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CONTENTS.

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WE have been taken quite by surprise by receiving from Mr. T. F. Laist, the *American Architect* Travelling-scholar, notice that he is about to return home, as the term of his scholarship expires September 24, but that he hopes to be able to welcome his successor before he actually leaves Europe. Unfortunately, the necessary steps for procuring a successor have not been taken, for, having lost sight of the matter, we have not of late advertised the existence of the scholarship nor stated the conditions under which it can be secured. These conditions will now be found stated in one of our advertising pages, and we must ask those who desire to take part in the examinations to notify us at once, so as to prevent an extension of the delay which our own oversight has made inevitable.

THE Convention of the American Institute of Architects for 1890, the first since the completion of the reorganization, will meet in Washington, D. C., on Wednesday, October 22. This meeting will be extremely important in determining the policy of the Institute, and the attendance should be as large as possible. The questions relating to the welfare of the profession have grown to be quite numerous, and it is much to be hoped that some of the most important, such as that of a permanent station for the Institute, the advisability of establishing a mutual defence fund, and the position of the profession in regard to open competitions, should be settled without delay. Fellows of the Institute are requested to contribute essays upon technical subjects, sending early notice of them to the Secretary; and Chapters in process of organization or reorganization are warned that the process must be completed, and a copy of their constitution and by-laws be in the hands of the Secretary of the Institute, at least two weeks before the opening of the Convention.

THE New York *Times* has been investigating the causes of the struggle between the local brick manufacturers and the walking-delegates of the Central Labor Union, and has made some interesting discoveries. It will be remembered that, a few weeks ago, all the union workingmen in New York were notified not to use or touch brick made by four firms, who make brick at Verplanck's Point, and certain other firms, who manufacture at Haverstraw. The reason for their action was said to be that the brickmakers in question did not pay their men regularly, and that there were other troubles, the nature of which was not defined. We expressed the opinion at the time that it was very unlikely that the manufacturers would fail to pay their men properly during the short brickmaking season, when any one who was dissatisfied could immediately find employment in some neighboring establishment; and that the other troubles, which even the imagination of a labor "organizer" was unable to particularize, could not be very serious. But the walking-delegates have power to enforce any order they may give, and the boycotted firms prepared to abandon their New York business. At this juncture the other brick manufacturers, who foresaw that similar attacks were likely to be made on them, resolved to make common cause with those first assailed, and, at a fully attended meeting, voted that none of them should send any bricks to New York until the proscription should be removed from the Haverstraw and Verplanck's Point manufacturers. This resolution went into effect about two weeks ago, and the building community is watching with great interest the result of a movement which will probably throw fifty thousand men out of employment, and will give the union workmen, for the first time, a taste of the medicine which they have so long been administering to other people.

ACCORDING to the *Times's* account, the affair, which has now become such a serious one for so many persons, seems to have grown out of a scheme of the walking-delegates in New York to increase their revenues and influence at the expense of the poor brick-moulders. There are about twenty thousand of these employed at the brick-yards on the Hudson River, and as the assessment which each member of an outside union pays to the central organization in New York is three dollars a year, there was obviously a possible income of sixty thousand dollars a year waiting for whoever should be successful in getting hold of it. It is needless to say that the labor "organizers" have a keen eye for such opportunities, and several attempts have already been made by them to acquire a foothold in the brick-yards. The first attempt at Verplanck's Point, where the present contest began, was in 1886. Before that time the four brickmaking firms at the Point had worked in perfect harmony with their men, who understood the business well, knew the market prices of brick in New York, the cost of manufacture and transportation, and the amount of competition in the trade and the wages which the manufacturers could afford to pay; and, knowing that they got as good wages as men in other yards, and as much as the state of the trade would warrant, were contented and faithful. In the year 1885 alone the operatives in the brick-yards at Verplanck's Point built twenty-three houses of their own. In 1886 the "labor organizer" made his appearance, and in the five years which have elapsed since then only five houses have been built in the village, either by the workmen or the manufacturers. The introduction of the workmen to organized felicity was craftily managed. Early in the year the "Verplanck Literary Association" was formed in the village, ostensibly with the purpose of developing the intellectual culture of a community consisting almost entirely of brick-makers. The idea of the literary association proved popular, and there were soon four hundred members, about one-half of all the brick-yard operatives. Then some eloquent gentlemen from New York happened-in at the meetings, and diverted the discourse from strictly literary topics to the Rights of Man, the Wrongs of Capital, the Dignity of Labor, and so on. The hearers, new to the arts of the skilful demagogue, were easily excited, and the Literary Association was soon "organized" into a local assembly of the Knights of Labor, sending its tribute regularly to the central authority in New York. There were still, however, four hundred operatives not yet in the fold, and the next step was to bring about a battle, to frighten the timid and magnify the authority of the leaders. A pretext was found in a disputed construction of an article of the agreement made between the masters and the men at the beginning of the brickmaking season, and a strike of the union men was ordered, resulting in the closing of the yards. The State Board of Arbitration interfered, and each side submitted its case, both agreeing to abide by the decision of the Board. The Board, after two days' investigation, found that the charges made by the executive committee of the union against the manufacturers were "not sustained," and gave an award accordingly. The union, however, instead of accepting the award, kept up the strike, and changed its ground, demanding an increase of wages, which was granted for the rest of the season. The next season the manufacturers refused to recognize the union, on account of its repudiation of its agreement of the previous year, and the men, who seem to have themselves had some sense of fairness, and who had had enough of "organization," deserted the union, almost in a body, leaving the local assembly with less than a hundred members, and reducing the tribute to New York from twelve hundred dollars a year to less than three hundred. During 1888 the Knights of Labor did not interfere in the brick-yards, and all the men, whether members of the Literary Association or not, had steady employment, at good wages.

IN the winter of 1889, two men who had been employed in the brick-yards went to New York, where they became intimate with the labor magnates, one of them being appointed a walking-delegate. Then began a series of troubles. A distinguished orator came up from New York and addressed a public meeting of brick-moulders, urging them to "organize" and resume their tribute to the metropolitan authority. Not content with appealing to the men, the orator, after the meeting, sought an interview with one of the manufacturers, who carried on two yards, and proposed to him that he should make his establishments "union yards," discharging all non-union men. As an inducement to do so, he said that he would order all the other yards boycotted until they also became union yards, so that all the business, meanwhile, would go to the first manufacturer who complied with his request. This tempting offer was promptly declined. Whether the same proposition was made to the other manufacturers on the Point does not appear, but, if so, it was rejected by all, and the orator went back to New York. A few days later, a printed notice was sent to all the dealers in building materials in New York, informing them that the Board of Delegates had "ordered the brick-handlers, drivers, etc., to cease handling the product of the following brickmakers of Verplanck Point," giving the names of the principal manufacturers, "until such time as a settlement of the difficulties now existing between them and their employés will have been reached." This, of course, meant the exclusion of the bricks made by these manufacturers from New York, and the other firms in the business, to protect themselves from similar attacks, combined for resistance. It is interesting to know that the *Times* sent a reporter to Verplanck's Point to talk with the workmen in the largest yards. He found them at work contentedly, unconscious of any "difficulties" between themselves and their employers, and, while they would be glad to get more pay, they acknowledged that their wages were as high as those paid at any brick-yards near New York, and their hours and times of payment as favorable as they ever were, and they had no idea that the Knights of Labor would help them to anything better.

THE Troy *Press* mentions that Dr. R. G. Wells, an experienced aëronaut, proposes to build a balloon, or rather air-ship, on a new plan, and exhibit it at the Chicago Exposition of 1892. This air-ship, like most of the scientific modern balloons, is to be spindle-shaped, and Dr. Wells hopes to be able to adapt to it machinery capable of driving it through the air. The *Press* thinks that this is probably feasible, and believes that the time will come when air-ships will regularly navigate the air, but it warns intending travellers that "of course, when an air-ship comes in contact with a cyclone, the funerals of the passengers would have to be held without the usual accompaniment of the remains." As a great many people probably have the same idea, it may not be amiss to suggest that the danger from cyclones, or winds of any sort, when aërial navigation is fairly established, is likely to be very slight. Cyclones of the violent sort occupy only the lower portion of the atmosphere, far below the probable track of air-ships, and an ordinary hurricane ought to pass by a navigable balloon of adequate power without injurious effect. The velocity of a wind capable of uprooting trees and blowing down houses is not more than a hundred miles an hour, and, as we believe, this is a trifle compared with the speed which air-ships are likely to attain. A few days ago, according to the daily papers, an experiment was made in France to see if swallows could not be utilized as messengers, as carrier pigeons are used. Two swallows were liberated from a cage in Paris, and in two hours arrived at Bordeaux, a distance of three hundred and seven miles. The birds flew back again the same afternoon, but at what speed is not stated. Although this flight, at the rate of more than a hundred and fifty miles an hour, is the swiftest yet measured, a swallow in England has been known to fly a hundred and twenty miles in an hour; and, if these tiny birds can slide through the air at a rate which would make them independent of the fiercest hurricane, it seems only reasonable to suppose that a well-planned air-ship would so far surpass them that it would notice the severest winds no more than an Atlantic steamer notices the currents in the sea. How this well-planned air-ship is to be built and experimented with is now an important question for all of us, and one can hardly help thinking that, if the United States Government would only spend in the solution of the problem one-half the amount that it devotes to building war steamers that it has no use for, after second-hand plans obtained as a favor from the lumber-room of the British Admiralty Office, it would make itself far more terrible to hostile powers than it can with whole fleets of cruisers copied from antiquated models. The best safeguard against invasion that the Americans possess, and a tolerably effective one, is their reputation for ingenuity in devising new means for making themselves disagreeable to their enemies. If we were known to be spending a great deal of money and inventive talent in constructing navigable air-ships, people would be very cautious about picking quarrels with a nation which might be in a position to respond in a few hours by dropping a lot of nitro-glycerine shells among their dock-yards and military establishments; and, even if our experiments were not very successful at first, the fact that we were carrying them on would inspire something of the respect which is paid to mystery. We know enough already to be sure that a spindle-shaped balloon could be made of aluminum, which, when partially exhausted, would have strength enough to resist the external pressure, and buoyancy enough to carry machinery, also of aluminum, for maintaining the vacuum and driving the whole apparatus through the air. Of course, it would be an expensive construction, but it is by no means beyond reach, and if the Government does not undertake it, it will probably not be long before private enterprise will try the experiment.

WE are astonished to find so careful an authority as the *Scientific American* furnishing some advice on the subject of chimneys which we hope no one will follow. It begins by saying that "chimneys, to be safe from fire, and draw well, should not be less than sixteen inches square inside, and built up from the cellar." So far as the suggestion that a chimney should be "built up from the cellar" is concerned, we have no criticism to make, the alternative, a chimney built on the wood floor, being obviously objectionable; but that all chimneys need to be sixteen inches square, irrespective of the uses to which they are put, is a very careless assertion. No doubt, a flue for a large open fireplace, in which wood is to be burned, is better to be sixteen inches square, or even more; but an ordinary fireplace for hard or soft coal, or wood of the sizes usually furnished for city houses, works perfectly with a twelve by twelve flue, and will do very well with one eight inches by twelve, if it is straight, smooth inside, and not choked anywhere. For close stoves, which warm nine-tenths of the buildings in the United States, a flue eight inches by eight is ample, and in Germany, where heavy porcelain stoves are used, with a slow fire, four by eight-inch flues are common, and are found serviceable. This is just one-eighth the size that the *Scientific American* sets as the minimum, and it is a pity to mislead innocent people by general statements of this sort into spending money uselessly, and encumbering their houses with flues three or four times as large as there is any need of. In regard to the construction of the chimney, the *Scientific American* is as over-liberal as it is unduly strict in limiting the size of the flue. "Use good brick," it says, "with clay, instead of mortar, up to the comb. Plaster it inside with clay mixed with salt." Those who have used clay in mason-work in place of mortar will open their eyes wide at this suggestion. To say nothing of the excessive settlement of the chimney which would follow the shrinking of the clay joints, it would be next to impossible to keep it from bending, through the irregular drying of the clay; while the rain, which runs in streams down any large chimney-flue, would soon dislodge the upper part of the lining, and the joints would go with it. The rest of the advice, which is that the chimney above the roof should be laid in cement; that woodwork should not come "too close" to the brick, and that the stove-pipe should not come within eighteen inches of the ceiling, is unobjectionable.

RELIGIOUS ARCHITECTURE.[1] — XXII.

ARABIAN ARCHITECTURE.

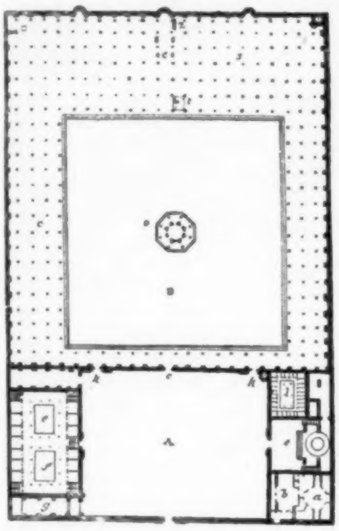


Fig. 1. Plan of the Great Mosque of Amrou, Cairo [7th-8th Centuries].

THE Mussulman emigration began in the year 622 of the present era. During the next few years the Arabs completed the conquest of Asia Minor, and took possession of Mecca, Damascus, Heliopolis and Jerusalem. On the very site of Solomon's temple they reared the mosque which may be considered as the earliest Arabian religious edifice of any considerable importance.

The conquerors subjugated Aleppo and Antioch. In 640 they penetrated into Africa, where they seized Memphis and Alexandria. At Cairo they built the great mosque which, through the college attached to it, was long the most celebrated intellectual centre of the Mussulman world.

At the same time they pushed out in an opposite direction, and the capital of Persia fell into their hands. Armenia and Mesopotamia passed successively under their rule. The second half of the seventh century was occupied in the conquest of India.

Meanwhile Mohammedan dominion was extending in Africa. In 670 the Arabs founded Kairwan, in Tunis, which soon ranked second among their religious cities. In 702 they had reached Tangier, where they found themselves face to face with Spain, a country which they were not long in subjugating. It was at about the same time that the Great Mosque was erected at Damascus, on the ruins of an ancient Christian church, probably St. John's.

The invasion of Spain began in 711. Two mosques were soon built at Saragossa. Most of the palaces and mosques of Cordova, Seville and Toledo were reared before the close of the eighth century. The Asiatic city of Bagdad was founded during this period, and thither the Mussulmans transported the art treasures which they had collected in Persia and the fragments which they had torn from the palaces of Madain (Ctesiphon), the capital.

Between 827 and the end of the ninth century the conquest of Sicily was effected, and the island was not re-seized from the Moslems until the eleventh century. Arabic power, which had at this moment reached its zenith, thenceforth began to wane. In Spain the Mohammedans gradually retreated before the Christians. After a bitter struggle, which lasted until the latter part of the fifteenth century, the Infidels were definitively driven back to Africa. It was the same with the Turks from Turkestan and northern China, who penetrated into Persia and Asia Minor in the tenth century, and were there converted to the Moslem faith. They invaded eastern Europe, but, in the seventeenth century, after having advanced triumphantly as far as the gates of Vienna, they were repulsed, their military progress was completely checked, and their social organization soon entered upon a period of decadence.

The religious edifice of Arabian architecture, the mosque, is generally built on a very simple plan. The entire structure[2] ordinarily comprises an oblong space, laid out almost due north and south, and shut in by walls. A more or less extensive portion of this space, usually on the north end, is set off for purposes of meeting and prayer; it is disposed as an open court surrounded by a covered cloister. The court is sometimes planted with trees, but more often it is paved with flag-stones or marble; it always contains a fountain, or cistern, for the ablutions prescribed in the Koran. The principal naves of the mosque, running north and south, communicate with this court, in Spanish called a *patio;* sometimes they are separated from it by a wall pierced with doors, one of which, larger than the others, is usually in the centre facing the mihrab, the most ornate part of the mosque. In every mosque, however insignificant, the mihrab marks the point of orientation called Kiblah, that is, the direction of the Kaaba at Mecca, toward which every Mussulman must turn when he prays. On the left of the mihrab, in the sanctuary, which is of varying dimensions and screened off from the rest of the structure, is the mimbar, a kind of pulpit, very richly ornamented and raised on several steps, to which the Imam, or priest, ascends to read the various prayers to the assembled people.

On the north side, usually directly in front of the mihrab, though sometimes in the next aisle, as at Cordova, there is a lofty tribune supported on columns. This tribune is for the use of the Imam Tatib, who announces the hours of prayer. The sanctuary is often surmounted by a cupola which towers above the edifice; sometimes, however, the great cupola is over the very centre of the mosque, in which case the structure bears a striking resemblance to the church of St. Sophia. The chief mosques generally have schools, hospitals and public baths attached to them.

The principal divisions are indicated in the accompanying plan of the mosque of Amrou (Figure 1). *A* is the fore-court which is entered at *h; a*, on the right, is the bath; *b*, the public watering-place; *e* represents the wheel for drawing the water; *l*, the court surrounded by latrines. On the left, at *g*, is a stable for the horses, camels and flocks; *e* and *f*, on this side, are buildings with peristyles and courts, divided into rooms for the accommodation of travellers.

The second court, *B*, is entered at *c, k, k*. In the centre is the fountain for ablutions, marked *D*, and porticos, *C, C*, extend around it; the tribune from which the muezzin proclaims the hour of prayer is at *t;* in the rear is the sanctuary, *s, s*, with the pulpit or mimbar, *z*; *c* is the lectern from which the Koran is read, and *i, i, i*, mark the position of the mihrabs.

