. The superstructure consists of plate-girders, and the bridge is decked with buckle-plates covered with a layer of about four inches of concrete. The ballasting is carried through, but on the bridge it consists of ashes, instead of the broken slag used generally on the whole line.

In the case of the third branch named — that carrying the Kilbirnie branch over the Glasgow and South-Western Railway at Glangarnock — the two abutments were built entirely of rubble concrete, of which about 2,300 cubic yards were used. The superstructure consists of cross-girders and buckle-plates carried on the top booms of two heavy lattice-girders.

In building these bridges the manipulation of the materials was done in steam concrete-mixers, which enabled a rate of building of 25 to 40 cubic yards per day to be attained. The rubble concrete was built within frames of horizontal boarding carried by vertical framing. For the bridges on the Ardrossan and Kilbirnie branches, the materials were the same as described in the case of the Tharsis and Calañas line; but on the Irvine line cement of a finer quality than that already described was used, leaving a residue not exceeding 10 per cent by weight upon a sieve having 5,800 meshes per square inch, and having a tensile strength of not less than 790 pounds upon an area of 2¼ square inches. After the concrete had been well mixed, it was tipped inside the boarding, levelled and well worked at the face. Then large irregular-sized stones up to two tons in weight (as they came from the quarry) were set so as to be three inches from the boarding and from one another, and were then firmly beaten down with malls to make a solid bed. All the spaces round the stones of this course were then packed solid with concrete, which was well worked as before. This course of stone was followed by another course of concrete, six inches thick, followed by another course of stone, and so on. Without counting the men engaged in breaking stones close by, the following were the numbers employed per crane; One crane-man and boy, one mason and ten laborers. In addition to these, about a quarter of the time of a joiner and his laborer was required daily to raise the boarding by a few feet at a time, so as not to cause unnecessary lifting of the stones. For ordinary bridges of about 400 cubic yards, the daily rate of progress was about 12 to 14 yards, whereas for larger bridges the rate was from 20 to 25 cubic yards daily. To maintain the same rate of progress in a rubble bridge of similar size would require about twice as many men, of whom a large proportion would be masons. Ten days usually were allowed to elapse before the boarding was removed. Weeping-holes were formed by inserting 2-inch tile drain-pipes at intervals, and advantage was taken of these pipes to insert bolts during the construction of the walls for tying together the two sides of the frame. As showing the hardness of the rubble concrete it may be mentioned that in the case of one of the bridges on the Irvine line the abutments slipped forward and it became necessary to chip off a few inches of the face and reface them. Each quarryman employed could only on the average remove 5½ cubic feet per day.

The arches over the River Dochart on the Killin Railway in Scotland form an excellent example of the application of concrete construction to this type of bridge. This viaduct consists of five arches of 30 feet span on the square and of 42 feet measured on the skew, the angle of obliquity being 34°. The piers were built in rubble masonry laid in cement mortar, the arches being thrown in concrete. The piers, spandrels, and a part of the arch were first carried up to about five feet above the springing. The arches were then thrown, each in one day. The concrete, which was of the same composition as that already described, was mixed by hand upon a platform about 100 yards from the bridge, and was wheeled along a gangway to a point directly above the arch, where it was tipped over upon the centering. It was then carefully rammed in layers about six inches thick, the surface of the layers being kept perpendicular to the surface of the cleading, the layers themselves being at right angles to the centre line of the bridge, so that each layer corresponded roughly to a course of arch-stones. As the layers approached the crown of the arch they became more and more nearly vertical, so that some difficulty was experienced in keeping the surfaces perpendicular. Each of the arches was thrown in one day, which was an important point in obtaining thorough homogeneity throughout. The Board of Trade inspector, in order to satisfy himself as to the hardness of the concrete, sent men to drill holes through the arch, and found that the depth drilled was only about one-third of that which could be done in the same time through ordinary building stone.

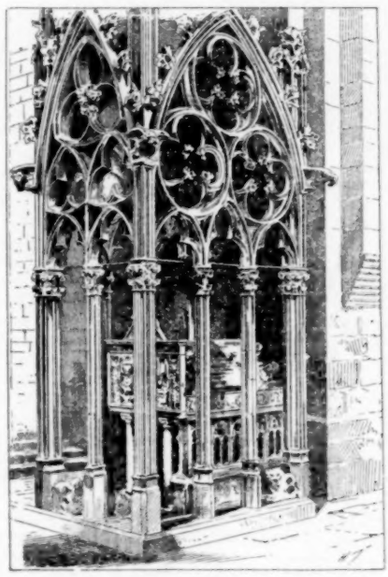
For smaller works, such as culverts, platform-walls, masonry-drains, etc., of which many are required of the same pattern on every contract, concrete is eminently suited, as the same moulds may be used again and again; it was not deemed necessary to use pure concrete for such works, and rubble concrete made with large flat stones radiating from the centre of the arches were employed.

A great economy is also effected in the dimensions of masonry structures when rubble concrete is used, as the volume may be reduced to 70 per cent of that required with ordinary masonry built in lime mortar, while at the same time the concrete gives greater strength. In order to compare the relative costs of material fairly, it is necessary under these circumstances to deduct 25 per cent from the cost of the rubble concrete per yard.

Concrete is also very suitable for the construction of engine and goods sheds and similar buildings in connection with railway works. A good example of its application to such buildings is found in the engine-shed at Ardrossan. The shed is 169 feet 6 inches long and 58 feet 8 inches wide inside, and accommodates twelve engines, there being four lines of rails. The side and end walls are constructed in bays of about 15 feet between vertical rolled columns, and are entirely of concrete made up of one part Portland cement to five parts of ballast. The method adopted was to clead both sides of the space (15 feet) between the columns with horizontal planks, put up one by one as the concrete was brought up, and then to fill-in the space between the planks with concrete, which was carefully worked against the planks on both sides to give a smooth surface. The concrete was brought up in layers of about 18 inches in depth. The walls are 10 inches thick, and flush inside and out with the columns. The rails are laid on longitudinal timbers 15 inches broad by 5 inches thick, and the cleaning-pit runs the whole length of the shed under each line of rails, being 3 feet 8 inches wide and three feet deep, below rail level. All the spaces between the lines of rails were covered with concrete 5 inches thick, draining into the cleaning-pits. There are three hydrants between each pair of lines of rails for supplying water for cleaning purposes. The height of the roof to the underside of the beams is 16 feet above rail level, and smoke traps are formed for each line of rails down to 12 feet 3 inches above rail level. The smoke is carried off by chimneys in each bay of the roof. The shed is entirely lighted from the roof, and is supplied with fittings for lighting with gas. The cost, with an adjoining range of buildings, consisting of offices, foremen's room, store, bothy, smithy and sand-drying kiln, was 2350*l*. There is a fifty-foot turn-table in connection with the shed.

In conclusion we have to acknowledge our indebtedness to Messrs. Strain, Robertson and Thomson, Westminster and Glasgow, for information on this subject. — *Engineering.*

A GERMAN TOWN AT THE MERCY OF AN ARTESIAN WELL.



A Tomb in the Monastery of the Holy Crosses, Taragona, Spain. From *La Construction Moderne.*

THE following tale copied from the New York *Sun* reads not a little like one of those hoaxes which are peculiar to American newspapers, but as it is interesting and not wholly improbable we give it for what it is worth:

The town of Schneidemühl, in the province of Posen, Prussia, recently bored an artesian well, and has suffered extraordinary calamity in consequence. Some experts have long predicted the catastrophe for whole regions of this country. One writer told in alarming detail recently how the whole of this continent east of the Rocky Mountains would surely one day be engulfed and destroyed through just such natural results of unnatural draining of the earth's interior fluids as has brought catastrophe to Schneidemühl. The case of the Prussian town has awakened great interest among scientists all over Europe, many experts have visited the scene and tried to stop the progress of the catastrophe, and public attention in large cities like Berlin, Paris and London has been strongly attracted to the danger the scientists tell of.

Some four months ago the municipal authorities of Schneidemühl, which is a manufacturing town of some ten thousand inhabitants, ordered the abandonment of a town-pump because during the cholera epidemic last summer the water fell under suspicion, and authorized the boring of an artesian well. A spring was struck at a depth of about 150 feet, but the water was impure. The pipes were rammed farther through the hard strata, and at a depth of 200 feet an immense volume of water gushed from the pipe. A big underground reservoir had been tapped, and the water, pressed on by the superincumbent soil, rushed through the artificial vent with such force and in such quantity as temporarily to flood the town, until it could be diverted into the river Kuedow. Then the pipe became clogged, the earth around it became loosened and the water began to ooze out at the sides. The borers were aware of the danger, and several experts were summoned. Larger pipes were ordered to be driven around the first, but by ill luck they did not arrive for a week or more, and by this time the orifice around the pipe had become of considerable width, and the water, bringing up great quantities of sand, seemed, if anything, to flow in increased volume.

On May 26, the pipe was drawn out and attempts to stop up the hole began. In the meantime underground rumblings, subdued grindings and explosions, and all sorts of subterranean noises were heard, and cracks appeared in the houses nearest the well. Bags of

sand were thrown and forced into the hole, and finally sand and stones were dumped in by cartloads, but all to no avail. Experts ordered a casing of brickwork to be made round the hole, to go down as far as the bed of clay. This was attempted, but could not be done. Herr Beyer, an eminent authority from Berlin, started to case in the hole the first week in June, but after a few days the whole casing sank into the hole. The workmen were at tea at the time, or they would have gone into the hole, too. Attempts were made to drive still larger pipes, but they struck stones, and still the water flowed like a big river, bringing up with it great quantities of sand, and even stones.

