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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

ARCHITECTURAL IMPROVEMENT OF NEW YORK CITY.

The strict regard for utility which characterizes the average American has been perhaps the most potent influence in a national industrial growth which is absolutely without parallel in the history of the world. But while utility makes for a rapid increase in wealth and material power, and the development of certain of the more robust elements of national character, these elements are obtained at the cost of certain other qualities, abstract and concrete, which many of us are beginning to realize the nation can ill afford to lose. Just now we have in mind the evil effects which a too slavish obedience to the promptings of utility have had upon the appearance of the great cities, in which the more important interests of the nation are centered, and in which so large a proportion of its people must ever dwell. Thus, whatever may be said, and a great deal may be said, in favor of the rectangular system of laying out the streets of a city, on the ground of its simplicity, its economy of space, and the readiness with which it lends itself to street nomenclature and numbering, it is coming to be understood that judged from the aesthetic and architectural point of view, and even from that of convenience, it has most serious drawbacks. Why is it that the average American tourist is filled with such immediate pleasure as he looks upon the winding streets and the general unstudied grace of an ancient European city? Something broader and deeper than a mere sense of novelty enters into his appreciation; and, as a matter of fact, his pleasure is founded in his unconscious recognition of certain fundamental laws of harmony and beauty, to which the stiff uniformity of the blocks and squares of the average American city does violence.

It is a curious fact that the ground plan of most of the great cities of this country was determined in the office of the real estate speculator and drawn with a lead pencil and a common office ruler. Certain it is that when the enterprising vendor of city lots pinned his rude sketch upon his office walls, he little dreamed that, before many decades had passed, the wildest flights of his prospectus would have been surpassed, and those crudely-drawn squares covered by the towering business buildings or the sumptuous homes of a prosperous city, and its streets filled with the rush and roar of busy commercial life.

For many years past there has been a growing conviction that the time has come for taking hold of the question of the architectural and aesthetic appearance of New York city, to say nothing of the convenience of its thoroughfares to the requirements of traffic, and devising some comprehensive scheme which will improve its present appearance and make provision for its inevitable future growth. Toward the close of the year 1903 the Board of Aldermen of this city created the New York City Improvement Commission which, after an exhaustive study of the problem, presented two reports, one in 1904, and a final report in January of the present year. The Commission realized that a comprehensive plan for the city's development must necessarily anticipate the future growth of the city for many years to come, and that it must be so designed that all of its parts should be consistent and form a homogeneous whole. This co-ordination was necessary in order that any future improvements might be carried out with a definite purpose and along definite lines, and not, as has been too often the case, without reference to any general plan for the city's betterment. The framing of such a system of improvement involved not only the laying out of parks, streets and highways, the location of city buildings, the improvement of water fronts, etc., but also questions of more or less detail relating to pavements, sidewalks, appropriate house numbers, gas and electric fixtures, the manner of indicating the streets, the location of statues and monuments commemorative of historical events, the question of tree planting, and many other matters, all of essential importance if New York is to take its place as one of the great metropolitan cities of the world, not merely as regards its size and numbers, but also in respect of its aesthetic and architectural beauty and dignity.

In studying the final report, with its ambitious and really stupendous system of boulevards, parkways, and monumental structures, one must be careful to bear in mind that the enormous expenditure of time and money involved in its execution is intended to be spread out over a long series of years. To adopt the Napoleonic method, would be to throw this city, in spite of its vast resources, into immediate bankruptcy. No such course is contemplated by the committee; and the elaboration of these plans on such a mammoth scale and with such completeness, is done so that the plan may be settled at least in its broad outlines, definitely and for all time, and an end made of the haphazard methods of the past.

The salient feature of the general plan, as it affects the city as a whole, is to afford adequate and suitable avenues of connection between the different parts of each borough, as well as between the different boroughs themselves and the outlying distances. Furthermore, while each borough is provided with a park system of its own, each system is connected with the other by suitable parkways so as to make them parts of one harmonious whole and by making each supplement the other, to add largely to the beauty and advantages of all. It is largely in view of the double purpose of uniting the separate park systems and at the same time preserving their individuality in each borough, that the Commission has planned for numerous and extended parkways and comparatively small parks rather than extensive individual park areas; and the wisdom of this policy cannot be disputed. The report is accompanied by a large number of maps illustrative of the designed improvements, and while limitations of space prevent any detailed reference to these, mention should be made of the special merit attaching to the plan for connecting and treating the terminals of the new East River bridges, and notably of the plans for a great circular plaza 800 feet in diameter at the point where the Brooklyn and Manhattan bridges converge on the Brooklyn side. It is sincerely to be hoped that after due discussion of the really admirable plans here presented, the report will be adopted, and the future convenience and beautification of New York city thus definitely assured.

THE DEMAND FOR TECHNICALLY QUALIFIED YOUNG MEN.