Colleges, libraries, caravansaries, baths and gardens are often attached to the mosque. The general plan sometimes differs from the one reproduced above, and approaches very nearly, as

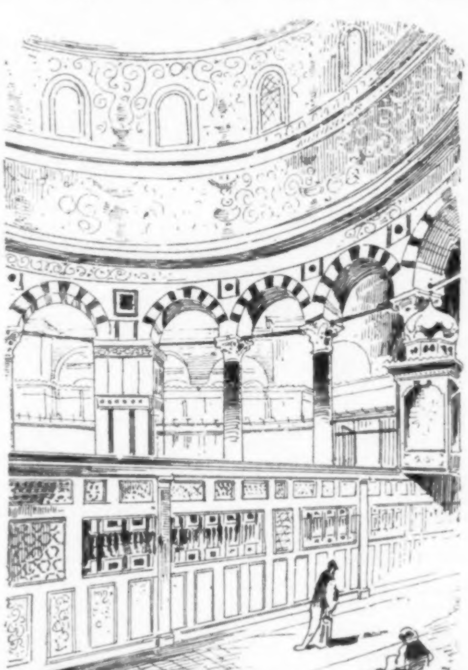


Fig. 2. Interior of the Mosque of Omar, Jerusalem [7th Century].

we have said, to the plan of St. Sophia, at Constantinople; it is chiefly at Constantinople and in Syria and Persia that the influence of the Byzantine basilica has manifested itself.

As a rule, the mosque has minarets appended to it; the number of these turrets varies, but only *djamis* of imperial foundation can have exactly four. In Shiite edifices the minarets are joined to the mosque, while among the Sunnites they are entirely separate structures.

We will glance at the various Arabian religious edifices, beginning with those built in Syria and Persia, the countries first

[1] From the French of P. Planat, in Planat's "*Encyclopédie de l'Architecture et de la Construction.*" Continued from page 130, No. 766.
[2] Girault de Prangey: "*L'Architecture Arabe.*"

subjugated by the Arabs, then taking up those in Egypt and the rest of Africa, as well as those of Sicily — following thus the course of Moslem conquest. We will not touch upon the mosques of India, as these have already been noticed in the section devoted to Indian architecture.

It seems improbable that there was any distinctively national style of architecture in Arabia before the advent of Mohammed. A few ruins at Bograh, which have not yet been carefully examined, constitute the only known traces of the Arabian structures of this early period.

On penetrating into Syria and Persia, the Arabs contented themselves with remodelling the Christian churches to suit Mohammedan requirements: when they began to build, Byzantine, and perhaps Persian, architects were employed; the remains of the edifices of antiquity were, moreover, utilized in these new constructions.

In Syria, the mosque of Omar, at Jerusalem, was erected in the seventh century; the Aksa mosque of Jerusalem and the mosque of Damascus belong to the tenth and eleventh centuries.

The so-called "Mosque of Omar" (Figure 2) was, in fact, built after the death of Omar. It is octagonal in form, and is entered by four doors facing the four cardinal points. The marble columns of the interior, which vary much in shape and height, are of Byzantine production. The lower portion of the walls is faced with marble; the upper part is inlaid with Persian faïence of much more recent date. The same is true of the revetement of the central dome.

In the same enclosure with the Mosque of Omar stands the mosque called El-Aksa (Figure 3); it was one of the old Justinian basilicas. Partially destroyed by an earthquake[1], it was reconstructed by the Arabs in 785, and was again restored in the twelfth century. There are later additions, such as the porch, which do not date back of the fifteenth century. The central aisles are in the Byzantine style, and are probably of the seventh century; the arches are pointed. Most of the columns were taken from various ancient monuments. The mihrab belongs to the fifteenth century, and the pulpit, which is of carved wood and inlaid with ivory and mother-of-pearl, dates from the same period.

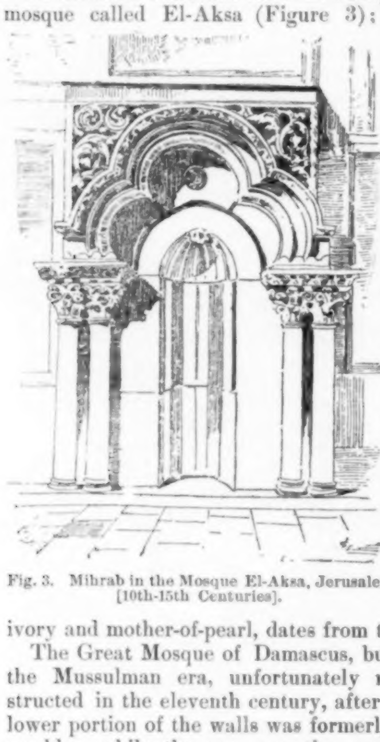


Fig. 3. Mihrab in the Mosque El-Aksa, Jerusalem [10th-15th Centuries].

The Great Mosque of Damascus, built in the early part of the Mussulman era, unfortunately must have been reconstructed in the eleventh century, after a destructive fire. The lower portion of the walls was formerly revetted with precious marbles, while the upper portion and the cupolas were embellished with mosaics; the ceiling was of gilded wood. All this ornamentation has disappeared, and has been superseded by elaborate Kufic inscriptions, a favorite style of interior mural decoration with Arabian architects of all periods. Three minarets still exist, one of which, called the Bride's Minaret, passes for being one of the oldest in Arab art.

These structures give only a very incomplete idea of the earliest specimens of Mohammedan architecture outside of Arabia. They are, however, sufficient to determine the close relationship between primitive Arabian art and Byzantine art. The employment of the dome, the shape of which was not at first altered by Arab architects, is especially significant. The columns are of Byzantine production or form; the arch is pointed, though not markedly so as yet, and slightly curved inward at the base. In all these primitive edifices, remarks M. Lebon, the capitals are connected by beams, a system which seems to have been early adopted by the Arabs.

In Persia, an extraordinarily rich architecture existed before the Arabic invasion. The Byzantine dome had been adopted, but the system of interior decoration was purely national. It was these decorative details which the Arabian architects borrowed.

Little remains of the edifices built by the Arabs immediately after the invasion. The mosques of Hamadan (Figure 4) and of Meshed may, however, be cited. These date back to the reigns of the first caliphs. The pointed arch has here the peculiarly Persian rectilineal form, and the aspect of the ornamentation and the long vertical divisions is wholly foreign to the Arabian style of architecture.

Fig. 4. Entrance to the Mosque of Hamadan, Persia [8th Century].

The Sunnite mosque at Tabriz, which has been minutely described by Coste and Flandrin,[2] and the later mosques of Ispahan, constructed by Shah Abbas in the sixteenth century, mark a new stage in Persian art—the period when it freed itself completely from Arabian influences. Certain features, such as the rectangular framing of the pointed grand portal, the forms of the bays and pendentives, as well as the decorative system, are purely Persian. From Tabriz to Ispahan the separation is still more noticeable. The Persian minarets have always preserved a characteristic form quite unlike that of the early Arabian square minarets, or that of the polygonal minarets of later Arab art. It may be said that, though Persian art, after having impressed itself upon Arabian art, was in turn subjected to Mohammedan influences, it nevertheless guarded its originality, and, gradually shaking off the Moslem yoke, became once more, in the sixteenth century, distinctively national.

[To be continued.]

EQUESTRIAN MONUMENTS.[3] — XXVII.

THE PARTITION OF POLAND. — II.

Plaque : Post equitem sedet atra cura. Alfred Gilbert A.R.A. Sculptor

THE immediate predecessor of Augustus the Strong on the throne of Poland was one of those patriotic and daring souls of whom Poland has furnished so many to the world's history; John Sobieski is a name to conjure with. Turkey, now the "sick-man" of Europe, was in those days an exceeding well and active man, and did not need the guaranty of England, France and Sardinia to preserve his autonomy. To their neighbors upon all sides the Turks were a thorn in the flesh, and it needed all the impetus of the old crusading spirit to prevent the Infidels making any farther progress westward; and as much, perhaps, as to any other single man the checking of the advance of the wave of barbarism was due to John Sobieski.

The son of the castellan of Cracow, the ancient capital of Poland, John had been sent to Paris to complete his education, and was serving in a corps of the musketeers of Louis XIV when he heard of the death of the King, Ladislas IV, and a serious outbreak on the part of the Cossacks who had invaded Poland. Abandoning his French service he at once returned home [1648] to cast his fate with his fellow-countrymen, and proving his worth at once advanced rapidly in power till, about 1668, he held chief command of the army. A few years after this the then King of Poland, Michael Korybut, attempted to make a most injudicious and inglorious treaty with the Turks, which Sobieski fortunately succeeded in persuading the Senate to reject — not a difficult thing, perhaps, as one peculiarity of the Polish constitution was the *liberum veto* which enabled a single legislator by his sole vote to prevent any act of legislation, a most dangerous prerogative whose abuse was the cause of the greater part of Poland's troubles. Having prevented the peace, Sobieski

[1] G. Lebon: "*La civilisation des Arabes.*"

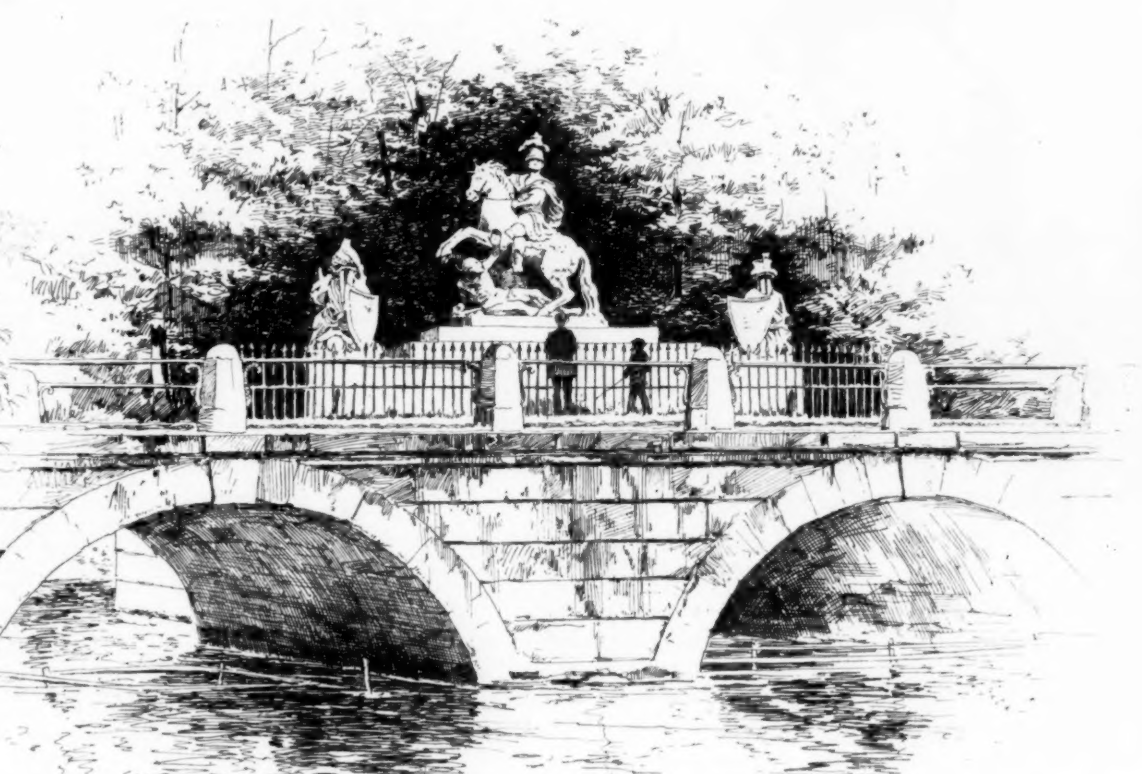
[2] "*L' Arménie, la Perse et la Mésopotamie.*"

[3] Continued from page 103, No. 764.

returned to the field and defeated the Turks at Chocim in 1673, the indirect result of which was his own election to the throne almost immediately thereafter, as King Michael died opportunely.

For more than thirty years Sobieski waged battle with the Turks, and fortune, as a rule, favored him. His most famous act, one which won for him the title of "Saviour of Christendom," was his aiding in the relief of Vienna in 1683, when that city was besieged by 300,000 Turks under Kara Mustapha, whose advance had been facilitated by one of the periodic revolts of the Hungarians. The fate of the city — and of Christendom — seemed sealed; the Emperor Leopold had fled, and with him many of the nobles and wealthy citizens, but the *bourgeois*, led by the valorous governor, Count Stahremberg, persisted in their resistance, in spite of its seeming hopelessness. Without the city, Charles V, Duke of Lorraine — the grandfather of the husband of Maria Theresa — had collected a considerable force, and aided the citizens by making attacks upon the Turks as opportunities favored. The siege began July 14, 1683, and as the autumn opened, Charles, who had shown great heroism and generalship during the summer months, had been reinforced by the Elector John George of Saxony, the Margrave Christian Ernest, Maximilian of Bavaria and others till he had under him an army of 40,000 men. But, in spite of repeated summons, John Sobieski, King of Poland, delayed to fulfil the obligations laid upon him by the treaty he had entered into in the preceding March, which bound him to bring to the field, whenever summoned by the Emperor of Germany, an army of 40,000 under his personal command. At length he came with an army of only 20,000 men, and the allied forces, feeling that nothing was to be gained by further delay, made an attack upon the Turks September 12, which was ably seconded by the beleagured citizens, who sallied out under the leadership of Count Stahremberg. The combined attack was successful, the siege was raised, and the retreating Turks were pursued perseveringly by the Poles and others. There seems to be as little doubt that the rout of the Turks was greatly due to the impetuous bravery of Sobieski and his followers as there is that his reputation has been built up at the expense of that of Charles of Lorraine, whom Louis XIV once called "*le plus grand, le plus sage et le plus généreux*" of all his opponents. But for some reason historians have magnified Sobieski's share in raising the siege of Vienna, and have made for him a reputation which is not borne out by other incidents of his career. He was brave, impetuous, dashing, and such characters generally win the love and admiration of their followers; but as a general and tactician he was distinctly a failure, and, if the siege of Vienna is left to one side, his career would be found more noted for disasters than for successes. To be a successful king one must be an able and far-seeing statesman, even more than a sagacious and capable leader of armies, and upon this point the judgment of one's royal peers is, perhaps, as deserving of respect as that of dispassionate or prejudiced historians. How Sobieski stands in this respect may be guessed by the remark made by Nicholas I, of Russia, one day. Thinking upon the results of his recent conflict with Hungary, he gave expression to his conclusion in these words: "The two kings of Poland who have committed the gravest errors are John III and myself, for we both saved the Austrian monarchy." Yet in spite of this he became a national hero, and as such was, of course, a fit subject for the sculptor's chisel, and several statues mark the respect that the denationalized Poles of to-day still feel for this energetic soldier.

One of these statues, an equestrian one, is at Warsaw, and represents the King trampling upon an overthrown Turk, who, if one may judge from the photographs, looks much more like a red Indian than like a good Mohammedan. In all probability the figure is modelled after a Tartar rather than a Turk. The statue, of marble or stone, stands upon the crown of a two-arch bridge in the Lazienki Park, and is supported upon either hand by two large trophies, wherein Tartar caps and Turkish turbans offer symbolic evidence of his prowess against the enemies of Christendom. Who was the sculptor it has not been possible to discover, but the group was erected in 1783, one hundred years after the raising of the siege of Vienna. It should be also borne in mind that the marble equestrian statue of Charles II, once in the Stocks Market at London, was in its original estate a statue of Sobieski.



Monument to John [III] Sobieski, Lazienki Park, Warsaw, Poland.

An event of such grave historic importance as this, the second siege of Vienna by the Turks, must have been commemorated in many ways, but it has been left to the present day to create the final and most elaborate memorial. This, the work of the Viennese sculptor, Hellmer, is to be erected shortly in the Cathedral of St. Stephen, but where space in that already crowded structure will be found for so large a work it is not easy to imagine. It is peculiarly appropriate that this memorial should be placed in the Cathedral, for to the upper story of its south tower Count Stahremberg daily ascended during the siege to observe the movements of the besiegers and catch the earliest sign of the approach of the dilatory Sobieski: the bench on which he sat is still pointed out to the curious.

Hellmer's composition indicates with much felicity the relative importance of the several actors in the great drama. The whole subject is crowned with the figure of the Virgin, and to her, upon either side, kneel the Pope, who was, of course, deeply concerned at the advance of the Infidel and correspondingly grateful for his repulse, and the Emperor Leopold, who is presumably asking forgiveness for his cowardice in deserting the city and abandoning his duty as emperor and Christian knight. Below the Virgin is the imperial escutcheon, and as supporters on either side stand the figures of Charles V of Lorraine, John Sobieski of Poland, John George of Saxony and Maximilian of Bavaria. Below, in the centre of the composition, in the place of honor, Count Stahremberg, an equestrian figure in high relief, rides out, surrounded by his fellow-citizens, from the city gates. Below this again, and on either side, stand the Mayor of the city, Herr Liebenberg, and Bishop Koleonitz. The full-size model of this elaborate memorial was exhibited about a year ago, and it cannot be long before the finished work is set in place.

The illustration of this memorial, which may be found on another page; shows an earlier and less happy arrangement. In this the positions occupied by Pope and Emperor are filled by little winged genii, while a standing figure of Leopold in armor takes the place of the Virgin and child. The present emperor, Francis Joseph, is a man of such strong common sense that there is no impropriety in assuming that he may have given the sculptor a hint that there was

Bogdan Tchmelnitzki, Kiev, Russia.

no reason in falsifying history by such an apotheosizing of his recreant ancestor.