By this time the flow was so great the artificial channel could not carry it off, and the water began to flood the cellars of the houses. The cracks in the houses had grown steadily wider, until house after house collapsed. The last mail report of the progress of events in the unfortunate town says:

"This morning at three o'clock another three-story house fell in, luckily nobody being hurt. Up to now twenty-three houses have sunk and eighty families have been obliged to leave their dwellings. On Sunday morning the back wing of a large house fell, and the next morning the front. Several streets look as if there had been an earthquake. The roads show everywhere great cracks, and the houses look as if they had been thrown up by volcanic force. The pavement has, here and there, been torn up, and is covered with the débris of the houses. The buildings, in spite of being supported, project threateningly forward or lean on one side. Great cracks run through the gables and down the fronts of the houses, and continue across the streets and yards. From time to time thunderlike rumblings are heard underground. The ground trembles and the windows and door-arches fall in. The houses have sunk three-quarters of a yard."

The *Sun's* cable despatches since then have brought reports that the subsidence continues. The water of a great lake near Neustettin, in the same province, has sunk many feet. Experts from Berlin, Danzig and Königsberg have been at the scene several weeks, but nothing they can do avails to stop the flow of water from the chasm.

Savants say there is nothing remarkable about the occurrence. It is only that the expected has happened. The pipe tapped an immense subterranean reservoir of water. As long as there was no escape for the water it formed an incompressible stratum on which the upper earth rested in safety. It is the simple law of the hydraulic press. The compressed water under Schneidemühl bore up the weight of 200 feet of solid earth so long as there was no outlet for it, but the artesian pipe afforded a vent, and as the water rushed out, the yielding soil it had upborne sank down. Of course, innumerable conditions may contribute to prevent the earth from so subsiding. Strata of firm rock is one obvious condition. Some causes have intervened, for the case of Schneidemühl is the first of which the danger of subsidence, always theoretically recognized, has been realized to any serious extent. What will be the ultimate result at the unfortunate Posen town cannot be in any degree foreseen, because the extent of the underground reservoir or source of the supply of water cannot be known. Already the town is practically destroyed, for while the disastrous results are as yet confined to one area the inhabitants naturally are in a dread of a general collapse, either coming suddenly or by degrees, as the work of destruction has so far taken place.

It will be remembered that a Dakotan town had a few months ago an unpleasant experience of something of this nature. An artesian well was driven, and such a tremendous volume of water struck, that for several weeks the town was flooded and in danger of being actually washed away. But there was no subsidence of the earth, and in time the flow abated or was controlled.

The danger of so prodigally drawing the supplies of gas and oil from the earth has been often described by scientists, and dilated upon by alarmists. The writer mentioned in the beginning of this article adduced several columns of figures and seeming facts to show that the result of emptying the gas and oil reservoirs in Pennsylvania, Ohio and other States in the central oil region, would result in just such catastrophe as has occurred at Schneidemühl, but on an appalling continental scale. Deprived of its support, he argued, the vast area would surely some day collapse, the banks of the great lakes would be broken down, and the waters would rush over the continent to the Gulf of Mexico, engulfing and destroying half America. However, this may or may not be possible; the danger of subsidence from withdrawing subterranean supplies is a real one, and even now great alarm is being evinced in London over the possible, though not probable, result of tapping the water-bearing strata under the British metropolis.

A NEW TEST FOR LUNACY.— A curious case is the contest of the will of A. Gerald Hull, of New York and Saratoga Springs. He was estimated to be worth about $400,000, including a country seat at Saratoga Lake and an interest in the Hotel Brunswick in New York City. The "late diseased," as Sam Weller would put it, was, it, appears, a collector of relics, consisting of old guns, antique pistols, sabres, ancient armor, etc., and from this fact the lawyers for the contestants claim that he was not of sound mind, and consequently unfit to make a will. If this argument holds, what a vast army of lunatics, devoid of testamentary responsibility, there must be in the world, and what a harvest the probating of their wills would provide for the legal fraternity. — *The Collector.*

COMBINATION-HEATING.[1]

Door at Schloss Tratzberg. From Paukert's "*Zimmergotik.*"

IN selecting the matter of combination-heating as the subject of my discourse, I am free to confess that I did so with some misgivings. It is such a common fault, not only among heating engineers, but also among the other learned professions, to condemn that method or system which is foreign in its teachings from that particular system from which they derive their knowledge. Thus, the allopathic doctor condemns every move or treatment of the homœopathic doctor, and the Methodist minister claims that the Baptist minister is all wrong; that their particular plan is the only one that will insure salvation to the world-weary sinner: and yet the objective point with each differing school is the same; each doctor strives to cure his patient and each minister to save the soul intrusted to his teachings. It is only natural, therefore, with these precedents, that heating-engineers should condemn, almost unheard, systems of heating which are outside of their particular line.

You, gentlemen, call yourself master steam and hot-water fitters, and there is hardly a man among you who will not take a contract for either steam or hot-water fitting, and who will not acknowledge that each system has its particular merits, and each in its way is worthy of the careful consideration of any prospective buyer; and yet it is within my short recollection in this business when steam men declared war to the knife against hot-water heating, and the advocates of hot-water were equally strong in their condemnation of steam. To-day there is hardly a man among you who does not and will talk against and condemn from every point the system of furnace heating. It is said that furnaces are dirty, dusty and unhealthy, because they admit smoke and gas into the living-rooms. It is also said that a furnace burns the air, and that one side of a furnace-heated house is always cold, while the other side is too hot. Inasmuch as a combination-heater is a combination of a furnace and a steam or hot-water boiler, it is necessary for me to defend the system of furnace-heating against the calumny of its opponents. Taking the accusations — dirty, dusty and unhealthy — in their order:

SO-CALLED BURNT AIR.

It is a well-known fact that all systems of heating are dirty, and all systems of indirect heating are particularly so. The reason for this, as we all know, lies in the fact that dust is an ever-present quantity in air, although it may be imperceptible to the naked eye. Even in a darkened room, which is hermetically sealed to the influence of the outside air, the presence of dust is made discernible even to the naked eye by the admission of a ray of sunlight. This is the evidence of the unceasing changes which the material world is continually undergoing — the irrefragable proof that the visible matter of the universe is slowly and almost imperceptibly passing through a series of transmutations which affect both organic and inorganic nature.

In all systems of heating, both direct and indirect, where air is brought in contact with heated surfaces, these minute atoms of animal and vegetable matter, which are carried suspended in the air, are charred or burned by contact with the heated surface of the furnace or radiator, as the case may be, and this gives rise very frequently to the opinion (more particularly so in furnace work than in steam or hot-water) that we burn the air. Now, the air itself is not burned, as it is impossible to burn air without combustion.

I remember reading an interesting article several years ago in the

[1] A paper by Mr. George D. Hoffman of Chicago. Read at the Fifth Annual Convention of the Master Steam and Hot-water Fitters Association in Chicago June 7, 1893.

Scientific American, in which an elaborate test was made of this very subject. Air was taken from one receptacle and passed through, between and over wrought-iron plates, which were heated to an intensity of 2000° F., and then passed into another receptacle; and after the air had sufficiently cooled it was subjected to a chemical test and found to contain all the life-giving qualities that it had previous to its passage over these plates.

INDIRECT HEATING SYSTEM.

The theory of furnace, or any other system of indirect heating, is one of displacement — *i. e.*, all the air in a room or building to be heated by this method must be displaced by the warmer air from the furnace, and, as this air cools from contact with the cold walls and other surfaces in the room, it must in its turn be driven from the room by a further introduction of warm air from the furnace. With a sufficient number of open fireplaces, or other means of drawing off the cold air from the rooms, the flow of the air from the furnace or indirect radiator is continuous and natural, and if the supply of air to the furnace or indirect stack is from the outside, there is a continual flow of fresh dust as well as fresh air. As cheap, poorly constructed furnaces are not considered "in it" in this article, and as well-constructed furnaces do not leak gas, smoke or dust from their combustion-chambers, the above argument against the furnace on account of its being dirty is the only one that will stand the search-light of unprejudiced investigation. Very few blessings are unmixed with evil, and in my opinion the blessing of an abundance of fresh air more than offsets the evil of the accompanying dust.

DRY AIR.

The main argument advanced to uphold the statement that the furnace is unhealthy is that it drys the air, thereby inferring that the original moisture contained in the air before its entrance into the heating-chamber of the furnace was lost by contact with the heating-surfaces of the furnace. We also very often hear this same argument advanced against steam-heating, but nothing can be farther from the truth. Air, when saturated with moisture, contains, at 32° F., one-one-hundred-and-sixtieth of its weight in water, at, 59° it contains one-eightieth and at 86° one-fortieth, doubling its capacity for moisture with each increase of 27° F.

We can readily see by the foregoing that instead of losing the moisture, we have simply increased the capacity of the air for moisture with increase of temperature. If allowed to remain in this condition the effect would not only be deleterious to persons occupying the room so heated, but the effects would be disastrous on the furniture and the woodwork of the room. It is a well-known scientific fact that rapid evaporation has a cooling effect, which enables one to withstand a much higher temperature without discomfort than would be possible in an atmosphere heavily charged with moisture. Thus we read every summer of numerous heat prostrations in New York, where the atmosphere is extremely humid with a temperature of not over 90° F., while in the high dry altitudes of some of our Western States a temperature of 100° to 110° in the shade is successfully withstood. In artifical heating a happy medium is the desideratum, and in all well-constructed furnaces ample provisions are made for supplying the extra moisture made necessary by raising the temperature of the air.

As to whether I have in the foregoing made a successful defense of the subject of furnace-heating is a question which you, gentlemen, must decide upon. In any event I shall drop this subject at this point from now on, and simply treat of the main subject of my discourse.

THE COMBINATION SYSTEM.

The word "combination" may be defined as the result of combining or joining together two or more different elements or systems into one harmonious whole. There are several distinct and different systems of heating, and the combination of any two of these systems into one would naturally result in a combination system. The specific form of combination-heating which I wish to treat of is obtained by a combination of steam or hot-water and air, or, as it is commonly called, furnace heat. The advantage of the combination system in buildings suitable to its use are manifold, but in order that these advantages may be made apparent, it may be necessary to diverge a little. Heat is supposed by many to be an actual and discernible substance, and until within a very few years even the more advanced students of natural physics were of the same opinion. Later investigation has shown that heat is nothing more nor less than molecular motion, consisting in case of air of nearly uniform rectilinear motions, with sudden changes in direction and velocity when the molecules come too near one another; in case of a liquid of irregular wandering of its molecules, and in case of a solid of orbital or oscillatory motions. By the foregoing definitions it will be readily seen that air will absorb heat much more rapidly than either liquids or solids, and as in combination-heating we are depending for fully 50 per cent of our heat on air heat, the natural conclusion is that a combination-heater will give results in the rooms to be heated much quicker than either straight steam or straight hot-water.

Heat is communicated from one body to another in three ways, viz: Radiation, convection and conduction. Radiant heat passes from one body to another at a distance through the air in straight lines and with great velocity, but it does not, to any appreciable extent, warm the air through which it passes. Conducted heat passes from one particle of matter to another at insensible distances, as an iron bar with one end in the fire becomes gradually heated at the other end. Convected heat is the movement of the heated body itself from one point to another, as the circulation of hot-air or hot-water. In combination-heating we again have an advantage over straight steam or hot-water, as we utilize in the rooms to be heated two of the three processes of heat distribution — *i. e.*, radiant and convected heat — while in steam or hot-water only the radiant heat is utilized.

VENTILATION.

One of the most important features of combination-heating is the fact that where the air-supply is taken from the outside, as it always should be, it insures a perfect ventilation throughout the building, as well as heat. The necessity for ventilation is very little appreciated by the general public, but as heating and ventilation have always seemed to me to be inseparable, and as the people naturally turn to our profession for their knowledge of these matters, it might be well for me to ask, What is ventilation, and why is it necessary? Ventilation is the act of replacing foul, impure air, in a confined space, with pure air. Please note that word "replacing." Times without number have I had people assure me that they had looked out for the ventilation of their house, as they had fireplaces in all the principal rooms. When asked if they did not know that "Nature abhorred a vacuum," and that their fireplaces would not exhaust unless there was some means provided for replacing the air thus removed, would reply, "They had not thought about that, but guessed there would be enough leaks in the doors and windows, anyway." I could cite any number of leading authorities and read whole chapters showing the necessities of ventilation and the vast consequences of the result of continued breathing of impure air, but a mere statement of the component elements of air will suffice for this article. If we divide air into 10,000 parts, its composition would be as follows: Oxygen, 2,096; nitrogen, 7,900 and carbonic acid 4 parts. When the proportion of carbonic acid in a room is increased from the normal amount of 4 parts in 10,000 to between 6 and 7 in 10,000, a faint, unpleasant odor is usually perceptible to one entering from the fresh air; if the proportion reaches 8 parts the room is said to be close. According to some authorities, a full-grown man at rest will exhale through the pores of the skin and from his lungs nearly three-fourths of a cubic foot of carbonic acid per hour. Taking a room containing 2,500 cubic feet of air in its normal condition, we find that the air contains one cubic foot of carbonic acid. Now, let us suppose this room to be a sleeping-room, not ventilated, occupied by two persons eight hours each night. If the windows and doors of the room were closed during the eight hours, the natural portion of carbonic acid would be increased to about 13 cubic feet (or 1 part to 200), and the occupants would arise in the morning with depressing headache. A person coming into the room from the outside would declare the air to be "foul," and a man does not need to be a crank on ventilation to reach the conclusion that such a situation would be anything but healthful. This condition could be obviated, to a certain extent, by raising the windows, but that practice is dangerous in results, is a prolific source of colds and sickness, and as a means of ventilation totally unreliable, not to mention the morning's discomfort of arising in a cold room. Accurate ventilation will replace the air in a given room every 20 or 30 minutes without draught.

FINAL ADVANTAGES.

I wish to call attention here to the reason why the combination-heater will from natural causes give more perfect and greater results in ventilation than it is possible to obtain from indirect steam or hot-water, more particularly hot-water. The force which we use to crowd the fresh air into the room and drive the foul air out is due to the expansion of the fresh air by heat. Air expands one-four-hundred-and-ninety-first of its bulk for every degree it is heated above 32° F.

Thus it will be seen if we heat the air 50° warmer than the surrounding air we have increased its bulk very nearly one-tenth. The greater the difference in temperature the greater the expansion, and, as a natural consequence, the more rapid the movement of the warmer air. On a moderate winter day the indirect radiator in a hot-water job is rarely heated over 130° to 140° F., and as it is not possible for the air in passing through the stacks to absorb more than from one-half to two-thirds of its heat, the temperature of the air flowing into the room under such conditions will rarely exceed 75° to 80° F. As the force with which the air comes into the room depends upon the difference in temperature of the air in the stack and the air in the room, it will be readily seen that the movement must be very sluggish. With the combination-heater, the air coming in contact with the fire and smoke surfaces only, the temperature is raised much higher, with the result of a rapid flow of a large volume of air into the room in question.

Now, one more point, then I am through. In installing a combination job great care should be taken to place the heater as near the center of the work as possible, locating all air-registers as near the heater as practical, so as to insure short connecting pipes in the basement. Always locate registers away from windows or cold walls, selecting, if possible, the warmest side of the room. Cold and warm air are always antagonistic, and you should give the warm air all the advantage possible if you wish for the best results.

Lastly, the combination system of air and water heating particularly is in the market to stay, and to you who are interested in residence or school heating the subject is worthy of your most careful consideration.

UNITED STATES PITCH-PINE INDUSTRY.

THE British Vice-Consul at Pensacola says that the immense quantities of pitch-pine wood hewn, sawn and manufactured, which have been shipped from the United States — notably to the United Kingdom — for so many years past, and which are still being shipped without any diminution, leave it apparent that information on this subject, generally, and particularly on the probable length of time that these pitch-pine forests will hold out, will be of value and interest to the principal dealers in this great article of trade. The pitch-pine trees of the Southern States are of spontaneous growth, and especially indigenous to those sandy soils near to the water of the Gulf and Atlantic coasts, and, therefore, hardly any attention is given to the culture of these trees. It is believed that the pine wood of the Southern States is coming more and more to the front, and that it is the most valuable wood of the country for mercantile purposes, and that, as the white wood of the Western and Eastern States becomes exhausted, the Southern States will be more relied upon. It is stated by the Forestry Bureau of the Department of Agriculture in the United States that there are about ten species of merchantable pine in the Southern States: the white pine and pitch-pine, the scrub or spruce-pine, the sand-pine, the pond-pine, the cedar-pine, and the long-leaf, short-leaf, loblolly and Cuban pines, which are the principal varieties in general use. There is a great deal of confusion arising from the indiscriminate use of local names for these timbers. Thus the long-leaf pine is called yellow pine, hard-pine, pitch-pine and various other names, but the settled name of this species of wood for commercial purposes at Pensacola is pitch-pine, and this quality of wood forms the largest if not the entire bulk of the shipments of pine wood from Pensacola. The short-leaf is called the old field and spruce-pine, the loblolly fuel-swamp, sap-pine and Virginia pine. The most important of these woods — the long-leaf pine — grows in the Atlantic and Gulf States, at some distance from the coast, covering a belt of about 125 miles in width. Next in importance to the long-leaf pine — pitch-pine — is the short-leaf pine, and this is more widely distributed than any of the other growths of pine. It is the predominating growth in some of the Southern States, and it covers immense areas to the exclusion of almost every other tree. In Florida the short-leaf pine is found along the northern border of the State. In Western Florida, nearer to Pensacola, it approaches the Gulf within twenty-five miles. It is said that the short-leaf pine gives from 3,500 to 4,000 feet, board-measure, per acre. A rough estimate places the possible standing timber of this species, distributed throughout the Southern States, at about 160,000,000,000 feet, board-measure. The loblolly pine is found only in the northern part of Florida, and the Cuban pine is found principally in Florida and along the Gulf coast. It grows mainly on the so-called pine flats or pine meadows. About twelve years ago the official estimates of the merchantable pine timber standing in the Southern States gave a probable quantity of 225,000,000,000 feet. Since that time there has been an enormous quantity of timber cut, but the amount standing now is estimated as follows: Long-leaf and Cuban pine, 232,000,000,000 feet; short-leaf pine, 160,000,000,000, and loblolly pine, 102,000,000,000 feet, making a total of 494,000,000,000 feet, board-measure. The long-leaf pine is known to be superior to all the other species in strength and durability. In tensile strength it is said to approach, and perhaps surpass, cast-iron. In cross-breaking strength it rivals the oak, requiring, it is stated, 10,000 pounds pressure per square inch to break it. In stiffness, it is superior to oak by from 50 to 100 per cent. It is best adapted, and much used, for the construction of heavy work in shipbuilding; the inside and outside planking of vessels taking the deals and planks of the best quality. For house-building it is used almost entirely in the district of Pensacola, and in buildings for railroads, railroad cross-ties, viaducts and trestles, this wood is foremost. The finer grades and the "curly" woods are very much used for the timber-work in the best dwellings. The hardness of this wood especially fits it for planks and flooring. The finer grades of curly-pine are used for the manufacture of furniture, and it is said that for bedsteads it is admirably adapted, as the resinous wood prevents the inroads of insects and similar pests. The resinous products of pine wood supply many parts of the world with pitch, resin and turpentine. And, contrary to opinion formerly held in this respect, it is said that the tapping of the pine tree for turpentine strengthens, instead of weakens, the wood. The Cuban pine is like the long-leaf pine, and is used in trade to a large extent. The short-leaf pine is a softer wood, and is more easily worked. This wood is admirable for house work, and is largely used by builders and cabinet-makers, and for other purposes. The loblolly pine is suited for rougher work than the other two species, but it is not so strong, and it will not last so long as the others. It is stated, in a recent report of the United States Department of Agriculture, that in respect of the pine forests of the Southern States, the supply is good for fifty years to come. — *Journal of the Society of Arts.*

BOOKS AND PAPERS.