It is worth noting that serving under Charles of Lorraine at the siege of Vienna, and attracting to himself the admiration of that sagacious leader, was the young Eugene of Savoy, who was later to become the main hope of Austria in her conflict with that other infidel, Louis XIV.

The uprising of the Cossacks, which called Sobieski home from France in his youth, was a matter which had very serious consequences. Just who the Cossacks are is an ethnological uncertainty, but the generally-accepted theory is that they are descendants from some nomadic Asiatic tribe who invaded Europe long ago, and have to a great degree preserved their racial and tribal characteristics nearly intact, in spite of their being brought more or less in contact with civilization. One large body of this people settled itself in Southeastern Russia, on the confines of Poland, and when Stephen Bathori, Prince of Transylvania, was elected King of Poland in 1576, he organized the Cossacks into a species of frontier-guard for his kingdom, to protect it from encroachments by Turks, Tartars or Russians. This arrangement suited the Cossacks admirably, as the constant border warfare gave full employment to their warlike instincts, which the passage of time has neither diverted nor extingushed to the present day. All might have gone well if it had not been for the oppression of the Cossacks by Polish officials and the persecution by Polish Jesuits to which the Cossacks were exposed, for the reason that they were members of the Greek Church. These abuses led to the revolt in question.

The Cossacks at this time were under the command of a hetman, Bogdan Tchmelnitzki, and his first attempt was the taking of the Castle of Kudak, which had been built to overawe the turbulent tribesmen, and was known as the "curb of the Cossacks." The stronghold was seized and the garrison massacred, but the Cossacks were soon subdued, and Bogdan, in place of being punished, was provided with a place at court. He was, however, soon made the victim of intrigue and persecution: his wife was persuaded to desert him, and his son was publicly whipped. Once more he rose in revolt, and this time [1648] sought the aid of the Kahn of Tartary, who placed 80,000 troops at his orders. Having grievous injuries to avenge, he ordered that no quarter should be granted to Poles, Jews or Catholic priests, and the excesses and inhumanities practised by the Cossacks were repaid in kind by the Poles. The struggle lasted, with varying results, from 1648 to 1656, and during this period, according to his necessities, Bogdan sought the alliance of Turks or Russians, the latter of whom aided him in 1654. In this way, Russia first got a hold upon Polish territory — a hold that has never been relaxed. Bogdan made his peace with Poland in 1656, but the outcome of his former alliance with the Russians was a war between Russia and Poland, which was closed by the Treaty of Andruszow in 1667, by the terms of which Kiev, Smolensk and the Ukraine were ceded to the Russians. Practically, this might be called the first dismemberment of Poland.

A traitor like Benedict Arnold earns only the contempt of those he serves, as he does the hatred of those he betrays, while an open rebel is seldom despised, even if he fail to achieve his aim. If he succeed, he may leave a blackened record with those against whom he revolts, but this is made more than good by the glory of the reputation he makes with those who have benefited by his undertaking, and he may live upon one side of history, at least, as a hero or a demigod. With the Russians, Bogdan seems to be considered in the latter light, and is regarded rather as a national benefactor, and in this character there was erected to his memory in the year 1888, at Kiev, an equestrian statue, upon the base of which are the inscriptions, on one side: "To Bogdan Tchmelnitzki. One and undivided Russia. 1654–1888;" and on the other: "We desire to be under allegiance to the Orthodox Czar." The latter inscription makes patent the fact that the uniting of the Cossack with the Muscovite was a most obvious result of an outbreak which was largely caused by religious persecutions.

The statue, which was erected during the centenary celebrations which marked the close of the ninth century of the rule of Christianity in Russia, is of bronze, and Bogdan is shown in the national costume of a Cossack hetman, pointing with his sceptre towards Moscow. The horse is animated in action, and, judging by the imperfect indications that have come to hand, the statue is good, rather than bad, in character. The granite pedestal upon which the statue stands, rough boulder-work, is said to be seventeen feet high, and consequently the statue is of colossal size. The monument as a whole, but particularly the pedestal, is interesting because the treatment is so evidently inspired from that of the famous equestrian monument to Peter the Great, which stands in front of the Cathedral of St. Isaac at St. Petersburg.

Bogden Schuls, Vienna.

The similarity of the names and the costume of the little statuette that decorates, at the height of the first story, the angle of a building at the corner of Heidenschulzstrasse and Strauchgasse, Vienna, seem to show that the Bogden Schuls, whose fame it perpetuates was a Pole, and the existence of this statuette on a street corner of Vienna is reason for thinking that he distinguished himself at the siege of Vienna. It is possible, however, that it is a representation under a Germanized surname of Tchmelnitzki himself. The statuette is of stone or stucco, which the Viennese use so skilfully, and about three feet high.

HELLMER. — Eduard Hellmer was born in 1850, at Vienna, and studied under Hans Gasser and Franz Bauer, and also in Rome. His principal works, in addition to the monument to the defenders of Vienna, comprise a "Wounded Achilles" and an "Andromeda in Chains"; two groups for the main entrance of the Historical Art Museum; a colossal statue of "Austria" for the Palace of Justice; and several statues for the City-hall — all the above-named buildings being in Vienna. He is now Professor in the Academy of Fine Arts.

STAHREMBERG. — Ernest Rudiger, Count Stahremberg (or Starhemberg), was born in 1638. He became successively a Councillor of State, a chevalier of the Golden Fleece, President of the Military Council and commander of Vienna, and greatly distinguished himself in the defence of that city against the Turks in 1683. For his services on that occasion he was made a field-marshal and a Minister of State by the Emperor Leopold, who also gave him a ring worth 100,000 thalers. He died in 1701.

TCHMELNITZKI. — Bogdan Tchmelnitzki was the son of a Polish nobleman who settled and wived among the Cossacks of the Ukraine. He was born in 1593, and died August 25, 1657.

SOBIESKI. — John Sobieski, son of Jacob the Castellan of Cracow, born in the Castle of Zloczow, 1629; sent to Paris in his youth, and served under Condé; returned to Poland in 1648 on the revolt of the Cossacks, and, with his brother Marcus, served under Ladislas and John Casimir, Kings of Poland; distinguished himself when Charles Gustavus of Sweden invaded Poland; defeated the Turks at Chocim in 1673, and shortly after was elected King of Poland; joined in the relief of Vienna, 1683, and drove the Turks out of Hungary, which was soon restored to the Austrians. His wife intrigued against him during his absence, one result being his making a disadvantageous peace with the Czar, so that he might turn his attention to the conquest of Wallachia, which he attempted several times with disastrous results. Died June 17, 1696.

[To be continued.]

SAFE BUILDING.[1] — XLIII.

CHAPTER X. — PLATE AND BOX GIRDERS (*Continued*).

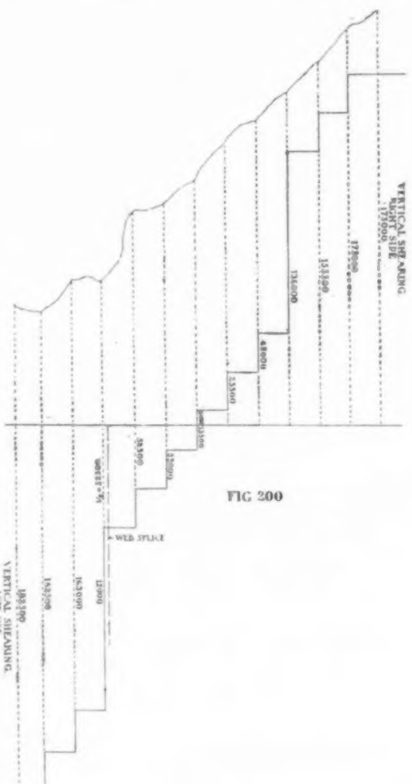


FIG 200

Example II.

Detailing a riveted girder. *A single web riveted plate girder is of 59′,0″ span. At four feet from left support, and thence every five feet to five feet from right support it carries a concentrated load of 19500 pounds, the third loads from each end being increased (by columns) to 91000 pounds. These loads include the allowance for weight of girder. The web must not be more than 36″ deep. Detail the girder.*

THIS girder is one of some twenty-five used by the writer in a large public building in New York City, hence the limitation as to depth of girder.

The working-drawings, as they were furnished to the contractors by the writer, are given in Figures 204 to 210 inclusive. The only objection (on the score of cost) was to the length of some of the flange plates, but this could not be avoided, as the level of beams resting on the girders could not be disturbed, and there was not room enough between beams to get in the necessary length of cover-plates for splices.

The reader will readily see that this is practically the same example as the former one (*Example I*), so that we need not refer to the Tables for preliminary designing. We know then from the Tables that the girder, at the centre, will need to have a 36″ x $\frac{5}{8}$″ web, a 3″ x 21″ flange, four 6″ x 6″ x $\frac{7}{8}$″ angles, and that we will use $\frac{7}{8}$″ rivets.

Size by Tables.

We will now see whether this is confirmed by calculation. We will first use the graphical method (see Chapter VII) on account of the large number of loads.

Curve of moment of resistance. In Figure 202 we lay off our vertical load line $m\,a$, where $m\,l = l\,k = j\,h = h\,g$, etc., $= 19500$ pounds, and $k\,j = d\,c = 91000$ pounds at pounds-scale. We would select the pole distance $x\,y = \left(\frac{k}{f}\right) = 12000$ pounds, but that it will make the moment-of-resistance curve too deep for convenience. We will, therefore, decide to make the distance $x\,y = 10.\left(\frac{k}{f}\right) = 120000$ pounds at pounds-scale. We shall, therefore, have to multiply all the verticals through the moment-of-resistance curve in Figure 199 by ten to get their actual values. We draw the moment-of-resistance curve (see Chapter VII) and find its base line $A\,M$. As our loads are not symmetrical on the beam, being four feet distant at one end and five feet at the other, we draw in Figure 202 $x\,y$, parallel $A\,M$ of Figure 199, and find our reactions

$$y_1\,m = q = 175000 \text{ pounds and}$$
$$a\,y_1 = p = 182500 \text{ pounds.}$$

Greatest bending-moment. The greatest bending-moment will be at load w_{v_1}, where the greatest vertical v through the moment-of-resistance curve measures 276 inches (by inch-scale). Not having used the pole distance $x\,y = \left(\frac{k}{f}\right)$ in Figure 202 we must multiply this by ten to get the actual required moment of resistance which would be $= 2760$. For the same reason we cannot use Formula (98) to calculate the flange thickness and therefore refer to Formula (36) and have for thickness of flange at centre

$$= \frac{\frac{2760}{37} - 16{,}4}{19{,}25} = 3{,}02$$

Required flange thickness. Or we need, as found by Tables, a flange thickness of three inches at the centre of girder. In the above formula, it should be explained, 2760 was the *required* moment of resistance at the point (that is at load w_{v_1}) for which we were calculating flange thickness; 37 represented the approximate total thickness of girder, allowing say for one half-inch plate to each end of girder; 19,25 was the net width of flange, after deducting two rivet holes; and 16,4 was the net area of cross-section (after deducting four rivet holes) of two 6″ x 6″ x $\frac{7}{8}$″ angles.

Where to diminish flange thickness. We will decide to use six half-inch thick plates in each flange and must next decide where to break them off. Accordingly we use Formula (99), and have value of two angles

$$= 16{,}4\,.\,36 = 590{,}4$$

or of the whole *required* moment of resistance (2760) the angles furnish an amount $= 590$; now, as our moment of resistance curve is only of one-tenth the required depth, we divide this by 10 and make $O\,T_1 = 59$ at inch-scale. We now divide $T_1\,T$ into six equal parts and draw the parallel lines to base $A\,M$, their intersections N, O, P, Q, R, and S with the curve are the points at which the respective plates can be broken off.

We shall, however, carry the first plate $N\,O$ the entire length, and as this plate is spliced inside of the curve, we shall have to carry plate No. 5 over the joint to make up for the lost section, and we shall have to carry both plates Nos. 4 and 5 sufficiently far to the left of the splice to get in the necessary number of rivets to equal the value of cut plate.

Number of flange rivets required. It will also be necessary to prolong some of the plates to get in the necessary rivets *beyond* their points of contact with curve. Thus between O and N (or end of plate beyond N) we must get enough rivets to equal in value plate No. 1; between P and O (or end of plate beyond O) enough rivets to equal plate No. 2; and so on till in the last plate No. 6 we must get enough rivets between T and S to equal plate No. 6. Now these plates are all of equal value $= \frac{1}{2}″ \times 19\frac{1}{4}″ = 9\frac{5}{8}″$ square inches of cross-section, which multiplied by $\left(\frac{k}{f}\right) = 12000$ pounds gives the real strain s on the rivets, or

$$s = 9\tfrac{5}{8}.12000 = 115500 \text{ pounds.}$$

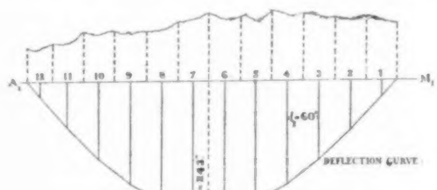


FIG. 201.

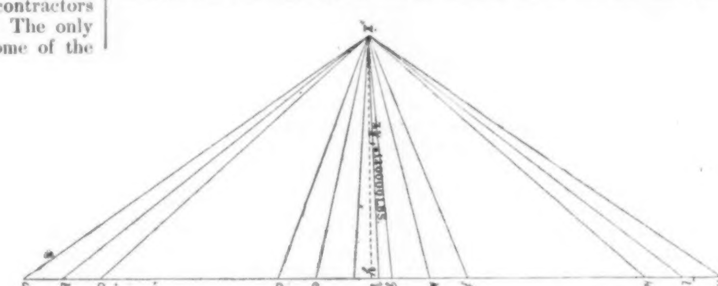


FIG. 202.

[1] Continued from page 84, No. 763.

Spacing flange rivets. We will, therefore, lay out rivets enough, in each flange, between S and the end A to take this strain five times, gradually decreasing the pitch towards the end of girder. We will then carry each plate sufficiently far beyond the length required by curve, to get its respective number of rivets.

Value of each flange rivet. Now the value of rivets ($\frac{7}{8}''$) in flange will be for shearing (single area) $= 4800$ pounds each. For bearing and bending the rivets will evidently get their value from the $\frac{1}{2}''$ plate, this being thinner than the angles, and we have bearing value $= 5250$ pounds per rivet. Either of the above can be found by calculation, or from Tables XXXV and XXXVIII.

rivets in each flange. From S to T we require only 29 rivets, but they will have to be spaced more frequently to comply with the rule for greatest pitch, or Formula (107), accordingly the pitch of the latter should not exceed $= 16 . \frac{1}{2} = 8$ inches.

Figure 207 shows a plan of the top flange of left half of girder. Plate No. 6 might have stopped at S, but is carried two rivets further to avoid breaking under a beam, which rested on the girder at this point. **Splicing the flange.** The splice of plate No. 1 has been made just to the left of R, where plate No. 5 might have stopped; we must, therefore, carry plates Nos. 5 and 4 at least 29 rivets beyond the splice, which has been done. Plate No. 4 might have stopped two spaces nearer R, but for the splice;

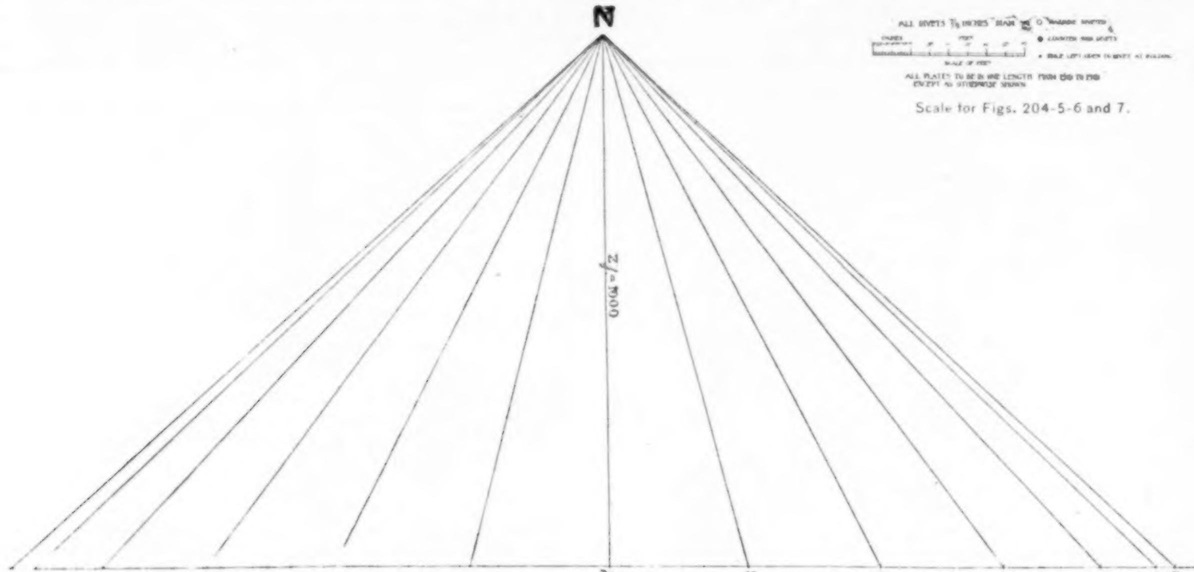


FIG. 203.

Scale for Figs. 204-5-6 and 7.

FIG. 204

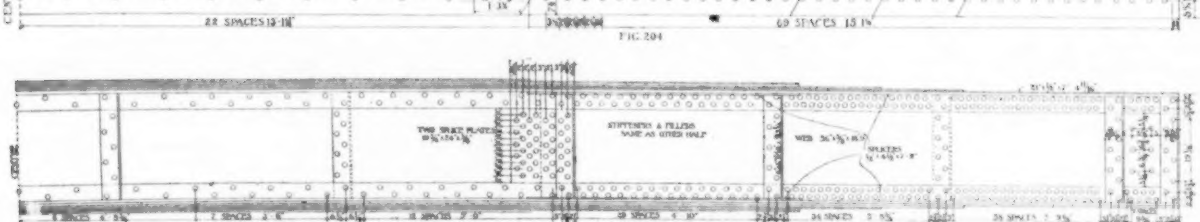


FIG. 205. REAR HALF

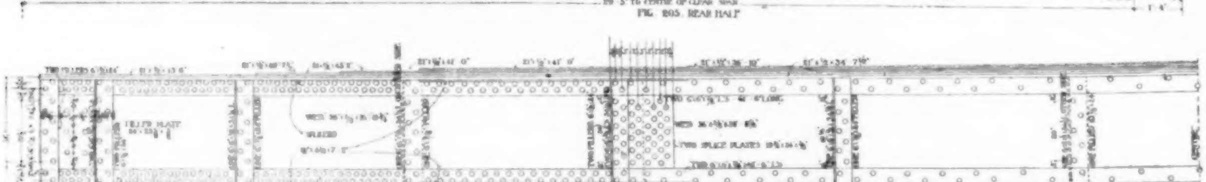


FIG. 206. ELEVATION OF FRONT HALF

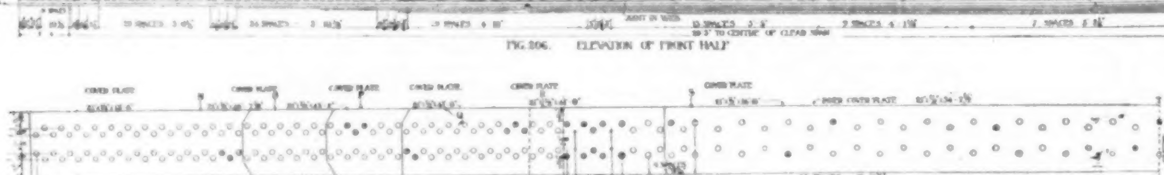


FIG. 207

For bending we have from Table XXXVIII for a $\frac{7}{8}''$ rivet, the safe bending-moment $= 990$ or say 1000 pounds-inch.

The actual greatest bending-moment will be, Formula (25)

$$m = \frac{u . (\frac{1}{2})}{2} = \frac{u}{4}$$

and as the safe

$$m = 1000 \text{ pounds-inch,}$$

we have

$$1000 = \frac{u}{4} \text{ or}$$

$$u = 4000 \text{ pounds.}$$

The value of the rivets against bending — (4000 pounds each) — being their least value, will control the design. Each cover plate therefore requires

$\frac{115500}{4000} = 29$ rivets, and from S to end we shall require 145

Plate No. 3 we stop at the right number of rivets to the left of Q, and plate No. 2 to the left of P. Plate No. 1, which might stop 29 rivets to the left of O, we decide to carry to the end.

The countersunk rivets shown come under beam or column ends. The blank spaces were to bolt column plates to. The blank spaces for beams were marked on later from memoranda in the contractor's shop.

Having detailed our flange, which will be the same both for top and bottom flange, we will now consider the web.

Thickness of web. The size of web we settle from Formula (124) and have for thickness b, assuming that there will be no more than six rivet-holes in any vertical section, or

$$d = 36 - 6 . \tfrac{7}{8} = 30\tfrac{3}{4}'';$$

$$b = \frac{182500}{30\frac{3}{4} . 8000} = 0{,}74$$

or nearly $\frac{3}{4}''$. The web, however, was made $\frac{5}{8}''$ as the above was required only at the one extreme end and through its rivet-holes. The effect of decreasing the breadth of web being, of course, to raise the actual shearing per square inch at this point to a little over 9000 pounds per square inch.

Where stiffeners are required. We next decide where stiffeners are required; we use Formula (127) and have

$$y = \frac{12000.\,\frac{5}{8}.\,36.}{1 + \frac{0{,}0003.\,36^2}{(\frac{5}{8})^2}}$$

$$= 135000 \text{ pounds,}$$

Or we require stiffeners from the end to the point where the vertical shearing is less than 135000 pounds.

By referring to Figure 200, we find this would be about ten feet from the end.

The stiffeners, however, were placed more frequently, as shown in Figure 206, both for looks, and as there was some danger of heavier loads being placed on the centre of girders, which would, of course, increase the vertical shearing near centre. These stiffeners were made of 6″ x 6″ x ½″ angle irons, with 6″ x ⅞″ x 24″ filler plates behind them, so as not to bend the stiffeners. The filler plates being cheaper than would be the cost of blacksmith work involved in bending these angles around the vertical legs of flange angles. Their upper and lower ends were "milled" off and made to bear firmly.

Now as to value of rivets through web, we should have for bearing

Value of web rivets. $\frac{5}{8}''.\,\frac{7}{8}''.\,12000 = 6562$ pounds; for shearing, being in double shear, twice the value previously found for single shear or, $2.4800 = 9600$ pounds; and for bending we have a ⅞″ circular beam of ⅝″ span. The safe bending-moment we previously found to be 1000 pounds-inch, the actual bending-moment is $\frac{u.\,l}{8}$, therefore

$$\frac{u.\,\frac{5}{8}}{8} = 1000 \text{ and}$$

$$u = 12800 \text{ pounds,}$$

Or the value against bending would be 12800 pounds. As the bearing value (6562 pounds) is the smallest we will use that in determining the number of rivets in web.

For end stiffeners we use Formula (125)

Number of rivets in end stiffeners.

$$s = 182500 - \frac{12000.\,\frac{5}{8}.\,16}{1 + \frac{0{,}0003.\,36^2}{(\frac{5}{8})^2}}$$

$$= 122500 \text{ pounds.}$$

Or we should need

$$\frac{122500}{6562} = 18{,}6$$

Or we should need some 19 rivets in the end stiffener, we therefore decide to use a filler plate 24″ x 23⅝″ x ⅜″ each side, which will not

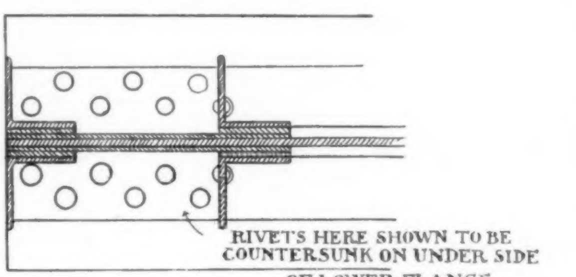


FIG. 208.

only help stiffen the web, but affords us the room to get in the necessary number of rivets, without cutting more than six rivet-holes on any one vertical line. Figure 208 gives a plan of arrangement of web at end.

Number of rivets in central stiffeners. We next take the stiffener located some 4′ 6″ from the end. The vertical shearing here (see Figure 200) is 163000 pounds.

From Formula (126) we have therefore strain on this stiffener

$$s = 163000 - \frac{12000.\,\frac{5}{8}.\,36}{1 + \frac{0{,}0003.\,36^2}{(\frac{5}{8})^2}}$$

$$= 28000 \text{ pounds.}$$

Or we should need

$$\frac{28000}{6562} = 4{,}3$$

or say five rivets, we must, however, locate them oftener, see Formula (107).

Splicing the web. We next decide to splice the web at the point shown in Figure 206, and as shown in plan Figure 210.

The vertical shearing at this point (see Figure 200) is 163000 pounds, we need, therefore, *each side of joint*

$$\frac{163000}{6562} = 24{,}8$$

or say 25 rivets. Including those in the angles, which, of course, help splice the joint, we have 26 each side.

We next settle the size of splice plate by Formula (114). We shall have for its neat breadth

$$b = 24'' - 6.\,\tfrac{7}{8} = 18\tfrac{3}{4}''$$

and have for thickness of splice plates

$$h = \frac{163000}{18\frac{3}{4}.\,12000} = 0{,}72$$

As there are two plates, one each side of the web, we shall make each one-half the above, or say ⅜″ thick, remembering, however, to fill out behind the angle with an additional ⅛″ thick (filler) plate.

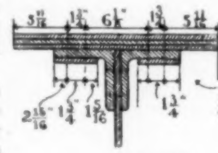


FIG 209.

Number of rivets connecting web and angles. We must next settle the number of rivets connecting the angle and the web.

The vertical through moment of resistance curve (Figure 199) at the centre measures 276″ and the axis $x\,y$ in (Figure 202) we made

$$= 120000 \text{ pounds,}$$

therefore, from Formula (93) the bending-moment at centre, or:

$$m_{\text{centre}} = 276.\,120000$$

$$= 33120000 \text{ pounds-inch.}$$

This divided by the depth will give the horizontal flange strain from centre to end of girder, see Formula (121), or

$$s = \frac{33120000}{36} = 920000 \text{ pounds.}$$

This again divided by the least value of web rivets, which we previously found to be 6562 pounds, gives the total number of rivets required, or

$$\frac{920000}{6562} = 140$$

In reality we have placed 143 rivets from centre to end, so as not to place the central ones too far apart. Again take a point just under the column (or w_{IX}) say fourteen feet from the left reaction. The vertical (Figure 199) measures 225″, therefore bending-moment at w_{IX}, or

$$m_{w_{\text{IX}}} = 225.120000$$

$$= 27000000 \text{ pounds-inch}$$

and horizontal flange strain

$$s = \frac{27000000}{36} = 750000$$

and required number of rivets

$$\frac{750000}{6562} = 114$$

In reality there are only 113 between this point and end, but that is near enough, as it spaces more evenly so. Again, take a point at

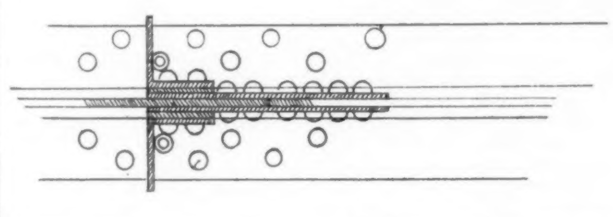


FIG. 210.

the first load to the left, or w_{IX} which is four feet from left reaction. The vertical (Figure 199) measures 75″, therefore bending-moment,

$$m_{w_{\text{XI}}} = 75.120000$$

$$= 9000000 \text{ pounds-inch}$$

and horizontal flange strain to end

$$s = \frac{9000000}{36} = 250000$$

Therefore number of rivets required,

$$\frac{250000}{6562} = 39$$

In reality there are 42 rivets.

Length of bearing on reactions. It will be noticed that in allowing for horizontal flange stress we take all the rivets to the very end of girder, this, of course, is right; although before right through for convenience we have considered the end as at the reaction. The amount the girder will run over the reaction will be determined by the crushing strength of the wall, or pier, or column it is supported by.

In our case we have a bearing 21″ x 16 = 336 square inches, and therefore load per square inch on masonry

$$= \frac{182500}{336} = 543 \text{ pounds}$$

per square inch. This was distributed onto the brickwork by heavy, ribbed, enlarged cast-iron plates.

The only thing remaining to be done now is to figure the deflection.

In Figure 199 we draw the vertical lines, 1, 2, 3, 5, 6, etc., through the moment of resistance curve, the distance between them (l_1) being practically 60″, the first one being a half distance. In Figure 203 we carry down these lengths in succession on line m 1, 2, 3, etc., to a. We select our pole z arbitrarily at a distance

Deflection found graphically.

$$zj = 1000''.$$

In Figure 201 we now construct the deflection curve. The longest vertical is in the centre of girder and

$$= v_1 = 243''.$$

The moment of inertia of the section of the girder at the centre will approximate very closely to 58000 (for exact amount see Table I, section No. 14) and remembering that for built-up plate girders of wrought-iron we must use a modulus of elasticity equal to only 18000000 pounds-inch, we have the central deflection, in inches, of the girder (see Formula 97)

$$\delta = \frac{243.\,60.\,1000.\,120000}{18000000.\,59000} = 1{,}66''$$

The safe deflection, not to crack plastering, would be, (see Formula 28)

$$\delta = 59.\,0{,}03 = 1{,}77''$$

Deflection by Table XLI. Or, our girder is amply stiff. Were we to consider our load as equal to a uniform load of 357500 pounds we could use the approximate formula for deflection given in Table XLI, and should have had

$$\delta = \frac{59^2}{75.42} = 1{,}105''$$

We must add one-half to this for a modulus of elasticity of only 18000000 (the approximate formula being based on 27000000) and would have

$$\delta = 1{,}105 + 0{,}552 = 1{,}657''$$

or the same as by the graphical method.

Deflection found arithmetically. Or, we might have calculated the deflection by Formula (39) again considering the load as a uniform load, and should have had

$$\delta = \frac{5}{384} \cdot \frac{357500.\,708^3}{18000000.\,58000}$$

$$= 1{,}62''$$

Or, practically the same result, and showing how closely the different methods agree. Had we figured the girder arithmetically we should have obtained practically the same results throughout. We should have considered our load as a uniform load of 357500 pounds, which would give us equal reactions, of 178750 pounds each, an error of hardly 2 per cent.

Bending-moment arithmetically. The bending-moment at the centre would be, Formula (21),

$$m = \frac{357500.\,708}{8} = 31638750 \text{ pounds-inch.}$$

The required moment of resistance therefore, would be, Formula (18),

$$r = \frac{31638750}{12000} = 2636{,}5$$

The actual moment of resistance (by section No. 14, Table I) will be found to be at the centre

$r = 2740$ or considerably more than required.

The load, however, is not strictly equal to a uniform load, hence the discrepancy, we should, of course, use the result found graphically, which was based on the actual conditions.

In figuring the girder arithmetically the required moments of resistance at different points along the girder should be ascertained; after which the curve of moments of resistance can be laid out and the flanges, web, rivets, etc., of girder, calculated the same as already explained. If our girder were not braced sideways we should have to calculate for lateral flexure, using Formula (5). For the area a we should take the area of top flange at centre, plus two angles and the part of web between angles. For the square of the radius of gyration we should take the same parts around an axis $M. \ . \ . \ N$ at right angles to flange, or as shown in Figure 211. We omit rivet-holes in this case, for ease of calculation, and as all parts are in compression.

Lateral flexure, top flange.

We have then

$$a = 3.21 + 2.9{,}73 + 6.\tfrac{5}{8}$$

$$= 86{,}21 \text{ square inches.}$$

Now for ϱ^2, not finding the exact section in Table I, we must find the moment of inertia i and divide this by the area.

We have then

$$i = \frac{3.21^3}{12} + \frac{\frac{7}{8}.12\frac{5}{8}^3}{12} + \frac{5\frac{1}{8}.2\frac{3}{8}^3}{12}$$

$$= 2468$$

Therefore $\varrho^2 = \dfrac{2468}{86{,}21} = 28{,}6$

and from Formula (5), l being, of course, the span of girder in inches:

$$w = \frac{3.\,86{,}21\,.12000}{1 + \dfrac{4.\,708^2.\,0{,}000025}{9.}}$$

$$= 1149600 \text{ pounds.}$$

One-third of this would be safe, therefore

$$\frac{w}{3} = 383200 \text{ pounds}$$

would be the safe stress in flanges not to cause lateral flexure, or the safe stress per square inch should not exceed

$$\frac{383200}{86.21} = 4445 \text{ pounds.}$$

The actual stress will, of course, equal the area 86,21 multiplied by the average fibre stress, per square inch. To find the average fibre stress, use the following Formula:

Average fibre stress in flanges.

$$v = \frac{2.\,x.\left(\frac{k}{f}\right)}{d} \qquad (128)$$

Where v = the fibre stress, per square inch, in flanges of plate girders.

Where x = the distance of the centre of gravity of part of flange being strained — (flange, angles and part of web between them) — from the centre of depth of web, in inches.

Where $\left(\frac{k}{f}\right)$ = safe modulus of rupture, in pounds, per square inch, or stress on extreme fibres, in pounds per square inch.

In our case this distance x would be found by rule given on p. 7, (Vol. I), and would be (see Figure 211)

$$x = \frac{21.3.\,19\frac{1}{2} + 12\frac{5}{8}.\frac{7}{8}.\,17\frac{9}{16} + 2\frac{3}{8}.\,5\frac{1}{8}.\,14\frac{9}{16}}{86{,}21}$$

$$= 18{,}63$$

Therefore the average fibre stress from Formula (128)

$$v = \frac{2.\,18{,}63\,.12000}{42}$$

$$= 10645 \text{ pounds.}$$

The actual total compressive stress on flange will therefore be

$$= 86{,}21\,.10645$$

$$= 917705 \text{ pounds.}$$

This result should, of course, be the same as our horizontal flange stress, previously found, and by referring back, we see that this was practically the same (920000 pounds.)

Our actual compressive stress we see therefore is about two and one-half times larger than the safe stress to resist lateral flexure as found above (383200 pounds.)

We should therefore, either brace the girder sideways — which was done by the beams in our case — or we should have to broaden the top flange.

Wrinkling of flange. We can readily see that there is no danger of wrinkling in so heavy a flange, but did we wish to calculate it, we would do so by Formula (4) or Table III.

A new deep beam. Since the publication of Table XX, the Homestead Steel Works of Pittsburgh (E) have begun rolling 24″ deep steel beams from 240 to 300 pounds per yard in weight.