MR. BIRKMIRE'S work on Skeleton Construction [1] is so good as far as it goes that one cannot help feeling a regret that it does not go a great deal farther. It is almost the first published work on the subject, and coming from one who is so thoroughly posted and so eminently qualified to make a profitable selection from the quantity of work which has been executed in this line during the past few years, it could reasonably be expected that the scope of the book would be much more extended than it is. In so far as concerns the general theory and to a certain extent the practical application of the skeleton construction to tall buildings, the book is complete, but since the science of building in this manner is still in a tentative state and experiments are being tried with nearly every new building which is erected, it is evident that architectural engineers change their minds frequently upon the subject, and endeavor in each succeeding building to improve upon the past. Therefore, the best way to enunciate the theory apparently would be to illustrate copiously existing examples. This Mr. Birkmire has not done. And, furthermore, had he been more willing to draw from other people's practice instead of limiting the illustrations chiefly to work which has come under his immediate supervision, while possibly the book would not be as coherent in plan, it would be much more valuable to the architects who are seeking for the latest achievements and the best devices in the construction of buildings on the skeleton system. With the exception of two unimportant details from the Fair Building and the Ashland Block in Chicago, the only work illustrated outside of New York is a portion of the wind-bracing of the Venetian Building in Chicago, all of the other examples being confined to New York. Such Chicago buildings as the Masonic Temple, which is remarkable for the manner in which it is braced and strengthened against wind-pressure no less than on account of its enormous height; the German Opera House, which is said to be one of the best pieces of architectural engineering in the country; the Old Colony Building, which is equally valuable; not to mention a score of others in the western metropolis, are entirely ignored by Mr. Birkmire except in so far as he casually mentions that such buildings exist. And although he states very authoratively that, considering the present rapid development of the skeleton construction and the necessity for high buildings, New York City takes its place at the head, not only in the designs but in the details of the construction, it is doubtful if architects elsewhere throughout the country would be inclined to entirely agree with him. The skeleton construction has been not improperly named after the city where it was first used, and whatever may be urged against the artistic qualities of the Chicago work, or however much the system may be abused in Chicago by incompetent constructors, Chicago, nevertheless, more than any other city, presents examples of engineering achievement in the use of skeleton construction which are far ahead, in the aggregate and in detail, of New York. In both practical and theoretical solutions the best of the Chicago buildings are far more successful than the New York ones, in that the former deal with actual loads and actual conditions, and the steel and masonry work is exactly proportioned to the duties to be performed; whereas in New York, partly on account of the provisions of the building-law and partly on account of the so-called conservatism which seems to lag behind the march of Western progress, the buildings are not exact engineering problems, but are rather massive constructions in which the metal is so far in excess of actual requirements that while the architects' commissions and the steel workers' profits may be eminently satisfactory, the buildings are really no better for it, and such over-calculated construction cannot fairly be called scientific. For instance, in the Venetian Building, Chicago, the dead weight of the floors is taken at 100 pounds per square foot, the live load on the first floor at eighty pounds, and the floors above at sixty pounds. The whole of the dead load and about one-half of the live load is carried onto the columns, making the live load per foot on the upper floors borne by the columns equal to thirty pounds. Whereas in the Havemeyer Building in New York the total loads are assumed at 200 pounds per foot, and the construction in each case being practically the same, it follows that one building is calculated for a live load of more than three times what is considered sufficient in the other. Consequently one of the two must be very badly miscalculated. Nor is the difference in principle between New York and Chicago practice confined to floor and column loads. In the Home Life Insurance Building, New York, the walls in the first and second story are made twenty-four inches thick, third to sixth twenty inches, sixth to tenth sixteen inches and above that twelve inches. The function of walls in this construction being simply to protect the steel work, it follows that if a twelve-inch wall is thick enough for the upper stories it ought to be thick enough for the lower, and consequently the masonry is nearly twice as heavy as it ought to be, so involving heavier columns, heavier beams, heavier foundations and larger bills to pay.

However, the unit loads on the floors and the thickness of walls are points which Mr. Birkmire enumerates without criticising one

[1] "*Skeleton Construction in Buildings*," by William H. Birkmire, New York: John Wiley & Sons.

way or another, and certainly, as illustrating New York practice, the book is exceedingly valuable. The Home Life Insurance Building, Havemeyer Building, Jackson Building, the New Netherlands and the Waldorf are fully illustrated, with details of joints, girder-connections, columns and beam-plans, together with very complete abstracts of the iron and steel specifications. The author is so eminently practical that the book is full of suggestions which, independently of the particular theory which might be followed in figuring the building, would apply to such constructions East or West. A few such taken at random will illustrate the useful character of the book. He recommends that angles and plates in columns and girders be whole from end to end and that in determining the sizes of beams for floor construction the proper way is to fix upon the loads which the floor-beams must carry and then determine the spans by the loads which will strain the beams to the allowed fibre strain, so that the whole construction will be loaded and strained equally in all parts. All connections should be riveted at the works or the building with hot wrought-iron or wrought-steel rivets, thus insuring more rigidity against wind-pressure than can be attained with bolt connections, and at the same time largely increasing the efficiency of the beams. All the beams should be rigidly secured, that is to say, each beam should be fastened at both ends by being connected by knees, or so firmly secured that the connection will not be severed if the beam is exposed to the ultimate load. In this case the beam is of the same character as if continuous over several supports or as if consisting of two cantilevers, the space between whose ends are spanned by a separate beam. A beam thus rigidly fixed at both ends and uniformly loaded will sustain a total load one and one-half times that of a beam which is simply supported at each end and secured against deflection sidewise.

Skeleton construction is still too recent an innovation in building practice to consider it as in any way perfect. As a system, many architects are opposed to it. Nevertheless, its use is every year extending, and it is now practically admitted that no other construction can be so economically applied to buildings over seven or eight stories in height. Nor is there, all things considered, any construction which is so rapid in execution and when properly applied so rigid and secure. The East has only just begun to appreciate the possibilities which this construction places within the reach of the architect, and Mr. Birkmire's book is greatly needed at this time. It is to be hoped that he will see fit to supplement it at a later date by a more extended illustration of methods in use elsewhere than in New York.

SOCIETIES

THE ENGINEERING ASSOCIATION OF THE SOUTH.

AT the meeting of the Engineering Association of the South, Nashville, Tenn., July 13, the subject of "Smoke Prevention" was presented by Prof. Olin H. Landreth, of Vanderbilt University. The paper discussed successively the causes, the effects of smoke and the remedies for it. Objectionable smoke comes mostly from bituminous coal, other fuels producing very little smoke. When fresh coal is thrown on incandescent coal, there at once begins the distillation of the more volatile hydro-carbons, which distilled matter is burned if sufficient oxygen is present and the temperature is sufficiently high, but which otherwise passes up the chimney as yellowish fumes. As the fresh coal becomes more highly heated, the less volatile hydro-carbons are distilled, and are decomposed at a temperature much below that necessary for the combustion of the carbon liberated, about 2,000 degrees F., a temperature so high as to give considerable margin of opportunity for this portion of the carbon to escape unburned. It is this free unburned carbon in a finely divided state that, while incandescent, produces the luminous flame and, when cooled, the clouds of smoke that issue from the chimney and afterwards settle as soot. After the volatile matter is driven off, the fixed carbon remains and in burning produces but little flame and no smoke, since the particles of carbon are not detached from the solid mass till combustion takes place. As to the effects of smoke-production, the fuel-loss in the smoke itself is but small — estimated at one-sixth of one per cent: but the causes of smoke are also the causes of imperfect combustion and consequent waste of fuel in the form of invisible gases, carbonic-oxide and light hydro-carbons, and the presence of smoke indicates this parallel waste. Aside from the fuel-waste, the effects of smoke outside the furnace make its abatement of public interest. It is authoritatively stated that the residuum of smoke in the lungs induces consumption of an incurable character; and that, in the city of Pittsburgh, Penn., the death-rate was 1.62 per 1,000 lower during the eight years in which the use of natural-gas almost freed the city from smoke, as compared with the preceding eight years; and that, since the partial return of smoke, the rate has increased 2.57 per 1,000. Carbon in a finely divided state is an easy vehicle both for noxious gases and organic impurities. The insidious soot pervades and defaces public and private buildings and calls for fruitless efforts for cleanliness, when cleanliness is impossible. Smoke is objectionable from the loss of light and increased cost of artificial light; also from the repression of æsthetic tendencies and consequent mental and moral discouragement. Consideration of the causes suggests the agencies and the mechanical devices for the prevention of smoke; these latter, so far as pertains to steam boilers, are classed as mechanical-stokers, air-flues in the walls and grate-bars, coking-arches, dead-plates, down-draught furnaces, steam-jets for injecting air and mixing the gases, baffle-plates and double furnaces. Smoke-prevention must be accomplished by educating the public to consider smoke a nuisance that unquestionably can and should be abated, for the smoke-producers are very slow to be convinced that this abatement is to their interest. Following the influence of public sentiment, laws are to be enacted and provision made for their enforcement and for furnishing to smoke-producers, when desired, professional advice regarding the means and appliances for smoke-prevention. The paper gives the statutes passed in Chicago, Cincinnati, Cleveland, Pittsburgh, New York, Rochester, Boston, Denver, State of Ohio, and City of Birmingham, England, with statements of the success attained in preventing smoke in these localities, success in each case being proportional to the vigor of action taken; it also contains descriptions of various mechanical devices for smoke-consumption and closes with a list of the literature on the subject.

The next meeting of the Association will be held September 14.