The data in regard to these beams is as follows:

	Depth of beam (d)	24″	24″
	Weight per yard	300	240
	Width of flanges (b)	7,20	6,95
	Thickness of web	0,75	0,50
	Area of each flange	6,83	6,55
	Area of web	16,34	10,90
	Total area (a)	30,00	24,00
Neutral axis normal to web.	Moment of inertia (i)	2349,00	2061,00
	Moment of resistance (r)	195,75	171,75
	Sq. of rad. of gyration (ϱ^2)	78,30	85,88
	Transverse value (steel)	1958000	1718000
Neutral axis parallel to web.	Moment of inertia (i)	47,13	41,65
	Moment of resistance (r)	13,10	12,00
	Sq. of rad. of gyration (ϱ^2)	1,57	1,74
	Transverse value (steel)	131000	120000

LOUIS DECOPPET BERG.

(To be continued.)

THE McLEOD HEATING AND VENTILATING SYSTEM.

THE fertility of the field of heating and ventilation for the growth of invention under the cultivation of cranks is great. The inventions include anything from a furnace-damper guaranteed to revolutionize the force and economy of combustion to complete systems for supplying, warming, distributing, circulating and discharging air for room, building, or territorial ventilation.

The claims and counter-claims of rivals confuse the public and disturb its confidence, and its experience in connection with such inventors and their inventions is too generally disappointing, if not exasperating. Hence the growing demand that claimants show their scientific credentials if they would seek public attention and confidence. This in turn gives rise to the desire on the part of the class of inventors named to obtain such recognition on the part of scientific societies or journals as shall meet the public demand, and also to the temptation offered them to induce editors to rate inventions by pecuniary rather than scientific standards.

The public good, as well as the reputation of science among the laity, calls for the strictest integrity and the frankest dealing in treating with such applicants. Let them address the public, if they will, through the advertising or other columns of a scientific journal, but let them understand that those same columns are open to the challenges which such declarations may provoke, and that intelligent criticism is as much desired and sought after as are the papers originally presented. The expectation of rousing a challenger would keep many an inventing adventurer from posing among the columns of a scientific journal, and save the community from his depredations, innocent or designed.

In keeping with such sentiment the following discussion is offered on a paper in the *Scientific American*, issue of July 19, describing the "McLeod Pneumatic System of Heating, Ventilating and Cooling," etc. Among its claims are, first: a centrally located furnace capable of extracting all the heat from combustion gases; second: the warming of rooms, buildings and blocks by means of radiators heated by a flow of hot air from such furnaces, rather than by the circulation of steam or hot water; third: the ventilation of such apartments by a blast from the air conduit; fourth: the distribution of such air to blocks of houses through sub-way conduits, etc.

In connection with these proposals and claims the following considerations suggest themselves:

First. The furnace is doubtless more of a possibility than a desirability. Given heating-surface enough, properly exposed, "all the heat" may be extracted from the combustion gases, but when that is done, what is to be the draught power of the chimney? In the absence of a heated chimney mechanical means must be employed to effect a draught. Further, as will be later shown, the working of the proposed system will not admit of such cooling.

Second. Heating radiators by a current of hot air forced through them is not impossible. But when one pound of steam at 241° condensed to water at 241° yields nearly one hundred times as much heat as the same weight of air cooled from 241° to 200° would yield, and when the steam has within itself its own propelling power while the circulation of air can be effected only by a powerful fan driven by a steam, electric or other motor, and when pipes some ninety times as large in cross-section are required for the air as for the steam if moved under the two-pounds-pressure difference proposed, and in the proportions indicated, what compensating advantage can be imagined for hot air over steam? Certainly none in compactness of apparatus, nor in the cost of its construction, nor in the economy of its use.

Take for example the single item of the power required for the air circulation through a "pneumatic system" suited to a single building of moderate size, say of 80,000 cubic feet capacity or such as would be heated by 800 square feet of direct radiating steam surface. That surface, under average working conditions, would yield some 250,000 thermal units of heat an hour. The volume of air cooled from 241° to 200° required to yield that heat quantity would be about 500,000 cubic feet per hour, or 140 cubic feet per second. If this air is moved against a pressure of two pounds per square inch at the fan the work in horse-power required becomes $\frac{2\times144\times140}{550} = 73$ horse-power. Add to this the inefficiency of fan-work, and the power expended in the *vis-viva* work, the total power required would exceed 100 horse-power. If the air is simply rotated under a pressure maintained independent of fan action, the work required must be large. To move 140 cubic feet of air per second through a straight pipe 300 feet long and 9 inches in diameter would require a pressure at the fan of 6 pounds per square inch.

The air is supposed to be rotated through the system, and since on its return to the heater it must still have a temperature of 150° to 200°, it is difficult to see how *that* air can be made to absorb "all the heat" from the combustion gases. To maintain heated radiators, the air within them must have a much higher temperature than steam or water for maintaining the same radiator temperature, because the radiator takes a mean between the temperatures of the air outside and inside, except as the activity of the inside currents operates in favor of elevating the radiator temperature. Hence, if the temperature of the radiator is to be 200°, and the air outside is 70°, the inside temperature, but for the activity of currents, would have to be 200+(200—70)=330°. It would therefore be necessary to return the air to the heater quite hot, so making a large extent of surface in the furnace necessary, or else an abnormally large radiator on the return end of the circuit.

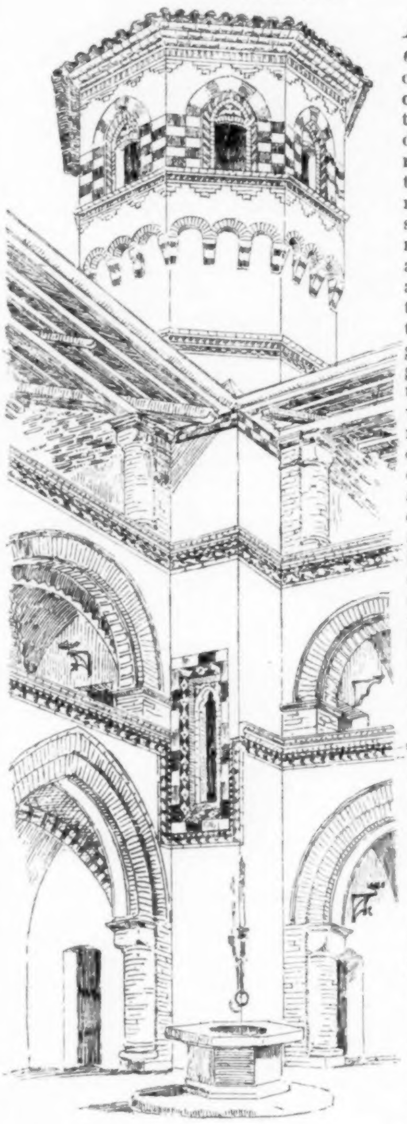
Third. For ventilation it is proposed to tap the pipes containing the compressed air which convey heat to the radiators. The extent to which ventilation could be carried by supplying air hot enough to heat radiators is a matter of easy computation. Effective ventilation demands large air volumes at low temperatures. Ventilation may perhaps be satisfactorily effected by the use of small air volumes at high temperatures, especially when the effects are reinforced by the noisy breeze of a blast of air escaping under two pounds pressure to the square inch. The nature of this blast is a sufficient explanation for the seeming indecorous wearing of his hat by the gentleman shown in the illustration in the *Scientific American* as being fanned by the ventilating current.

Fourth. If the circulation of air through the "pneumatic system" of a single building offers such mechanical difficulties as have already been noticed, as well as others unnoticed, the more involved problem of supplying a large number of buildings from one central furnace is further and more hopelessly difficult, because of: (1) The power expenditure necessary. (2) The impracticability of providing uniform pressures throughout the system, or maintaining a constant pressure on any part of it. (3) The exceedingly imperfect duty which can at best be had from a system designed to meet the many and varied requirements of heating and ventilation by one air-supply at any fixed temperature.

Ingenuity in the planning of the McLeod system is not denied, but no small degree of ingenuity is required to plan a monstrosity.

S. W. WOODBRIDGE.

SOME CONSIDERATIONS CONCERNING COLOR AND COLORING.[1]



Tower of the Casa di Pinerolo, Turin. From *Teknisk Tidskrift.*

DISTRIBUTION and Balance of Color. — When the constituents of a set of colors to be associated together have been decided on it still remains to determine their sequence and the relative areas they shall occupy. Triads may be made disagreeable or pleasant by altering their distribution or their proportions. The triad red, gold, blue affords as good an illustration of this fact as we could wish. If we make the red and blue come into contact throughout the design in equal areas, and if we then spread over the surface a spray of gold foliage in such a way as to employ, in masses of considerable extent, just as much gold as red and as blue, the result will be crude and unsatisfactory. But we may develop the varied beauties of which this group is susceptible by modifying the arrangements and proportions of its constituents in scores of different ways. Let us devise one such way, of which the plan shall be — separation of the blue and red by gold, and the use of these three chromatic elements in the ratio 7: 3: 1. So we make our blue ground cover 7-11ths of the area to be decorated; our arabesque and its curves, or our spray and its foliage, will be of red, 3-11ths, bordered throughout with gold, 1-11th. I need not tell you how much we may modify and improve the result by the beautiful curves of our spray, and by half entangling patches of the ground within its borders. And this end may be reached by many other methods which I cannot stay to describe.

One tetrad will serve to illustrate these matters of arrangement and proportion. The example is taken from an early Irish illuminated missal. The four elements are silver, gold, red and black. The proportionate areas are 4: 4: 1: 1. Silver and gold quatrefoils alternate. They are bordered by red in the form of a line of uniform breadth; the residual space is covered with black, but this is broken up into such small portions that it does not look heavy, while the continuous red outline serves at once to bind the whole

[1] A Cantor Lecture by Professor A. H. Church, M. A., F. R. S.

design together, and to prevent too strong a contrast of tone between the black and gold or silver. You will be able to think of many an arrangement of these four elements which would prove less felicitous, and doubtless of others equally good.

It will be easy to carry out the principle of the "dominant hue" by modifying the area of the elements in our triads. In this way one of our "cold" triads, such as bluish-green, violet, red ochre, may be made "warm." In such a case we shall have to increase greatly the area occupied by the red ochre, and to proportionately diminish that of the other two elements of the group. We may, for instance, prepare a large design of foliage of red ochre upon a ground of bluish-green, separating these two colors by a contour line of violet, adding perhaps some fine veins of violet to our large leaves. But it must be noted that such arrangements often become easier and more pleasing when we are at liberty to introduce a fourth element, even if that element be but white or other neutral.

A fine old Rhodian tile in my collection affords a case in point. It has a ground of a red-ochre hue occupying 5-10ths of the whole area. Upon this a design of white foliage, highly conventionalized, spreads in a connected and symmetrical fashion, and covers 3-10ths of the surface. The remaining 2-10ths are shared between a full blue and a slightly bluish-green in nearly equal proportions. These colors are distributed upon the white portions of the design chiefly in the form of veinings. There is also a fifth but inconspicuous element in the chromatic scheme, namely, a delicate contour line of deep gray. The effect of the whole arrangement depends upon the dominant red hue of the ground, but this is refined and lightened by the net of white foliage, which, in its turn, gives strength and purity to the graceful curved forms of blue and green which it encloses. The uses of color-schemes, in which a dominant hue is present, are frequently of the utmost importance in hangings, paper and wall-decorations. These have to perform the office of a background, and to set off one or more conspicuous chromatic elements in the room. If you want to display properly some fine pieces of blue and white porcelain, your walls must not be so colored as to interfere with their effect, but rather to enchance it both as to tone and hue. A flat buff or gray may make your porcelain too conspicuous; a bright blue and a pure white will clash with it; a strong red will overpower it. A scheme of coloration which in its totality produces the effect of a grayish olive-green, half-way in depth of tone between the white and the blue of your vases, will probably be found to answer well. When it is not desired to direct attention specially to the colors of the objects in a room, then it is allowable to gather into certain parts of your wall-decoration the more telling of the chromatic elements which enter into its composition. You accentuate the design by focussing the more saturated and luminous colors in the more important parts of the design.

From what I have stated thus far I think it will be evident that, even if we could attain such a chromatic balance as would produce a true "neutralised bloom" on our walls, or in the carpets on our floors, we should still have left out of our scheme the more important chromatic elements belonging to our movable furniture and ornaments. In fact, the system of contrasts of hue and tone—contrasts more or less subdued—is the only one by which a real unity of effect can be reached; at the same time that due prominence and relief are secured for those parts or objects where prominence and relief are needed.

Returning once more to our triads, I would mention a principle of arrangement often adopted with success, namely, the separation of two nearly related tones by a tone which is darker or lighter. Sometimes this sequence brings together chromatic elements which clash, and of course, it must then be avoided. Still, the rivalry of two colors having the same degree of brightness is frequently unpleasant, especially where they are both strong. The triad of full red, gold, full blue illustrates these observations. The use of a triad of three full colors is rarely successful, and can no more be tolerated than the presence of three trees of equal size and equal prominence in a landscape picture. Where three colors having three decidedly different tones are used in one scheme we are almost compelled to arrange them in the order of their depth — dark, medium, light. You will, I think, excuse the elementary and fragmentary character of all these remarks of mine on distribution and balance of color; no one can be more conscious of their imperfection and of their commonplace character than I am.

Counterchange and Interchange. — In heraldic coloring the principle of counterchange is frequently adopted. Ermine is white spotted with black; counter-ermine, black spotted with white. Suppose a shield of arms divided diagonally from right to left, and bearing a star. Where the field is azure the star is argent; where the field is argent the other half of the star is azure. In the latter half of the eighteenth century the same arrangement was adopted in textiles and embroideries, great skill being shown in the passage from a design, say, of red upon a blue ground to the same design in blue upon a red ground. I have noticed that in the more successful of these counterchanged patterns the areas occupied by the pattern and the ground are about equal. When these designs were executed in "cut" work there was no loss of material, for the pattern cut out from one part of the design formed the ground of the next. In the cut clothwork of Resht in Persia a similar mechanical method of procedure was adopted, but the counterchanges were not effected in the same piece.

The principle of interchange may be illustrated by the alternation of a set of tones of greenish yellow with a corresponding set of tones of violet. These tones may be so arranged that the series begins with the deepest tone of each color alternated, the rest following in regular sequence, or the deepest tone of one color may be followed by the lightest tone of the other, and so on; but a satisfactory effect is difficult of attainment.

Colors of Minerals. — I have time to refer to a very few only of the characteristics of colored minerals. The colors of some of the most beautiful precious stones are in a measure dependent upon the phenomena of dichroism which they exhibit. The ruby, sapphire, emerald and tourmaline may be named in this connection. Quite apart from the prismatic decomposition of light which these gems effect when faceted, they show, with more or less distinctiveness, the twin colors of dichroic bodies. The ruby exhibits in the same stone a pure red and a crimson or carmine-red; the sapphire a straw-yellow and a pure blue; the emerald a bluish-green and a pure green; and the tourmaline broken tints of yellowish-green and reddish-brown. No monochroic substance, such as paste, enamel or glass, can give rise to the variable fluctuations of color seen in these dichroic gems. The peculiar chatoyancy of Labrador spar has also not yet been imitated in any artificial material. The beauty of lapis-lazuli and of many agates and jaspers is no doubt partly dependent upon the pulsing of the colors they exhibit, partly upon a certain measure of translucency which they possess. This quality of translucency is also seen in many marbles, especially when they are polished; its absence from some artificial materials (such as terra-cotta) is perhaps one of the reasons why it is difficult to associate the two classes of materials together with satisfactory effect. When both are in small pieces, and especially when they all receive together the same polish, the incongruity in question does not attract notice. The tesselated Roman pavements found in this country often afford excellent illustration of this harmonizing of natural with artificial materials — marble and stone with pottery and even glass.

The picturesque colored markings and veinings of many marbles are best developed by polishing, and best seen in surfaces of considerable size. If these surfaces are not plane, their curvature should not be complicated with flutings or other sculptured treatment. A carved ornament in such marble is a mistake, at least whenever the colored markings are decided. Man's art in relief spoils nature's decoration in color. For this reason the carved work in Derbyshire alabaster, for which the late Sir Gilbert Scott showed so much partiality (witness many a reredos which he designed) is most unsatisfactory. Over and over again a dark veining makes a prominent part of the carving appear to recede, while a bright and pale patch throws a hollow or recessed detail into conspicuous relief.

Pictorial and Decorative Art. — It has often been pointed out that color is an end in decorative art, a means in pictorial. This almost amounts to saying that decorative color is without meaning; expresses neither the ideal nor the real. I cannot but think that this view is far from being correct. Let us contrast and compare the coloring of a landscape and that of a decorative fabric. In the picture great use is made of gradation of tone and hue, in order to represent atmosphere, the play of light and shade, and different planes; the artist, moreover, is restrained in his use of full and saturated colors, nor does he attempt to represent all he sees, but makes such a selection of the materials at his disposal as, without violating nature, shall best serve to realize his impression of the scene. Form is with him of equal importance with color, while symmetrical arrangement and repetition of similar elements are never made evidently conspicuous. The designer of a fabric, one, say, for use as a curtain, avoids the use of those contrivances by which the flatness of the surface would be destroyed; gradation of hue and tone, though admissible, plays a quite subordinate part in his work. He is at liberty to use the most saturated and intense colors, provided only he can so employ them as to produce a pleasing harmony, and at the same time be in accord with the nature of his material and the purpose to which his design is to be put. Moreover, the decorator selects, as does the landscape-painter, but he rejects much more than he absorbs. To nature he goes for motives, but individualization assumes the last place, generalization the first. Form and color are not with the decorator of equal moment, — sometimes the former being paramount, sometimes the latter. Usually, the less pronounced his color the more dependence does he place upon his form, although in complex chromatic schemes also he has often to rely greatly upon trenchant contours in order to avoid confusion. The notion that bad or weak drawing is permissible in decorative art ought not to be accepted for one moment. The very fact that the boundaries between two colors in ornamental designs frequently need to be sharply accentuated by means of well-defined outlines should suffice to demonstrate the necessity of thorough draughtsmanship. And, lastly, the decorator makes large and frequent use of symmetrical and repetitive arrangements.

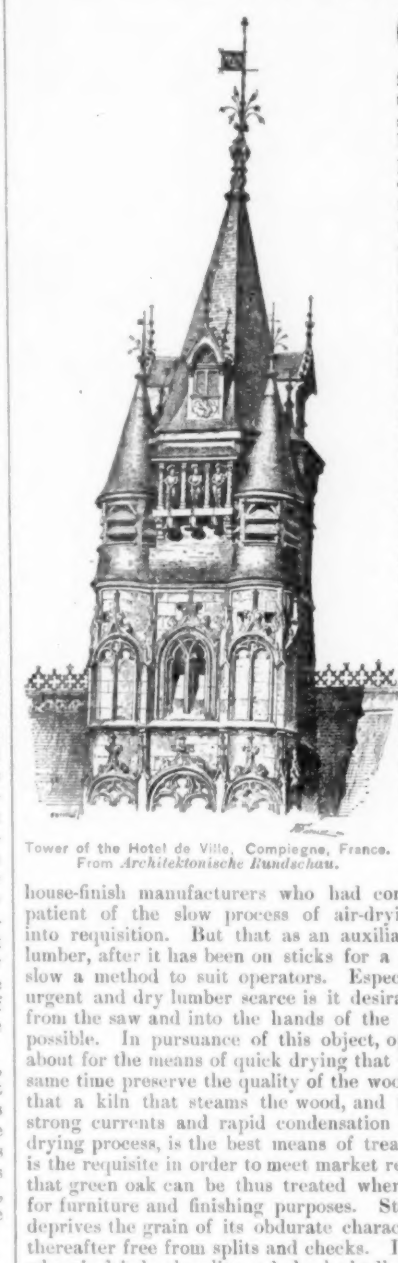
If I am right in this comparison and contrast, then the distinction between decorative and pictorial work is, like many another distinction in the domain of art, one of degree rather than of kind, quantitative rather than qualitative. The same elements are at the disposal of the decorative and of the pictorial artist, but they must be employed in different proportions. And here I am in accord with the view that there are an infinite number of possible transitions between the coloring that is most fully pictorial and picturesque, and the coloring that is most purely decorative or conventional. Much, but by no means all, of Japanese decorative work in color illustrates some of these transitional forms.

Color in Relation to Sculpture. — In the very few words on this subject for which I can find time I should wish to draw your attention to these two points, namely, the surroundings of sculpture in relation to its color, and the material of sculpture in relation to its color. It seems to me that when sculpture is destined to form an integral part of an architectural scheme, its tone and its hue must not be such as to interfere with the unity of the plan, but rather to enrich and vary it. And it may easily happen that an association of sculpture in marble with an edifice in stone may be harmonious when both marble and stone are fresh, but may in course of time accord less happily, as the latter darkens with age much more considerably than the former. The same effect is produced when a glaring white marble monument is intruded into a building deeply toned with the rich warm gray of centuries. So, on the other hand, a statue in bronze may be too deep in tone to harmonize with new clean-cut stone, but as years pass the startling difference between them will abate. The case is different where the building and the sculpture it contains are not intended to fuse into one organic whole. Under such circumstances, the building must be subordinated to and even contrasted with its contents; it becomes a background so colored and so arranged as to emphasize the statuary it protects; and in considering the vexed question of the artificial coloring of works in sculpture, it will be well to glance for a moment at the four chief kinds of material out of which such sculpture is generally wrought. These materials are terra-cotta, bronze, stone and white marble. It will be owned that the critical eye accepts without hesitation the refined coloring which the exquisite terra-cotta figures from Tanagra still so frequently retain, as well as the varied hues of the patina on statues in bronze. In the latter case we go so far as to dislike what may be called the natural hue of the metal, unless it appears to a limited extent only in such parts of a figure as might be supposed to have lost their artificial or altered surface color by a process of attrition. But when we leave artificial materials and pass on to those which are natural our attitude as to the problem of coloring differs. While there seems to be an innate congruity between artificial materials and artificial coloring, natural materials lend themselves less readily to chromatic treatment. Perhaps there are here two causes at work, one being our satisfaction with and appreciation of the natural beauty of the tones and hues of native substances, the other being the difficulty of bringing our added coloration into harmony with that which is natural. This view is supported by the observation that the addition of color to the rarer and choicer materials, such as statuary marble, is more generally resented than the similar treatment of the commoner and less interesting kinds of stone. But is there not a third and more potent cause? Does not pure white marble, with its slight translucency and its beautiful crystalline texture, lend itself so perfectly to the presentation of ideal forms that even the faintest suggestion of realistic color may look like sacrilege, and may only too easily lapse into vulgarity?

In architecture, too, the poorer and less interesting the material, the more useful does the addition of artificial color become. Yet it may serve, on the one hand, to emphasize the poverty and weakness of bad contours and mouldings, though, on the other hand, it may be made to accentuate and to ennoble forms which are in themselves beautiful. Its distribution and arrangement are as important as its tone and hue. It may destroy the unity of an architectural scheme, or it may serve to fuse discordant or fragmentary elements into one harmonious whole.

MAORI ARCHITECTURE. — In his recent novel, "*Nation Making,*" a description of Maori architecture is given by Mr. J. C. Firth, one of the early settlers in New Zealand. The Maoris built their council houses of large size, and enriched them with much carving and paint. One that was 150 feet long, 45 feet wide, and covered with a high roof, with eaves reaching nearly to the ground and a porch at one of the ends, is described as follows: "The front gable was ornamented by deep barge boards, boldly and richly carved in open scroll work, the terminal at the peak of the gable being the figurehead of a renowned ancestor of the tribe, the face tattooed with the *moko* (tattoo, practically the 'tartan') of the tribe. Within the porch were a low doorway and two small square openings to admit light and air, closed when required by sliding panels. Six massive posts, twenty-five feet in length, running down the centre, supported the heavy roof tree. From the roof tree rafters, usually six feet apart, came down to a heavy wall plate, this being supported by carved, massive wooden figures, six feet apart, each representing an ancestor, and every face tattooed with the *moko* of the tribe. These figures were carved in a grotesque, sometimes in a hideous, manner, but, considering the rude implements employed, not without great artistic skill and boldness. Every face wore a strange, placid gravity, almost Egyptian in character. The eyes were represented by pieces of muttonfish shell like mother-of-pearl, the usual three-fingered hands resting on the breast; the walls between the carved figures were filled in with reeds, plain and colored, arranged in various patterns. The spaces in the roof between the rafters were filled with fronds of the *Nikau* palm, and were blackened with the smoke of many council fires." — *N. Y. Times.*

SEASONING OAK WOOD.



Tower of the Hotel de Ville, Compiegne, France. From *Architektonische Rundschau.*

OAK has always been considered a slow wood to get ready for market and consumption, and difficult to season on account of its liability to check in that process. For this reason dealers in this wood have not been able to handle it rapidly, and have been obliged to use much care in piling and shipping so as to prevent depreciation in value. Owing to this, dealers in oak have calculated to hold a sufficient margin between the buying and selling price to insure a fair profit. They have always insisted that there was so much loss in grading and the depreciation of stock, and the stuff had to be carried so long before being sold, that anything less than an average of $5 a thousand between the mill and yard was considered inadequate.

Within two or three years, or since oak became so largely used for furniture and finishing purposes, there has been an increased urgency toward handling stocks more rapidly than previously. Consumers who had large lines of goods to turn out and keep on the market, and house-finish manufacturers who had contracts to fill became impatient of the slow process of air-drying, and brought the kiln into requisition. But that as an auxiliary in the finishing off of lumber, after it has been on sticks for a few weeks, has become too slow a method to suit operators. Especially when the demand is urgent and dry lumber scarce is it desirable to get lumber forward from the saw and into the hands of the manufacturer as quickly as possible. In pursuance of this object, operators have been looking about for the means of quick drying that will be effective and at the same time preserve the quality of the wood. It is claimed by many that a kiln that steams the wood, and that at the same time, by strong currents and rapid condensation of moisture, completes the drying process, is the best means of treating hardwood when speed is the requisite in order to meet market requirements. It is claimed that green oak can be thus treated where the lumber is to be used for furniture and finishing purposes. Steaming prevents checking, deprives the grain of its obdurate character, and the wood remains thereafter free from splits and checks. It is argued that the reason why air-dried oak splits and checks badly is because it becomes dry and case-hardened on the outside, while the inside is still green. Before the moisture escapes from the dry and hard exterior it forces the grain apart, resulting in the defects named. Splits and checks will close up when the lumber becomes perfectly dry, but that requires a long time, as every handler of hardwood knows. While the dealer is waiting for his lumber to recover its normal state, the interest on the money invested, and the other expense of carrying, is working against the dealer's profits.

Men of experience in the handling of hardwood logs and the manufacture of lumber know that when logs are long soaked in water they turn out much better sawed stock than those that are not thus treated. Logs that float in the streams long distances to the mills, and remain months in the water, produce excellent lumber that sells higher than dry land stock, in case the purchaser knows the difference between the two kinds. "Water oak," as that from soaked logs on the Ohio is called, is always held in high favor. It is claimed that inch lumber cut from a log thoroughly soaked can be dried ready for the consumer, or for shipment, in thirty days. It is also claimed that it does not split or check so as to be at all troublesome. This assumption can probably be fully substantiated. Granting this, it suggests a way whereby the quality of oak can be improved, and the handling of sawed product can be greatly accelerated. In every case where a reservoir can be secured contiguous to a mill, it should be a depository of logs held in reserve for sawing. Of course, small operators, remote from water, and depending largely on portable mills, cannot for a moment consider the log-soaking process. But they can do this when sufficient water is available — soak their lumber thoroughly before it goes into pile. It makes but little difference whether product is soaked in the log or after it has been converted into lumber; the result is about the same. Soaking logs and lumber, and steaming in the kiln have much the same effect on the lumber, and it is altogether beneficial. Thus operators have means, adapted to their various situations and capacities, to treat their lumber so as to prevent depreciation of quality, add to its workable value, and hasten the process of preparation for market. —*Northwestern Lumberman.*

PROPOSED CANADIAN SHIP-RAILWAY.

"All the Modern Improvements."— No. 17.

CANADIANS have proposed many schemes for a short cut from inland centres to the Atlantic seaboard, including some half-a-dozen railways to connect with a generally port-bound harbor at Hudson's Bay, but none appear so plausible as an old project recently revived to connect Lake Huron with Lake Ontario at Toronto.

The project, which is by no means a small one, and which is being discussed in Canada just now with a great deal of interest, if carried out would have a serious effect on the traffic of the railways operating in the Northwestern States; and Canadians who are at all posted on the matter do not hesitate to claim that, if properly utilized, the natural routes from the West to the Eastern seaboard through Canada can offer facilities for the movement of freight incomparably superior to those through American territory. Engineer Corthell, of Chicago, is of the opinion that Canada has "one of the best possible locations for a ship-railway, and also one where an immense saving would be effected for commerce."

The distance between Lake Ontario and Georgian Bay, Lake Huron, from the mouth of the River Humber, west of Toronto, where the ships would leave the railway, is sixty-nine miles. The elevation at the highest point in the ridges that the railway would have to pass is 664 feet above the level of Lake Ontario. The heaviest grade south of the ridges would be thirty feet to the mile, and north of the ridges seventy feet to the mile, the greatest portion having easy grades to the summit, where the railway would cross, the ridge being only 327 feet above Georgian Bay.

The ship-railway would cross five railways on the way to Toronto, over which viaducts would have to be constructed. There would be lift-locks 270 feet in length, 35 feet in width, 14 feet in the sills and 50 feet in height, with protecting harbors at each terminus and four turn-tables at certain points along the route, to enable vessels to pass each other, similar to railroad switches, but without curves. There would be three railway tracks of the ordinary gauge, but the rails would be from 100 to 110 pounds per lineal yard. The total cost is estimated at $12,000,000, being one-half the cost of a ship-canal of the same capacity.

The ship-railway, when constructed, would be sufficient, with three large locomotives, to transport a vessel of 2,000 tons weight, including vessel and cargo, or more than 1,000 tons register, at the rate of ten miles per hour, or seven hours for sixty-six miles. On an ordinary railway, this distance would probably take four hours, and it would require five locomotives with trains of twenty cars, holding ten tons each, to convey 1,000 tons from lake to lake.

In the case of the ordinary railway, two trans-shipments would be required, but the ship-railway would save that expense. These facts are the result of careful calculations made by the late Captain Eads. Such a ship-railway as proposed would save 428 miles of lake navigation, and 28 miles of canal between Chicago and Montreal. In addition to the saving in lake and canal navigation that would be accomplished, there would be the additional advantage, which now exists, of a water-passage for grain from the Northwest to the seaboard by the St. Lawrence canals, rather than by way of Buffalo, where the grain frequently becomes heated on the way to the seaboard.

It is thought, if the Dominion Government can be induced to grant a subsidy for the construction of the proposed Hurontario Ship Railway, that capitalists could be easily found who will undertake the work. By this route, a propeller leaving Chicago would reach Montreal or even Quebec before it would reach Buffalo, and at least three days would be saved between Chicago and the Atlantic seaboard, with the additional advantage of reaching an Atlantic seaport some hundreds of miles east of any port by way of the American routes. The old project of a ship-canal between Lakes Huron and Ontario is almost lost sight of now in the discussion of the more practicable scheme for a ship-railway. Montreal, Toronto and other Canadian cities are fully alive to the importance of the project, and, if it soon assumes definite shape, these cities will doubtless give it hearty support.—*N. Y. Star.*

The ILLUSTRATIONS

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

LA MAISON DU DIABLE, MALINES, BELGIUM.

[Gelatine Print issued with the International and Imperial Editions only.]

THE probability that a town famous for its [Mechlin] lace, and at one time exceedingly prosperous, would have architectural remains of interest caused the inclusion of this town in the itinerary, which had been planned before our expedition set out; but when the "parting of the ways" was reached, there were so many attractive possibilities on all sides, that it became questionable, whether to follow out the programme or depart from it. What decided the matter in favor of keeping on was finding in a Brussels shop a photograph of this group, and it seemed plain that if this were a fair sample of the buildings to be found in Malines, it was not a place to be neglected. Arriving at the town the first duty was to ascertain what the place contained, where the interesting buildings were and how they were situated with reference to the light. Unfortunately, a start was made in the wrong direction, and the results of a two hours' tramp was a feeling of disappointment: the town appeared to have not much of interest, and the particular group sought was finally decided to be in some other town; but just at dusk a more attractive quarter of the town was penetrated, and here the quondam home of his sulphurous majesty was found. Which of the three houses, in this interesting group, the Devil inhabited is not clear: not the one at the corner, evidently, for in the window-heads of the two lower windows are faïence, or painted stucco, bas reliefs which chronicle scenes in the Garden of Eden, which in spite of the nudity of the figures, would hardly be the decorations one would expect to find upon the house owned by such a master.

MEMORIAL OF THE SIEGE OF VIENNA TO BE ERECTED IN THE CATHEDRAL OF ST. STEPHEN, VIENNA, AUSTRIA. PROFESSOR EDUARD HELLMER, SCULPTOR.

SEE article on "Equestrian Monuments," elsewhere in this issue.

THE HOLLAND HOUSE, NEW YORK, N. Y. MESSRS. HARDING & GOOCH, ARCHITECTS, NEW YORK, N. Y.

NEW BUILDING FOR THE *Mail and Express*, NEW YORK, N. Y. MESSRS. CARRERE & HASTINGS, ARCHITECTS, NEW YORK, N. Y.

THE façade of this building is to be of white marble.

HOUSE FOR DR. W. T. BOLTON, BATAVIA, N. Y. MR. OTIS DOCKSTADER, ARCHITECT, ELMIRA, N. Y.

[**Additional Illustrations in the International Edition.**]

CAFÉ-RESTAURANT, VIENNA, AUSTRIA.

[Gelatine Print.]

SALCOMBE CHURCH, DEVON, ENG. MR. J. D. SEDDING, ARCHITECT.

OLD MEETING-HOUSE, MANSFIELD, NOTTS, ENG. MR. LOCKE WORTHINGTON, A. R. I. B. A., ARCHITECT, WESTMINSTER.

THROUGH the kind liberality of the late Mr. William Hollins (who unfortunately passed away before the works were completed), some extensive alterations have been effected in the picturesque interior of the Old Meeting-House, Mansfield, Notts. Rich oak fittings have been fixed throughout the church of the best native seasoned wood, and the roof has been richly panelled and moulded, the walls recemented, and windows and doors richly moulded. Stained-glass has been placed in all windows. Expense has not been spared in the use of ornamental tiles and wrought-iron fittings of the best description.

GARDEN ENTRANCE TO COUNTRY HOUSE.

DESIGN FOR ASSEMBLY AND CLUB ROOMS FOR THE MOSELEY UNITED QUOIT AND BOWLING CLUB. MESSRS. ESSEX & NICOL, ARCHITECTS, BIRMINGHAM.

IN our illustrations this week we give the design for this new building, which was submitted in limited competition. The conditions required that a set of assembly-rooms and club premises be provided for the sum of £3,000. These designs, in addition to the requirements stipulated, provided for the rooms being used for Masonic purposes.