WALTER G. KIRKPATRICK, *Secretary.*

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings, plans and a full and adequate description of the buildings, including a statement of cost.*]

DWELLING-HOUSE, CORNER FOLLEN ST. AND CONCORD AVE., CAMBRIDGE, MASS. MESSRS. LONGFELLOW, ALDEN & HARLOW, ARCHITECTS, BOSTON, MASS.

[Heliochrome, issued with the International and Imperial Editions only.]

TRINITY CHURCH (CONGREGATIONAL), EAST ORANGE, NEW JERSEY. MESSRS. STEPHENSON & GREENE, ARCHITECTS, NEW YORK, N. Y.

THE building takes up the whole width of the lot except one foot on one side and a driveway on the other. The cut of the floor-plan shows the general arrangement of the whole building. There are three entrances to the new auditorium, one in the tower, another on the south side, and the principal one on the street under a wide arch and through an open porch with tiled floor. Both the tower and principal entrance lead into a spacious vestibule with six windows on the front, and doors leading into the auditorium and into the reading-room. The pulpit platform is placed on the north side, so that the part of the old building that is retained can be opened into the auditorium with wide sliding-doors fifteen feet high, thereby adding largely to the seating-capacity of the building for special occasions. The treatment adopted was suggested by examples of the round-arched French Gothic. All the new auditorium is built of an unpressed buff brick of an uneven color, with trimmings of terra-cotta a shade lighter than the brick. The roofs are covered with light greenish-gray slate. The tower rises at the southwest corner, where it will give prominence to the building from both directions. It is of brick to the belfry floor and above of terra-cotta. The tower has a low spire surmounted with a wrought-iron cross. The new auditorium is cruciform, the roof-trusses of the nave and transepts coming down on the large clustered piers near the entrances. The roof is open to the ridge, is ceiled up with narrow boarding and is carried by richly worked trusses resting on turned columns, with diagonal trusses where the nave and transepts cross. The new auditorium will seat four hundred and forty-six persons. All the new building will be wainscoted. The pews and interior finish, except roof-trusses, will be of dark oak. The building will be heated with steam, principally by the "indirect" method, and will be ventilated by drawing the air out under the floor and passing it off through the large ventilation-shafts.

REMODELLED CHAPTER-HOUSE OF THE DELTA KAPPA EPSILON SOCIETY, MIDDLETOWN, CONN. MESSRS. BARRETT BROS. & COMSTOCK, ARCHITECTS, HARTFORD, CONN.

THE roof of present building to be removed and attic story of same raised up so as to make another story. New cornice and roof as shown on perspective to take the place of old roof. New cornice, roof and cupola added in place of old one. New rear and front verandas added. The rest of the building on the exterior practically the same as at present. The building is a granite building. Cornice, balustrading, cupola, etc. to be of wood and painted white, and the interior has been quite extensively re-arranged.

A SKETCH FOR EFFECT. COMPOSED BY MR. C. ALOIS HERMAN, ST. LOUIS, MO.

BUSINESS BLOCK FOR MESSRS. HUMPHREYS & HUGHES, AND H. F. RUMP. VAN WERT, O., MESSRS. WING & MAHURIN, ARCHITECTS, FORT WAYNE, IND.

BUILDING is to be built of Indiana Oolitic stone and costing $20,000.

[Additional Illustrations in the International Edition.]

SOUTH-EASTERN HOTEL, DEAL, ENG. MESSRS. JAMES BROOKS & SON, ARCHITECTS.

THE site for this hotel has been chosen so that the building will be detached, and from two of its fronts there is no interruption to a view of the sea. The principal front is approached from a wide street and esplanade extending from Deal Castle to the Pier, about two miles long.

The building consists of basement, ground-floor, first and second floors and attics. Fireproof floors are to be used in three of the stories. The basement contains the kitchens, scullery, pastry-rooms, room for cooking vegetables, pantries, larders, room for uncooked meat, fish, etc., wine and beer cellars, two large boilers for heating and cooking purposes, a billiard-room, card-room, bar, lavatories and water-closets. The ground-floor has a deeply-recessed porch, and a large hall filled with lounges, and which will serve as a smoke-room. A wide corridor extends the entire length of the building. The dining-room is on the right hand, with a canted end, designed to give a view of the shipping in the Downs; in connection with this room is a servery, still-room, and service-room and lifts from the basement. On the left of the entrance is a private dining-room, a large room for the golf club, having a canted end similar to the one in the dining-room, giving a commanding view of the sea and Deal Castle. There is a large billiard-room, a bar, and office, lavatories and water-closets, with a staircase to the bedrooms over. Immediately opposite to the principal entrance is the manager's room, a lift, the principal staircase, and reached from the half landing are a lavatory and water-closets for ladies.

The wing in Ranelagh-road has two private sitting-rooms, stores, linen-room heated with hot-water, a staircase to basement and rooms on the upper floors.

The first floor contains a large drawing-room and balcony, six large private sitting-rooms, and nine large bedrooms, a ladies' bath-room; there are also a bath-room and water-closets for gentlemen. The second floor contains nineteen bedrooms with ladies' water-closets and bath-room, and water-closets and bath-room for gentlemen. The attic floor contains fourteen good bedrooms. The servants' bedrooms are in the wing next Ranelagh-road. Especial attention has been given to the lighting, heating, ventilation and sanitary arrangements. There are linen-rooms on each floor fitted with hot-water pipes for airing the linen. There are also housemaids' closets for each bedroom floor, with hot and cold water laid on. The materials for the facings are red bricks, with Ancaster stone freely used for dressings, etc.

The South-Eastern Railway has given the scheme its active support. Three of the Directors and Sir Myles Fenton, the General Manager, are upon the Directorate.

The drawing was exhibited at the Royal Academy, and this plate is copied from the *Builder*.

NEW PUBLIC OFFICES, DALHOUSIE SQUARE, CALCUTTA, INDIA. MR. W. BANKS GWYTHER, ARCHITECT.

THIS fresh addition to the architectural attractions of the City of Palaces occupies a prominent position at the northwest corner of Dalhousie Square, alongside the Post-office with its prominent dome and massive colonnade. This square is now nearly surrounded by imposing structures and is rightly acknowledged to contain the finest group of modern architectural buildings in the East.

The New Public Offices were designed to accommodate the departments under the Commissioner of the Presidency, the Collector of Calcutta and the Collector of Income Tax. The plan of the building is rectangular with a court-yard in the centre, the front portion overlooking the road, and which forms the subject of our illustration, being three-storied with a Mansard roof over it, the two sides or wings being partly two-storied and partly single-storied, and the back or end block entirely single-storied. The Collector of Calcutta who has large dealings with the public has his offices to the left of the main entrance taking in the ground-floor up to and including the whole of the back or end block, also the left portion of the first floor. The Collector of Income Tax occupies the ground-floor on the right side as well as the corresponding portion of the first floor. And the Presidency Commissioner is accommodated in the main portion of the first floor and also occupies the whole of the second floor.

The rooms to which the public have access are all on the ground-floor and are very conveniently grouped round the central court or quadrangle; the internal arrangements in regard to ventilation, lighting and counters, etc., for the transaction of business have been well devised. These offices are worth a visit both on account of their architectural as well as their practical excellence.

The design externally is a study in red brick with light red terra-cotta dressings and is, we consider, a happier scheme than the alternative terra-cotta treatment in buff color of which there are several examples in Calcutta. The façade consists, as our illustration shows, of a central feature of which the large entrance archway is the key: the coupled Doric columns flanking it, lead up to the entablature which runs along the level of the first floor and forms an appropriate band crowning the *rusticated* basement or ground floor. The end towers supply another feature in the façade and give a key to the rest of the treatment. The massive but well-proportioned main cornice makes a most suitable finish to the three stories which are comprised in the building and the Mansard roof impresses a character on the whole, the elevation as seen from any position in Dalhousie Square being effective and harmonious, neither dwarfed by, nor itself overpowering, the adjacent buildings.

The designs were prepared in the Public Works' Department. The plate is copied from *Indian Engineering*.

NEW RAILWAY STATION, HALLE, GERMANY.

THIS plate is copied from *Zeitschrift für Bauwesen*.

SECTION OF THE SAME STATION.

HOUSE AT COLOGNE, GERMANY.

THIS plate is copied from *Architecktonische Rundschau*.

CHÂTEAU DE MARTIN-WAST, NEAR CHERBOURG, FRANCE.

THIS plate is copied from *La Semaine des Constructeurs*.

SKETCHES MADE AT VICTORIA HOUSE, WORLD'S FAIR GROUNDS, CHICAGO, ILL. MR. R. W. EDIS, ARCHITECT.

THIS plate is copied from the *British Architect*.

NEW RESIDENCE, WOKINGHAM, ENG. MR. GEORGE W. WEBB, F. R. I. B. A., READING, ENG.

THE residence which forms one of our illustrations to-day is in course of erection for Mr. H. B. Blandy, on an elevated site near Wokingham, Berks. The facing bricks are of a deep-red tint, specially selected from Messrs. Lawrence & Son's kiln at Bracknell, with ornamental tile-hanging and moulded-brick cornices, etc., to first floor, and half-timber oak-work in gables filled-in with thin bricks laid to pattern. Dark tiles are used for roofing.

SHOP AND DWELLING, TOTTENHAM-COURT ROAD, LONDON, ENG. MR. FREDERICK WALLEN, ARCHITECT, LONDON, ENG.

THIS house has been erected for Mr. James Elmy, china and glass merchant, at the corner of University Street. The materials of the front are red brick and Doulting stone. The site is about 48′ x 19′ 3″, the basement used for warehousing extending 12′ in addition to these dimensions. The contract for the building was 2,300*l.*, and for the vaults under street 515*l.*, and the total cost is about 3,000*l.*

RESIDENCE, LICHFIELD ROAD, ERDINGTON, ENG. MESSRS. ESSEX, NICOL & GOODMAN, ARCHITECTS, LONDON, ENG.

THIS residence is now being erected for Dr. Aspinall by Messrs. Bishop & Charles, builders, of King's Heath, near Birmingham. The elevations are being carried out with light-colored red bricks and red Hollington stone dressings; the ornamental brickwork and quoins are of cherry red Bracknell rubber bricks, and the roofs are covered with brown brindled tiles.

AUGSBURG.

CORRECTION.

"THE Memorial Arch" published in our last issue as erected at Norfolk, Virginia, was designed by the architects, Messrs. Carpenter & Peebles of that city, for erection at the University of Virginia, near Charlottesville. The inscription being "To the Memory of Her Sons Who Died in Battle." We regret that a mishap in printing, which escaped notice at the time, deprived one of the authors of this design of a large and important portion of his name.

RESULT OF THE SPITZER SALE.—The auction of the Spitzer Collection has ended, and the amount received has amounted to 9,107,931 francs, or about 365,000*l.* The experts who calculated the value of the collection at 400,000*l.* were not far out, for in such cases it is impossible to foresee what may happen, and the biddings for many objects are likely to exceed the market value. It denotes the power which antiquity still possesses when we find collectors from many parts of the world struggling for two months in the hope that they may carry off treasures. It is generally understood that an Australian, Mr. George Salting, has been the hero of the auction, for his captures have excited the envy of all rivals. Thanks to him, it may be calculated that Great Britain secured a third part of the objects, France another third, and Germany, Austria and Belgium the remainder. The collection of arms has yet to find its way under the hammer, when probably three millions of francs will be obtained by the representatives of M. Spitzer. The proceeds of the sale are sufficient to prove that there is little difficulty in finding enormous sums to gratify the passion for acquiring bric-à-brac. *The Architect.*

COMMUNICATIONS

[*The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.*]

A QUESTION OF COMMISSION.

ALTOONA, PA., July 13, 1893.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you kindly answer through the *American Architect* the following questions? A firm of architects agreed to draw all plans and superintend the construction of a certain public building. The contractor claimed the work was completed but the architects refused to accept it, but consented that the viewers should be appointed by the court and if they were satisfied they (the architects) would enter no further objections. The viewers were accordingly appointed and sustained the decision of the architects. The commissioners then formally instructed the architects to enter upon and take possession of the work; hire men and purchase material and to complete the building according to the terms of the specifications. After several times refusing they did as requested and had the work done to the satisfaction of the viewers. The trouble and worry and enmity (of the parties interested) was of far more consequence than the actual work involved on the part of the architects. Now will you kindly say what you consider a fair and reasonable charge for the extra work caused by acting as the commissioners' agents. Two per cent is in the opinion of the said architects a very reasonable amount. Yours truly, ARCHITECTS.

[Two per cent seems to us a very moderate charge for the extra work involved in this transaction. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

GLASS-LINED BEARINGS AND GLASS-LINED PIPES. — Although American plumbers and steam-fitters make great game of the English practise of putting pipe together with flanges, there are certain advantages in the method which cannot be overlooked, and which are strongly brought out in a set of circulars which are before us in regard to Ryland's Glass-lined Tubing and Block Bearings. The glass bearings in general seem to take the place of brass, being very much the same shape as the brass, except that those illustrated in the circular are square outside and are divided into four pieces, a construction which is doubtless necessary on account of the nature of the glass. The glass used for these bearings, being of a very strong and durable nature, has been applied not only to the lining of bearings but the lining of pipes. Some years ago a device of this kind was introduced into America, but it failed on account of our general system of piping. Instead of having pipes cut to definite lengths and coming together with butt joints, our American method is to screw them into fittings an indefinite distance, leaving a space between the ends of adjoining pipes, or, in the case of elbows, leaving an ill-defined space in the fitting between the end of the pipe and the body. With the flange-system of fitting the pipe the glass lining can be made of a definite length, and when brought together a firm square joint is made, and the glass can be left with surface to surface without exposing the iron. In this country it was found that it was impossible to cut the pipe outside the factory without shattering the lining, and when once it was cracked, broken or chipped, the rusting of the iron would take place, becoming so severe that the pipe was worse than useless. Tin-lined iron pipes suffered from the same objections, and a complete set of washers for the protection of fittings and joints had to be made from tin in order to cover this objection. When Robert Briggs designed the American pipe-thread he produced one of the neatest mechanical and practical results that had ever been seen in this particular line. Unfortunately, although thanks to his ingenuity and foresight pipe-threads will match all over the country, yet the extreme accuracy which was necessary for perfect workmanship with his system has brought about a series of difficulties in the way of securing fittings which make it out of the question to do a perfect grade of work. At least it is not possible in the general and commercial work to cut pipe for a job in the shop and put them together outside. All these glass fittings, even where screw connections are made, are arranged so that the pipe, the glass, the cement, by which the pipe is held, and the iron come together surface to surface, and are not dependent upon the length of the threaded portion forced into the fitting. Practically the glass-lined screw fittings are arranged on the principle of a union coupling. This slight modification of the system of putting together overcomes almost entirely the objections to the use of glass-lined pipes. Aside from giving a perfectly pure and clear pipe, the friction required to pump through such a pipe is estimated by the best engineers to be at least 25 per cent less than that needed with ordinary piping. It is found that, with ordinary rough work, that amount of extra friction is produced by the roughness caused by the ends of the pipe not touching and by imperfect fittings. These pipes are made of wrought-iron, with socket couplings, in 6-foot lengths, in sizes from ¼ to 3 inches in diameter. The union couplings are made from ½ to 4 inches in diameter, and cast-iron, in 6-foot lengths, from 1 to 4 inches. All these different styles can be had in 9 12 or 18 inch lengths, with elbows, tees, equals or reducers of any required diameter. In fact, a whole pipe-system is available with the glass lining. Where flanged joints are used of cast-iron they are faced, and in this way perfectly graded lengths are available. They are used for chemical purposes where water entirely free from lead is desired, in breweries for corrosive liquors, for handling fluids which are to be used medicinally, etc., and for conduits for electric-light couplings. Their advantages are such as to call for close consideration from manufacturers in this country. — *Metal.*

LARGE CONCRETE PIERS. — In building the piers of a bridge across the Red river, the Chicago, Rock Island and Pacific Railway resorted to the expedient of making monolithic piers of concrete in the absence of stone of the proper kind. These piers were made by first sinking at the site of each a caisson or box of wood 32 by 13 feet in size through the sandy bottom to rock, which was easily done by weighting the caisson and then pumping out the sand and gravel previously loosened by means of a jet of water. These caissons were then filled with concrete made of one part of Louisville cement, two parts of sand and four parts of stone broken to pass through a ring two and one-half inches in diameter. After the caisson was filled a mould of 2-inch plank was made of the form of the pier. At the bottom it was 29 feet 10 inches long and 11¼ feet wide; at the top it was 8 feet 2 inches wide and 26 feet 8 inches long, with semi-circular ends. Inside these moulds concrete was placed composed of 400 pounds of German Portland cement, 10 cubic feet of sand and 1 cubic foot of broken stone, which was allowed to harden thoroughly. The plank mould was then removed and the surface covered with a mortar of equal parts of Portland cement and sharp sand. The river could be forded nearly all the time the work was in progress and was sometimes almost dry, although occasionally the water would rise to a depth of twenty feet, and the bottom lands in the neighborhood would be flooded for a distance of two miles. — *Providence Journal.*

TRADE SURVEYED

IT is remarkable how well the industries are passing through the present depression. The reason, of course, is that the country is earning enough to supply its wants. The scarcity of the medium of exchange can only temporarily embarrass exchanges. Business men are most anxious to know how long the depression is to last, but it is impossible to say. It has been stated heretofore that mere legislative remedies will not avail; that we are passing through a transition, developing out of one condition into another. New rules and new measurements must be adopted. The average law-maker does not see this; he is content to juggle with the old tools, and rely upon the same class of measures and remedies to solve the difficulties which now beset us; but intelligence only can bring relief. It would not be safe, even now, to present the bald facts of the problem confronting us to the people at large; it is a question of education and patience. Prejudice and opposing opinions obstruct action, and make it dangerous, if not impossible, to apply ultimate remedies. No political party sees the issue as it is, and political leaders, if they do see it, dare not say so. The business men of the country are weary of uncertainty, and fear even worse conditions. They are both right and wrong. Necessity will force the adoption of right measures at last. So far, the volume of indebtedness in business circles has declined. This is an encouraging feature. In this respect, the present depression is different from all that preceded it. Production has been wisely restricted to market requirements. This is another important matter. In previous depressions, accumulated stock has caused bankruptcy; now work is stopped when orders are filled. Prices decline to almost cost limit, but do not run below. The reason for this is that production was never so well controlled; its organization in this country is far better than abroad. The cost of transportation has also declined during the year, and, if railway authorities are to be trusted, a further decline is probable on all kinds of freight. Within the past month, a decline in cost of several kinds of raw material has taken place, and buyers believe that this decline has not yet reached its limit. Finished products are low in price, but stationary. In a general way, it can be said with safety that there will be very little fluctuation in prices between now and spring. Whatever fluctuations do take place will probably be in a few kinds of raw material — possibly in those which an early revision of the tariff will cheapen. The industrial situation is better than it appears to be on the surface. In the first place, production has been restricted, and there are very light stocks on hand. Retailers and consumers are buying from hand-to-mouth. Capital has been restrained in enterprise, and this holding off — this checking process — has done a great deal of good. Merchants are looking forward to September for a revival of trade, but they are anticipating a little too much and too soon. The revival will come, but later and slowly. The failures show that only weak traders and producers are being driven out of the way. This clearing-out will result in great advantage to the older and stronger concerns. By next spring our industries will be in better condition; competition will be reduced, and margins will, of necessity, widen. Going into details, we find a further reduction in iron and steel making. The steel-makers have made the mistake of supplying double the necessary capacity; the textile manufacturers have been wiser. The capacity for manufacturing building-material is very little beyond actual wants; in fact, a little improvement in building activity would soon call the whole capacity into play. Throughout the South a good feeling prevails, because of the increasing markets for the staple products of the section. Their cotton goods are wanted to the extent of the present production, and new mills are projected. The decentralization of industries in the South is remarkable, and the results encouraging. Capital is finding employment in small shops, in mines of limited capacity, and in a multitude of directions individuals with small means are finding opportunities for earning a competence. Throughout the West a depression exists, largely due to the sudden suspension in mining. Large numbers of men are idle, and the disemployment is likely to continue indefinitely. Better conditions prevail throughout the Lake region and the far Northwest. A restriction of twenty-five per cent in crops is estimated, but this deficit will be partially counterbalanced, at least, by higher prices.