THE SUMMER ROOM, CARDIFF CASTLE, WALES. W. BURGES, A. R. A., ARCHITECT.

THE PERISTYLE IN LORD BUTE'S TOWER, CARDIFF CASTLE, WALES. W. BURGES, A. R. A., ARCHITECT.

DESIGN FOR COUNTY COUNCIL BUILDINGS, LONDON, ENG. MR. E. RÜNTZ, ARCHITECT.

WE have already published a general view and plans of a design for the offices of the London County Council, on the site upon the Thames Embankment, which is undoubtedly the most eligible in the metropolis for the purpose. This week we give a view of the principal court and part of the front elevation, which by themselves will indicate the character of the design.

COLONEL WARING ON TRAP VENTILATION.

A MONTH or so ago, Colonel Waring, who had been called in to advise the city of Columbus, Ohio, in the matter of certain sewerage works in process of construction, explained his views to the citizens assembled in the Board-of-Trade Auditorium, and at the close of his remarks expressed a willingness to answer any questions bearing upon the matter, which any citizen might wish to ask. Amongst other opinions and recommendations, thus drawn out, the following are of general, no less than special, interest: —

MR. KELLEY: What recommendation would you make with regard to the ventilation of house-drainage?

COL. WARING: I am rather radical on that subject. I should ventilate the house-drains from the sewer, through to the top of the roof. I should never put, or allow to be put, a trap on the main drain. I should have the sewer in reasonably decent condition, and then I should depend upon this universal ventilation all over the town, through the four-inch pipes, leading above the roofs of the houses, to produce such a change of air as to keep it in better condition than it can be possibly kept in any other way.

MR. KELLEY: Then you do consider one line of soil-pipe for the house is sufficient ventilation?

COL. WARING: Perfectly; not one house on a long sewer, but a four-inch pipe for every house along the street that is connected with the sewer.

MR. KELLEY: I mean one dwelling-house.

COL. WARING: Quite adequate.

MR. KELLEY: Do you recommend fresh-air inlets into the sewer at the outside of the house?

COL. WARING: No, not if that system of ventilation is carried on, because every soil-pipe being connected with it, some of those pipes will serve as inlets and some as outlets; some will be on the sunny-side of the house and some on the shady-side; some will be connected with warm rooms and some with cold rooms, and circulation enough will be supplied without any fresh-air inlet.

MR. KELLEY: Do you recommend the ventilation of every trap in the house?

COL. WARING: No, sir, not at all. I will be frank, however, and say that I am opposed in that view by a great many other people.

MR. KELLEY: By all the plumbers in the country.

COL. WARING: Of course, the plumber — it pays him to ventilate. [Laughter.] There are a few cases where it is necessary to introduce air to prevent siphonage in the trap. Where that has to be done there is no system so good — back-venting don't compare with it — as the use of what is called "McClellan's trap-vent." That is a little cup inverted in mercury, which will respond to the pressure of a half-an-inch elevation of water, and operates in such way as to prevent siphonage. Then there are two or three other contrivances used to accomplish the same purpose.

MR. A. W. THURMAN: What do you mean by a trap in the main line?

COL. WARING: I mean a trap cutting off the air of the house-drain and soil-pipe in the house from the air of the sewer. The theory was that house-drainage was liable to all manner of defects, and that if anything disagreeable or dangerous entered the house-pipes, it would escape into the house; that therefore, as the source of all danger was in the sewer, you must put in a trap to shut it off. Now I maintain, and I think it is entirely true, that most of the odor you get in your house-drains is due to the decomposition of the filth produced in the house itself lodging in the trap and in the drain back of the trap, and that by putting a trap there you prevent its perfect ventilation. I would therefore run an untrapped drain from the sewer to and through the house, and open above it, and have as free a circulation of air as possible, and treat it as a part of the public sewer, and then be very careful as to the joints and as to the manner of trapping off from it every fixture of the house. I would not admit the air of that pipe into the house at all, but I would use it as a ventilator and would then isolate every fixture in the house by a trap of its own.

MR. KELLEY: Colonel, do you recommend the ventilation of the trap under the water-closet?

COL. WARING: It depends on what kind of a water-closet you use.

MR. KELLEY: Where tank-closets are used — flushing-tanks?

COL. WARING: What kind of an arrangement below the hopper?

MR. KELLEY: It has a trap underneath the closet.

COL. WARING: A wash-out closet do you mean, or a pan-closet?

MR. KELLEY: No, we do not have any pan-closets; a wash-out closet and sometimes a plunger.

COL. WARING: With a plunger-closet you must have good ventilation. You have a combination of stinks there, and it could not be kept in condition without ventilation in the part below. I am speaking now as a sanitary man and not as an æsthetic man. You will get an odor from almost any closet unless you have seat-ventilation. That is unpleasant, but it does not do any harm.

NOTES AND CLIPPINGS

THE ST. CLAIR TUNNEL. — At noon, August 25, all the excavation was ended which successfully connects the United States and Canada by the greatest sub-marine tunnel in the world and the longest railway tunnel of any kind on this continent. It is the Grand Trunk Railway's immense prospective passageway under the broad and swift-flowing St. Clair River at this point, with Port Huron, Mich., as its western terminus. At present and heretofore all through-trains over the Grand Trunk or the Chicago and Grand Trunk Railway (except those few running from London, Ont., west via ferry over the Detroit River and through the city of Detroit) have had to run on this side north to Point Edward, three miles above Sarnia, and on the American side to Fort Gratiot, Mich., an equal distance above Port Huron. When these respective river terminals are reached the through-trains, freight and passenger, are delayed from one to two and even three hours awaiting international transit on ferry-boats, each of which could carry a whole passenger train, and two of which can take over twenty-four freight-cars each. In winter, when the current between Point Edward and Fort Gratiot is filled with huge blocks of ice, rushing down at a rate of seven miles an hour, this transfer by iron ferries has been subject to even greater and more vexatious delay. With a traffic embracing 197,500 cars that crossed at this point in a year, there has been for years, as can be readily computed, an aggregate delay such as the great Grand Trunk Railway, with its about 5,000 miles of tracks, could ill afford. Especially was this the case after it had been demonstrated that this railway could and did repeatedly break all the records for speed on this continent. Its grades between St. Mary's and Guelph, Ont., have made possible long runs that would average a mile in a minute or better. Being the only Canadian road to compete with American lines for passengers and freight to and from Chicago on quick time, the hinderances at the St. Clair River ferries were not to be tolerated any longer than seemed absolutely necessary. Hence the great tunnel under the still broader portion of the river between Sarnia, Ont., and Port Huron. It will not only cut off the three miles extra run on both the Canadian and American sides, but will render possible an international transit within the space of two or three minutes which has heretofore required at least an hour's delay. At noon, August 24, the connection was successfully made between the Canadian and American ends of the tunnel. A large augur-hole bored through the remaining distance, ten feet, enabled the men working on the Canadian side to talk to their fellow-workmen on the American side. The tunnelling was completed at noon, August 25. The work had been progressing slowly but steadily for three years, involving considerably more than the original estimated outlay of $2,500,000, of which the Dominion Government contributed $375,000 as a subsidy. The total length of the tunnel is 6,800 feet, of which 2,310 feet is under the river, 2,160 feet under dry land on the Canadian side, and 2,330 feet under dry land in Michigan. Of the portion under the river, 1,500 feet is nearly level. The depth of the lower part of the tunnel below the surface of the water is 88½ feet. The minimum depth of the top of the tunnel below the bed of the river is 15 feet. The tunnel is to contain a single track of railway only. In cross-section it will be circular, with a clear internal diameter of 20 feet. The lining is to consist of an immense cast-iron tube, 6 inches thick and 20 feet in diameter, each plate of which weighed half a ton when prepared to be riveted into its place in the tube as a whole. The boring has been done through blue clay entirely, and has been rendered absolutely safe by means of driving a great cylinder or hollow augur 16 feet at a time into the clay and permitting 22 men to work inside the cylinder and remove its excavations before an immense hydraulic power should again thrust the augur forward. By means of various scientific appliances the tunnel has been kept as dry as a street in summer. Work has been pushed from both ends simultaneously, and, as stated above, the two groups of workmen have now met under the middle of the river. The tunnel will probably be fully completed and ready for use by the close of the present year.—*Philadelphia Record.*

Draining the Foundation of a Gas-Holder Tank.—In 1872 I was called to construct a gas-holder tank for the Titusville Gas Co., at Titusville, Pa., under the particular and unusual condition of superabundance of water in the earth. The location was a level piece of ground in the valley adjacent to a creek and the excavation coarse gravel and small boulders. The excavation was made 12′ below surface of ground, 6′ of which was below the bed of the creek. To make the excavation and construct the tank wall it was necessary to raise 8,000 to 10,000 barrels of water per day. The method of procedure to accomplish that end was as follows: A well was sunk outside of the space to be occupied by the tank, and to a depth sufficient to drain the earth below the required depth of the tank wall. After the excavation had been made to grade of the bottom of the footing, a ditch was dug outside of the line of footing deep enough to receive a line of sewer pipe ranging in size from 10″ to 4″ in diameter, running in both ways from the well to the opposite side of the tank. The joints were left open to permit the free access of the water from the gravel. Then followed the laying of the footing and the building of the tank wall, during which time the pump was kept in constant operation. A 10″ iron pipe was laid under the footing, at a point opposite the well, through which to convey the water collected on the inside of the tank wall. Another row of sewer pipes, ranging in diameter from 10″ to 4″, was laid along below and near the inner line of the footing and connected to the iron pipe leading to the well. From a few points inside of the tank, where abundant springs appeared, a line of 4″ sewer pipe was laid to the larger sewer pipe, by which means all water appearing was safely and surely conveyed to the pump well. The whole surface of the bottom of the tank was then covered with cement and concrete to the depth of 8″, but leaving a vent-hole 10″ in diameter at the junction of the sewer pipes and the iron pipe to permit the inflow of water into the tank in the event of the stopping of the pumps, and the outflow of the water from the well. When the concrete was completed and properly set the holder was built, and then a plate was secured to the vent-hole and covered with cement mortar. The water from the pump was then turned into the tank until filled to the top, completing the undertaking. —*G. A. Hyde, before the Engineers' Club of Cleveland.*

The Palais des Machines, Paris.—The Municipal Council has decided to keep the Palace of Machines—a praiseworthy determination, for it would have been a pity to have pulled down this immense construction, all of iron and of glass, and a magnificent triumph of industrial architecture. It would even have been an absurd waste of money, for it is built to last a long time. Only, instead of using it for the practical purpose at first proposed, that is, to have given it to the Minister of War, who, without any expense save that of sand thrown on the ground, could have made of it a splendid riding-school and winter exercise-hall for the cavalry in Parisian garrison, they have destined it for a place for popular fêtes, of which there is no need whatever. It is admirable and wise to endeavor to amuse the people of Paris, but they are too oblivious to the fact that, as they are constantly increasing their taxes, they leave them no money with which to pay for pleasures. And meanwhile the poor soldiers, who are also of the people, are obliged to exercise in rain and snow, and are, moreover, forced to go very far afield from their barracks for those exercises and drills, the result being, consequently, a loss of time and increased service hours. Up to the present time the Palace of Machines has only been used for one popular fair, or kermesse, organized last week by the Press for the benefit of the sufferers by the great fire at Martinique, the profit of which did not by any means come up to their expectations. First, three successive days of storm and rain did tend to harm it; and then the expenses of these charitable fêtes, when they are conceived in such vast proportions, eat up the greater part of the receipts, especially as, in order to attract the public, rather tired of these amusements, which are eternally the same, they are obliged to put the entrance prices very low. It has also been decided to keep, besides the Palace of Machines, the perpendicular gallery called the "Gallery of Thirty Metres," which joins-on to the building known as the "Central Dome," and also the two Palaces of Fine and Liberal Arts, which formed the two sides of the exhibition buildings. These are retained for the same purpose, popular fêtes, scholastic games, congresses and meetings, or for small exhibitions of paintings. This last spring the Secessionist *Salon* of M. Meissonnier was held there. These buildings are very handsome, and the desire to keep them can be easily understood. Only, as they were simply built for temporary use, it is very probable that they will soon become so much damaged that it will cost more to repair them than to have pulled them down and rebuilt them in a more solid manner. Already the storms of last winter have done much harm to the enamelled bricks of the roof, to the blue and gold decorations, to the terra-cotta reliefs of the fronts of the buildings, and it has been necessary to refresh and to repair them a great deal. The Parisian climate is not suited to polychrome buildings, copied from the Italian Rennaisance.—*Paris Letter to the N. Y. Commercial Advertiser.*

To Remove Stains from Granite.—A correspondent of the *Building News* (London, England) writes to that paper asking for information as to how best to get stains out of granite. Several correspondents reply. "Elbow Grease" says: "You have a troublesome job before you in attempting to get smoke and soot stains out of granite. Try this: A paste of 1 ounce ox-gall, 1 gill of strong solution of caustic soda, 1½ tablespoonful of turpentine, with enough pipe-clay to make it thick and consistent, scour well." "A Mason" is of opinion that "Washing is about as useful in getting stains of soot out of granite as tickling with a feather or fixing an electric belt round the window-sill. Pick out a place where the stain is worst, and as a sample apply the following: Mix together ¼ pound whiting, ¼ pound soft soap, 1 ounce washing soda, and a piece of sulphate of soda as big as a walnut. Rub it over the surface you propose to treat, let it stand four and twenty hours, and then wash off. If it succeeds, try another portion." "G. D. M." replies that "Smoke and soot stains can be removed with a hard scrubbing brush and fine sharp sand, to which add a little potash."—*Scientific American.*

A Wire-Bound Fly-Wheel.—A novel fly-wheel of large dimensions, which differs materially in construction from those ordinarily in use, has been designed by Messrs. Mannesmann, to guard against the the terrible danger of bursting, to which accident cast-iron fly-wheels are only too subject when worked at a high speed. This wheel, which is in operation at the Mannesmann Tube Company's Works, in connection with their process for making seamless tubes, consists of a cast-iron hub, to which are securely bolted two discs of steel plates of about 20 feet in diameter. Round the periphery of the wheel thus formed about 70 tons of No. 5 gauge wire are wound, under a tension of about 50 lbs., thus binding the whole securely together. There can be no comparison between the resistance of a wheel so constructed to the centrifugal force, and that offered to this force by a cast-iron one. This fly-wheel, of 20 feet diameter and weighing 70 tons, revolves 240 times per minute, therefore the periphery of the wheel has a speed of 2.85 miles per minute, or nearly three times the speed of the "Flying Dutchman." It works on the main shaft from which the tube mill is driven by means of helical toothed steel wheels.—*Specialties.*

TRADE SURVEYS

All signs point to an early and heavy autumn trade. Stocks are heavy in importers' hands, the increase this year over last being ascertained at $24,549,754 in value for the first seven months of the year. The money market has been made easy by the return to circulation during August of $19,821,340. No stringency will be permitted as long as it is in the power of the Government to prevent it, but it is a matter of regret among business men that so much and so constant watching and care is necessary to prevent disaster to the enormous and rapidly growing interests of the United States. Certain foreign manufacturing interests are profoundly alarmed over the prospects of serious trade losses through the enactment of pending tariff legislation, and preliminary steps have been taken in some instances to establish works on this side for the production of the products that will be practically excluded by the new law, should it pass. Discussions in Congress develop very little opposition to the bill as framed in committee, and a strong pressure is being brought to bear to have the programme carried out according to the political promises made long ago. It is hardly out of place to observe here that the groundwork is being laid for future political differences and complications in the now dominant party which investors and promoters and manufacturing interests generally would note with regret. The policies of the two political parties as regards tariff legislation are so opposite that capital will feel apprehensive when the next struggle comes on before the people. But, after all, the American people may be trusted to make no mistake when they come to decide in the light of experience between the two economic policies. The railroads for the most part have all the traffic they can handle. Prosperous agricultural conditions in the Western and Southern States are reflected in enormous sales among jobbers and business men in Eastern commercial centres. Manufacturers of farming implements are very busy, and are large buyers of raw material, especially iron and steel products. New England hardware manufacturers report a good demand for all lines of heavy and light goods. Western carriage and wagon makers enter upon a most promising fall trade. Clothing manufacturers have employed fully as much labor as last year. Textile manufacturers, especially in cotton goods, have made fair profits. Failures do not increase according to the increase of business. The spirit of land-speculation has once more broken out in the Southern States, and about a score of "towns" have been staked out this summer, into which capital and enterprise are drifting. The manufacturing interests generally are realizing good margins—sufficient, at least, to justify extensions and improvements. The electrical interests are overcrowded with work, and there is greater call than ever for services and supplies in foreign countries. Engineering talent is in demand, and the manufacturers of equipments for shops, mills, railroads and mines are exceptionally busy. The iron and steel makers have an abundance of work. Anthracite coal has been marked up at New York from 10 to 25 cents per ton, and at Chicago 50 cents. The demand for bituminous coal and for coke is very heavy, and much new soft coal territory is being opened. Shop labor of all kinds is fully engaged, and never was there as little excuse for idleness. Savings bank statistics so far as published this year, exhibit a creditable growth of the habits of saving. There is also an encouraging growth in the number of building and loan associations. Formerly the operation of these associations was local, but companies have been recently organized in which a wide range is taken. There are several reasons for saying that railroad building will be undertaken next year on a larger scale than this; also for the statement that much capital will seek employment in coastwise ship-building and in lake and river boat-building. The opportunities for profitable investment are certainly not narrowing down, nor is the faith of foreign capitalists in American investments diminishing. Between twenty and thirty syndicates have begun operations on this side within the past four months, and many of them will effect their purpose. The autumn outlook is encouraging, especially to persons of small capital in the newer States, and large numbers are taking advantage of these attractive opportunities.