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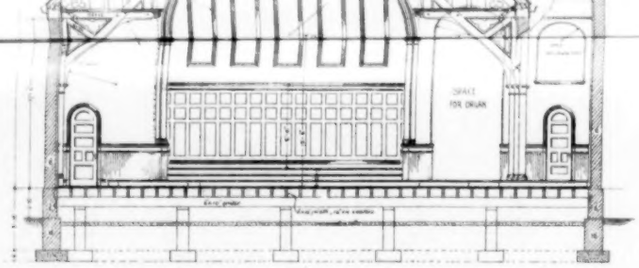

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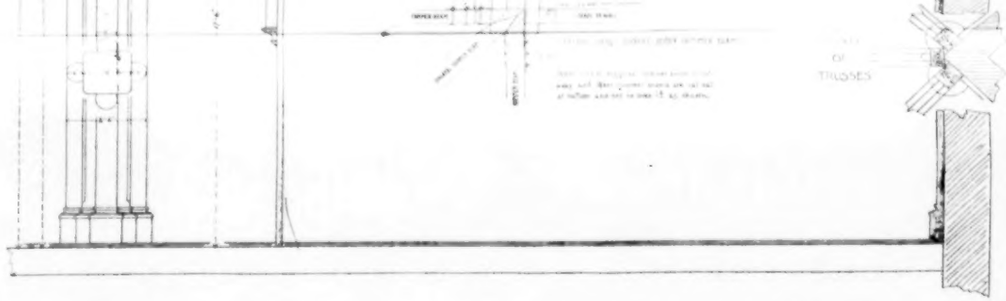

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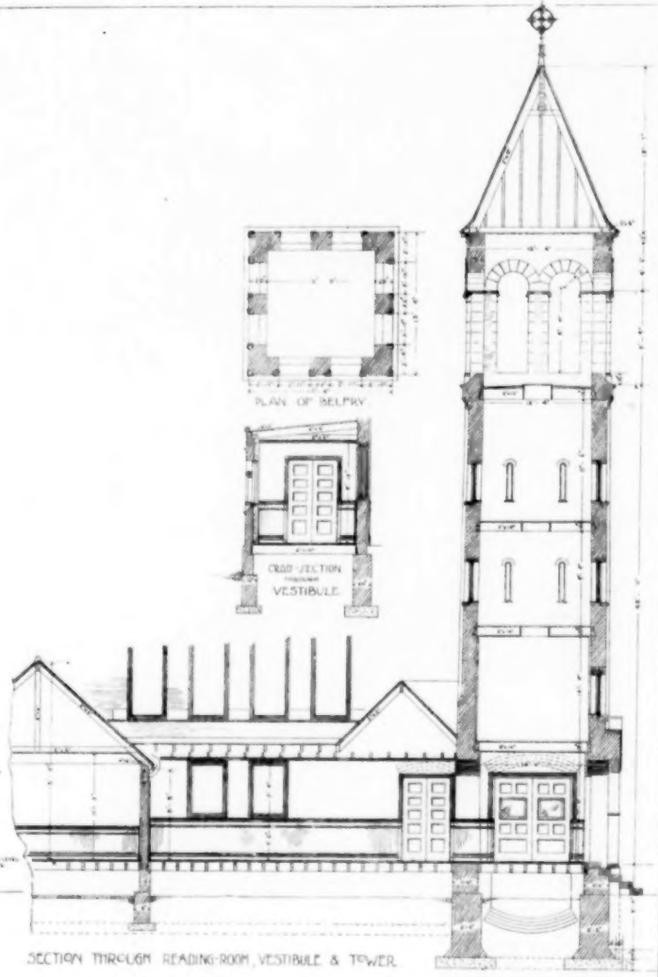

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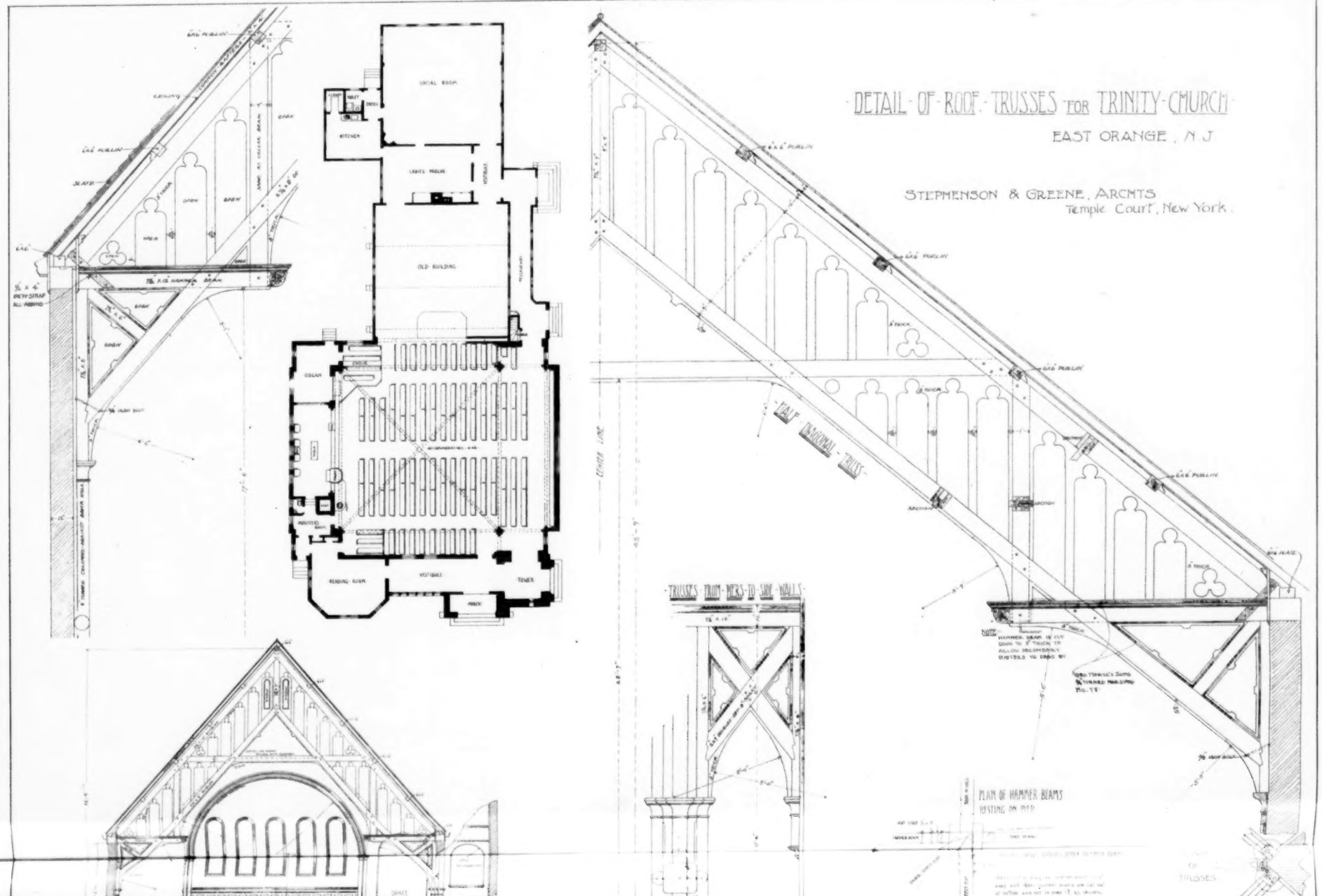