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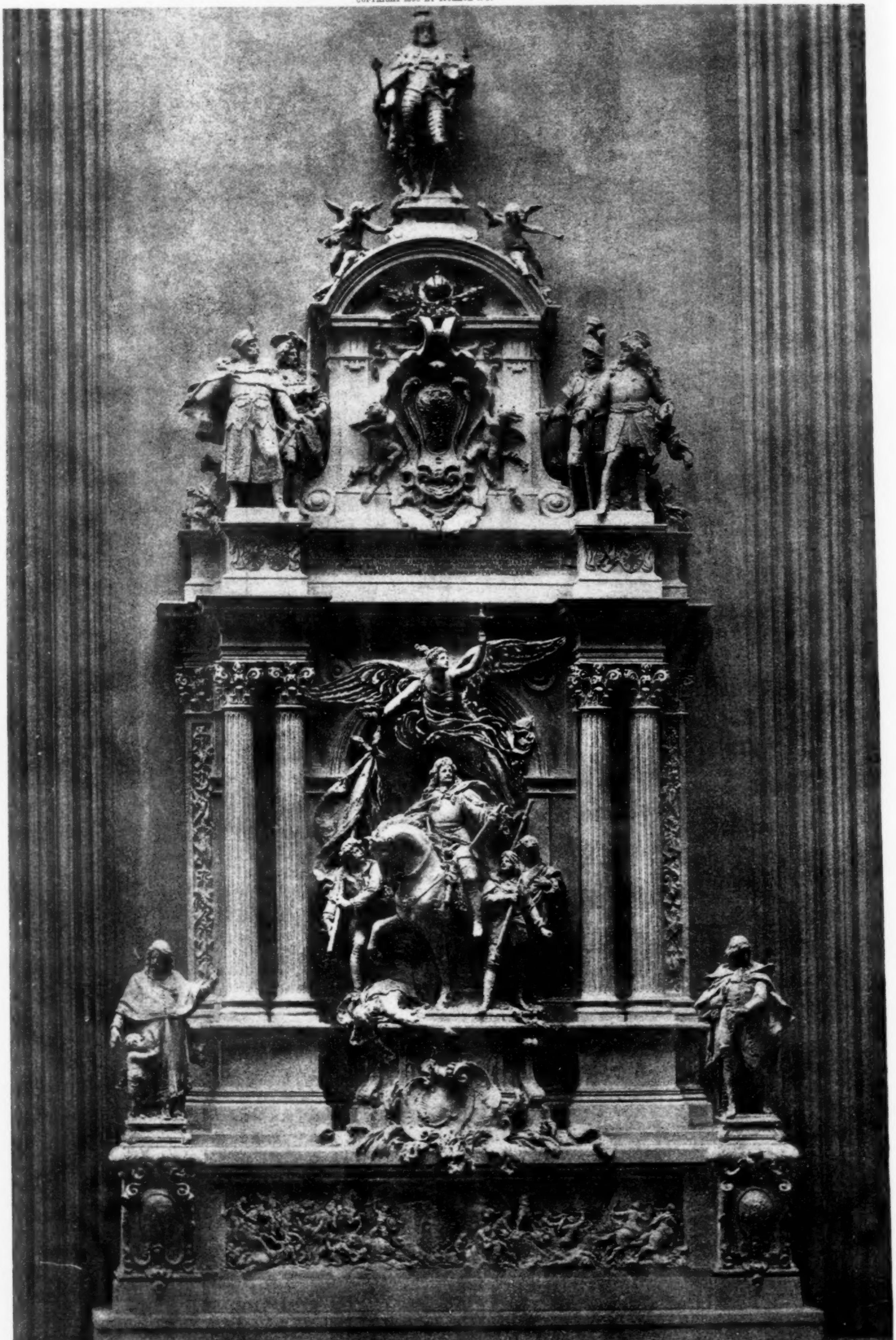

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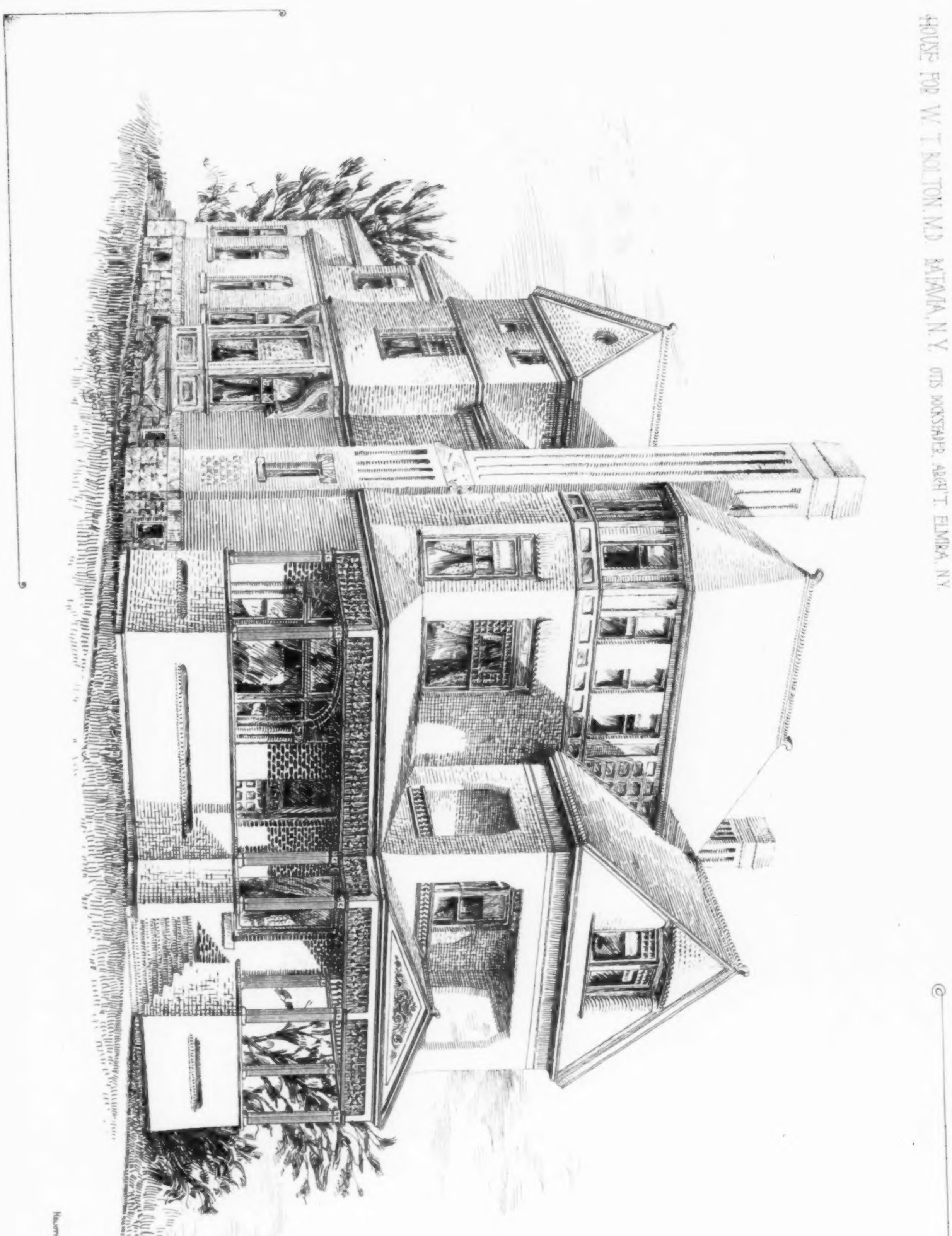

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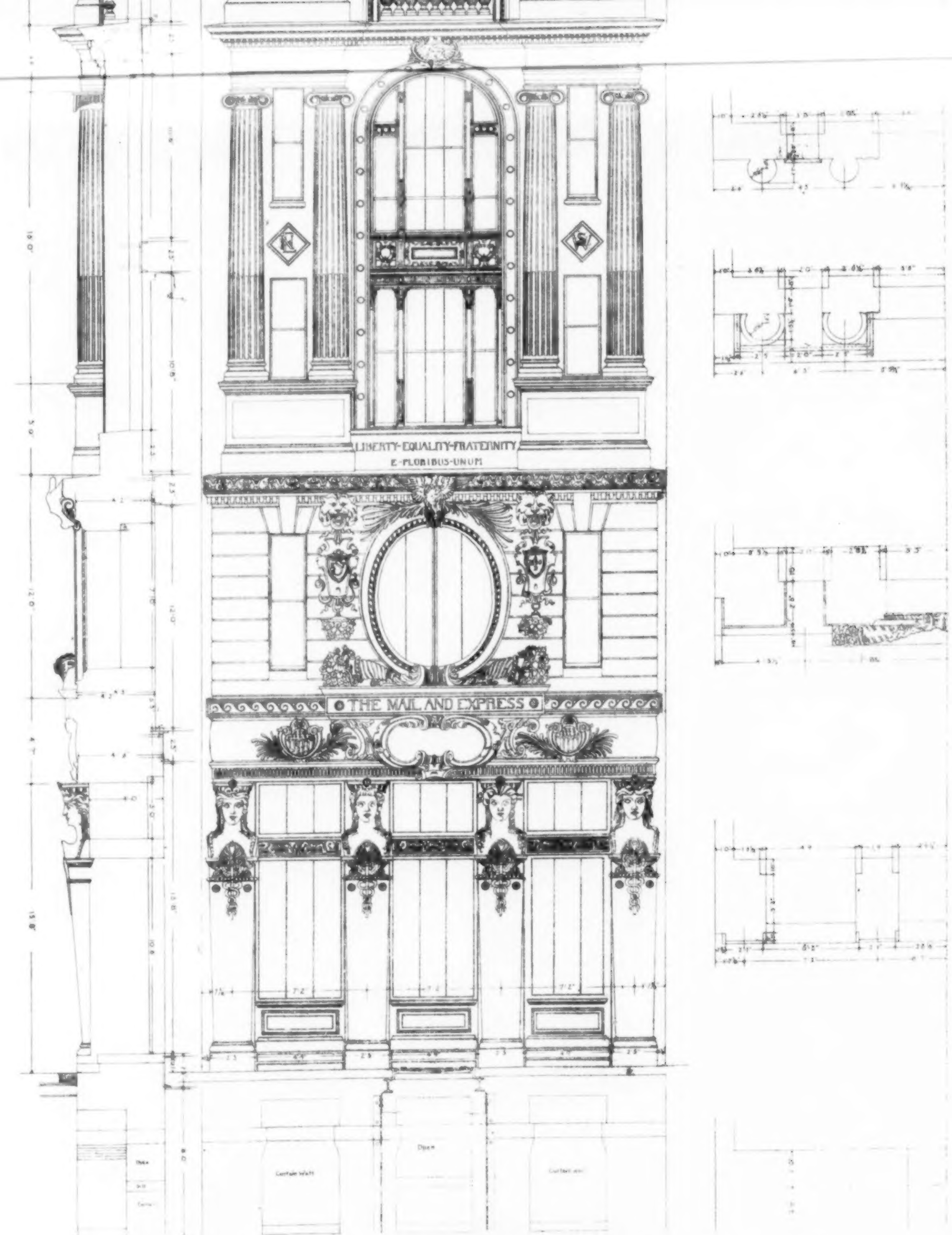

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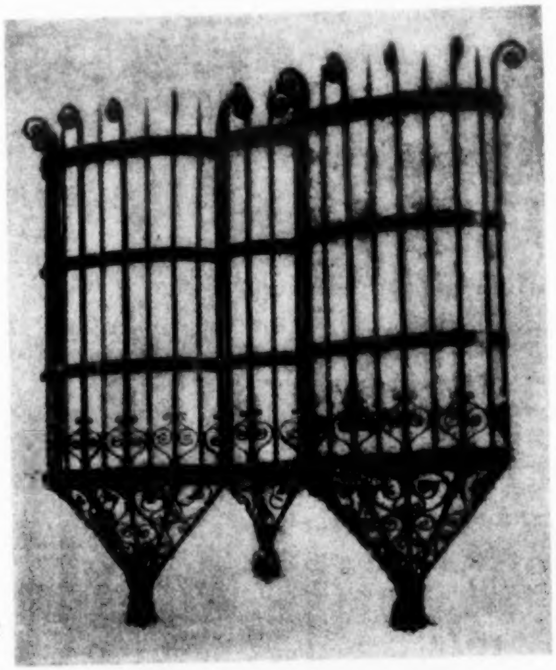
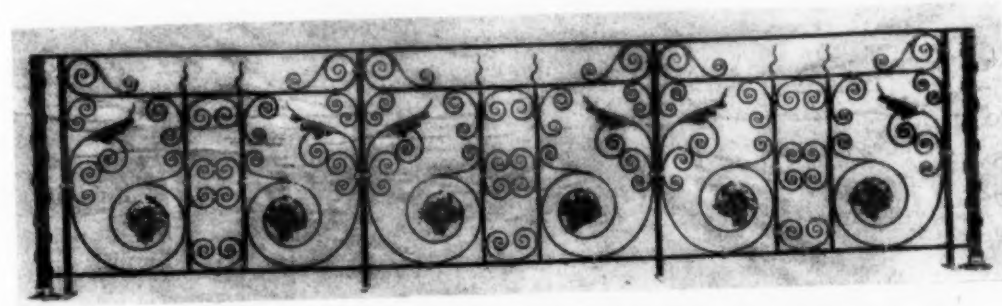
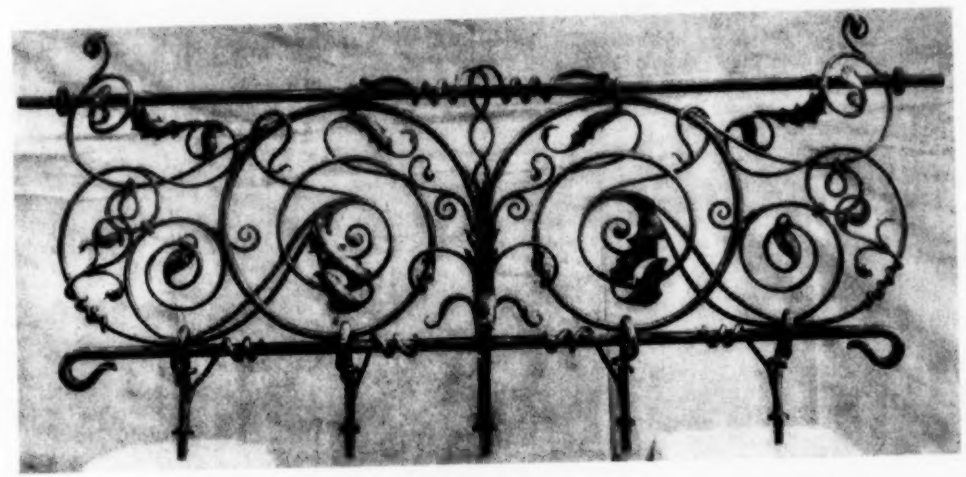



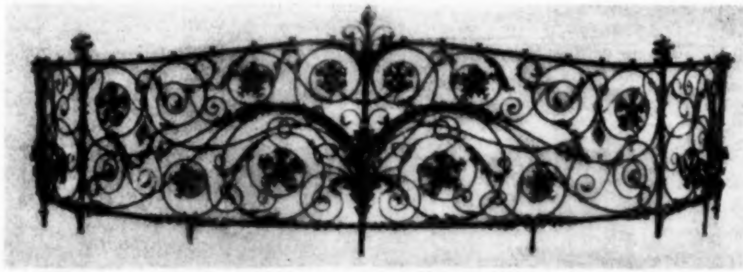

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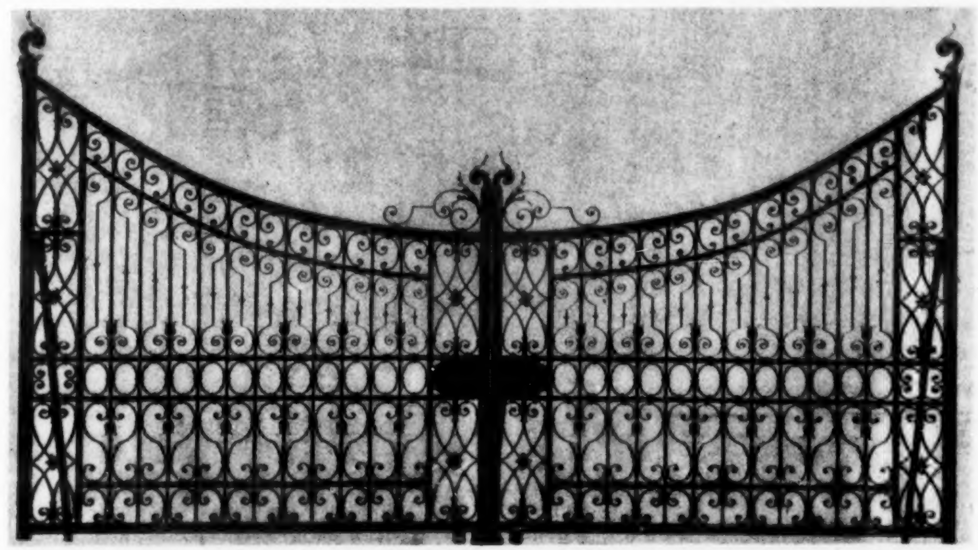

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