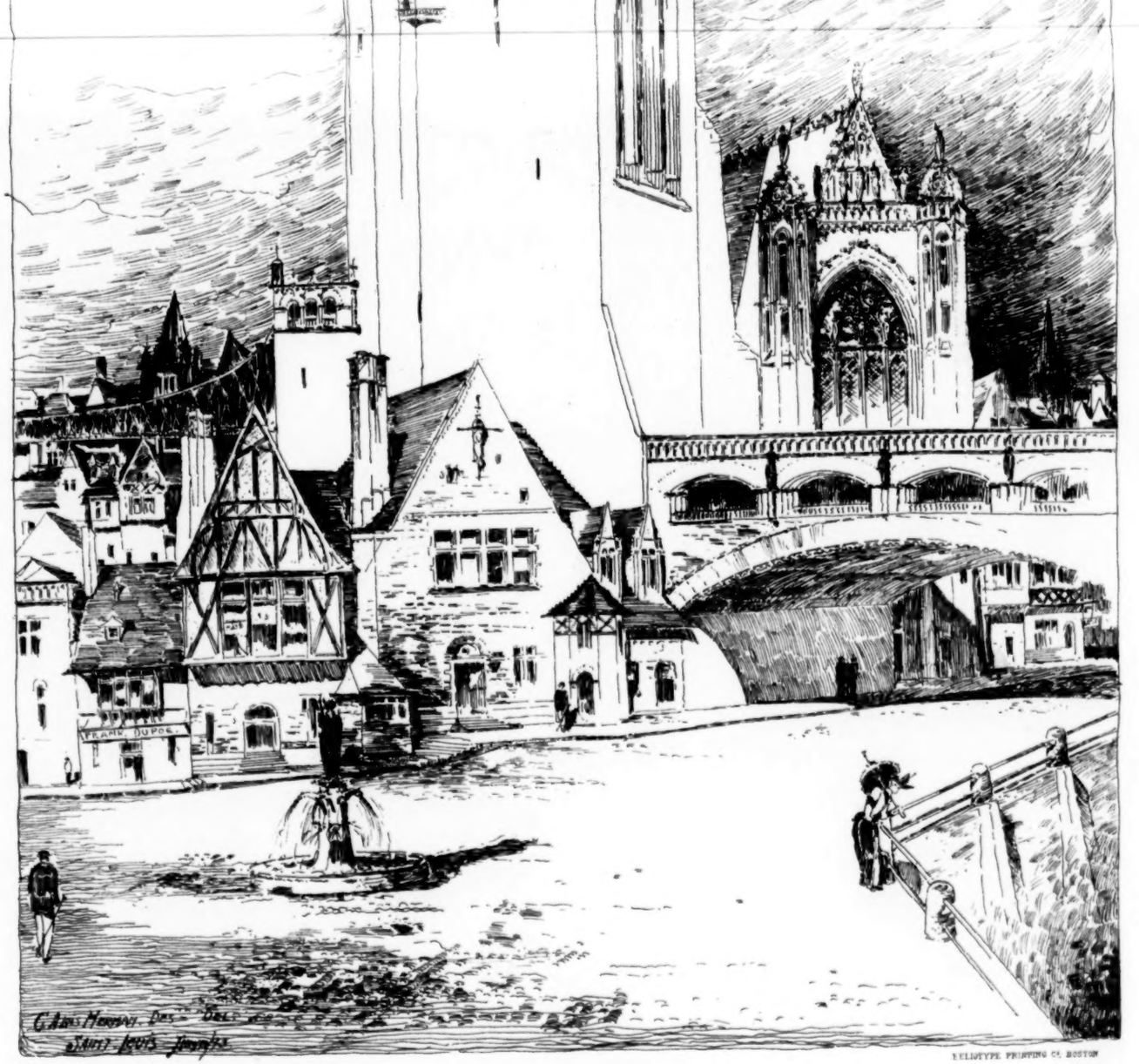

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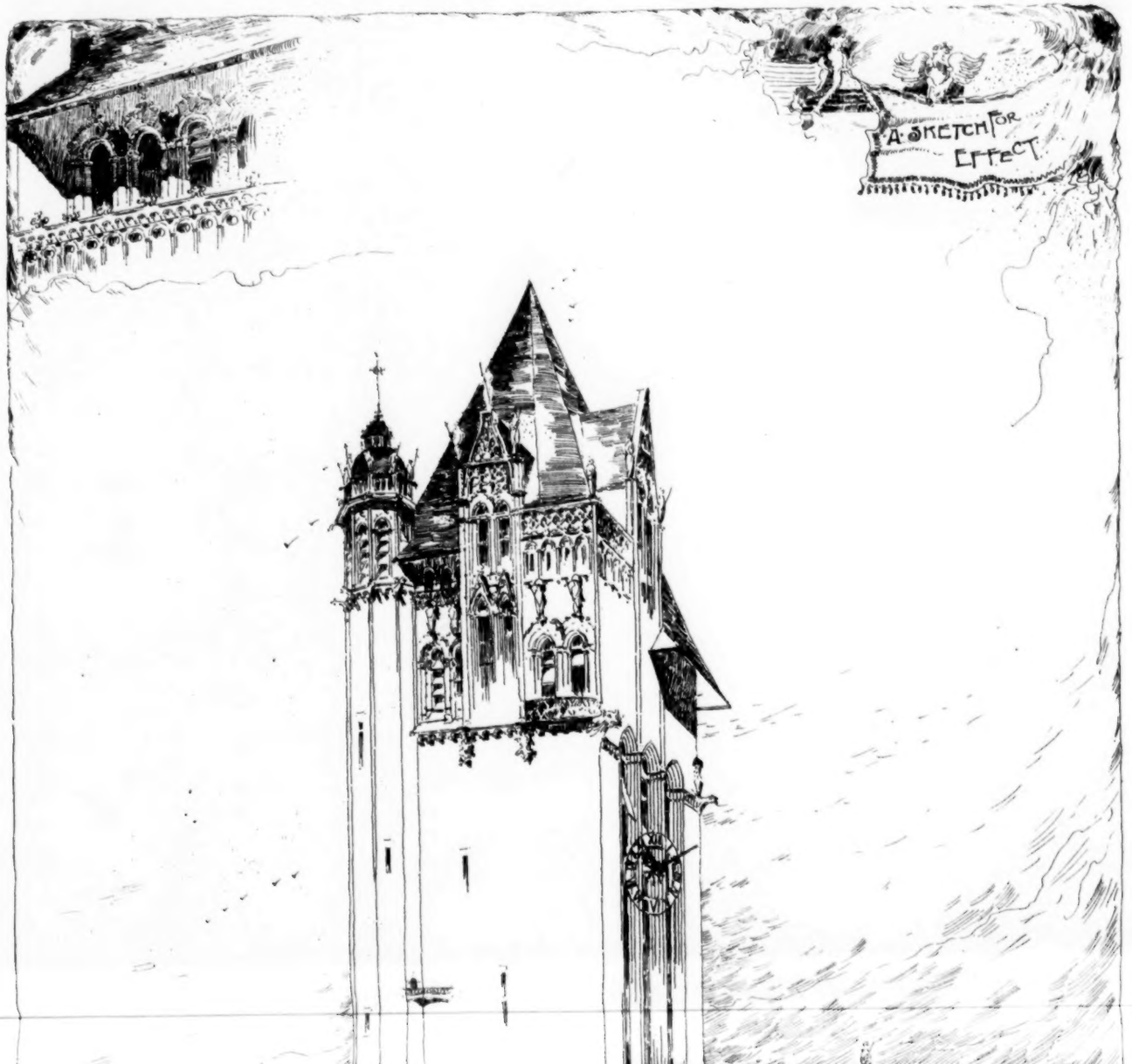
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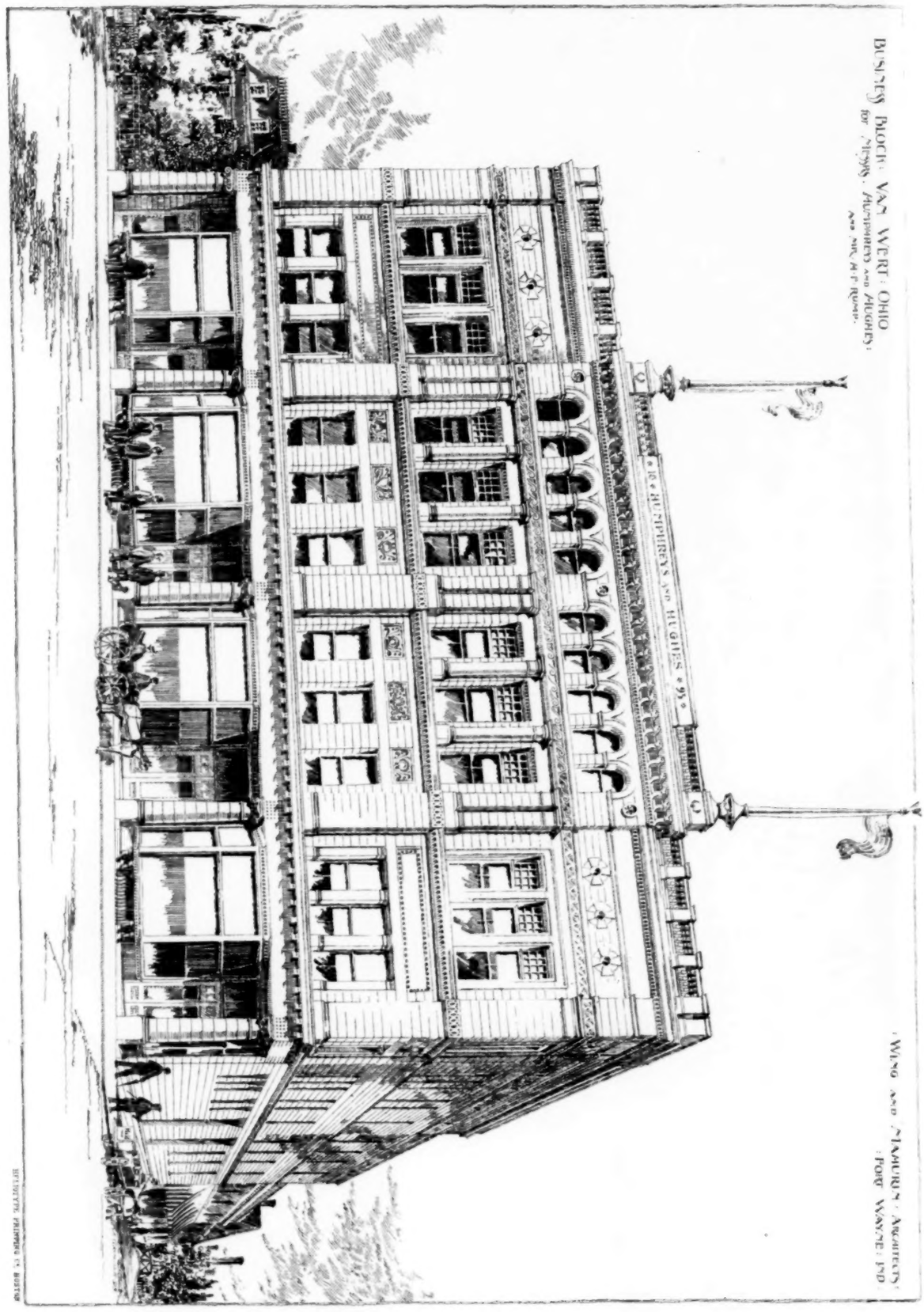

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