In view of the general impression that the professions are greatly overcrowded, it is surprising to learn that some of the leading railroads of the country are finding much difficulty in securing properly qualified young men to fill subordinate positions on the engineering staff. One road in particular has recently gone so far as to make the fact known in the public press, and to invite communication from young men who have passed through technical schools, and possess the necessary qualifications to enable them to commence work as rodmen and chainmen, or do the simpler instrumental work connected with the construction and maintenance of railroads. It was further stated that the remuneration would be sufficient to enable these men to maintain themselves at once in decency and comfort, and that for those who showed aptitude and application there was a reasonable expectation of early promotion. Further evidence of the excellent opening afforded by the present industrial activity is found in the fact that, in one of the leading technical colleges of the country, every member of the graduating class of 1906 had secured an appointment some months before the close of the college year. The demand for technically-qualified men in railroad work has unquestionably been stimulated by the recognition of the fact that the increase in the capacity and weight of the motive power and rolling stock, and the demand for more intelligent supervision due to the introduction of electric traction on steam roads, is rendering it desirable that not only the engineering department, but also those which have to do with the maintenance and operation of the road should be run by men with sufficient technical knowledge, with sufficient training in natural science, to enable them to exercise a more intelligent oversight of their departments than is possible in the case of men whose theoretical knowledge is bounded by the limits of a common school education.

In this connection it is gratifying to note that there is in successful operation in this State a railway training school under the supervision of practical railroad men, in which the students are put through a course designed to prepare them specifically for employment in the various departments under which the complicated operation of our railroads is carried on. Without casting any disparagement upon the many able men who, from humble positions on our railroads, have risen to stations of great trust and responsibility, we believe that the complicated problems involved in the operation of a great modern railroad system have rendered it not only desirable but imperative that the heads of those departments which have to do with the mechanical and constructive elements of a railroad should be graduates of technical schools or members of the engineering profession. To make such a provision a general one would, after all, be merely to apply broadly a principle which, for many decades, has been followed upon the Pennsylvania Railroad system, whose late distinguished head, President Cassatt, was a civil engineer who had risen by steady gradations from rodman to president.

THE "JENA" DISASTER AND STABLE GUNPOWDERS.

In all probability the recent terrible disaster to the French battleship "Jena" will be found to have been due to the explosion of her after magazines as the result of spontaneous combustion of the powder. If this be so, the accident is of the same character as that which, at the close of the recent war, tore out the side of the Japanese battleship "Mikasa" at a time when, like the "Jena," she was at one of the government dockyards.

In spite of the really remarkable progress which has been made in the development of modern powders, the best of them are liable, under certain conditions, to a decomposition which, if it proceeds to a certain point and be accompanied by certain conditions of temperature, may result in the explosion of the magazine and the loss of the ship or arsenal, as the case may be. Our modern smokeless powders, when in storage, are the occasion of a degree of anxiety and watchfulness which was never felt in the days of the brown or black powders. Although it is true that the stability of smokeless powder made on the latest formulas shows a great improvement over the earlier powders, it still remains for someone to produce a slow-burning powder which, without any sacrifice of ballistic power, shall possess the desirable quality of being absolutely stable under any conditions of climate and for any period of storage.

COHESIVE FIREPROOF TILE CONSTRUCTION.

The elimination of the fire hazard in modern buildings is based upon the principle that all supporting iron or steel girders, columns, and beams must be protected from fire by some material which is a poor conductor of heat and not easily disintegrated or injured by high temperatures. Burned clay materials, such as flat, hollow, porous, and semi-porous terra-cotta blocks, and certain grades of burned bricks, are commonly employed for this purpose. Owing to the relative lightness of these materials and their high fire-resisting qualities, most steel frameworks of our large buildings are incased in hollow or flat terra-cotta tiles laid in cement mortar. Many of these clay tiles and blocks are burned in the making to 2,000—2,500 deg., so that in any fire they will not crumble or crack at a temperature below that to which they were originally subjected.

No great stress is imposed upon the hollow porous blocks used for fireproofing beams, girders, and columns, and their crushing strength is not very great. Their function is performed in protecting the steel work from an excessive interior temperature, while the metal carries the loads of the different floors. The use of hard, flat terra-cotta tiles for certain construction purposes, both to carry the load and to resist any interior fire, has in the last year or two assumed an important development. Modern methods of burning and making the terra-cotta tiles have greatly improved their strength and durability, and the better grades of them have been used in a number of buildings in New York city and elsewhere which fully illustrate the new method of cohesive fireproof tile construction.

In the new custom house in New York city the large dome surmounting the great interior rotunda is constructed entirely of fireproof flat tiles, and the total absence of any metal for supporting this huge elliptical dome shows the great cohesive power of hard, flat tiles when properly laid up in cement mortar. The dome is 80 by 135 feet in size, and supports on its summit a huge skylight of glass and metal whose total weight is 140 tons. The tiles used for this purpose are 12 inches in length, 6 inches in width, and about 1 inch in thickness. They are laid on edge, and form a perfect curve.

The masonry walls of this rotunda are built of brick up to the lower part of the dome. A massive flat ring of steel is fitted on the top of this masonry and imbedded in it, and from this the dome springs. The foundations of the dome are of solid, flat tiles cemented together on their edges, but after a few courses an outer and inner shell is formed. Nine layers of 1-inch flat tiles form the lower courses, but as the curvature of the dome is reached one course after another is omitted until near the middle there are only three layers of tiles for each shell, leaving an open space between them.

A central mid-rib composed of tiles laid flat runs around the dome to strengthen it, and similar ribs of

tiles laid flat radiate from the apex of the dome to the foundations. These ribs are joined to the central midrib by cement, and all are inclosed by the two shells of the tiles laid on edge. The cohesive strength of tile construction is thus amply demonstrated. Engineers representing a number of structural steel manufacturers intimated before the work was undertaken that it was impossible to build the dome in this way without metal reinforcements of some kind; but the dome has been finished for some months and the heavy skylight placed in position. The lightness of the tiles makes the dome nearly half the weight of another of similar size constructed of metal, while the fireproof quality of the material insures the dome from interior destruction by fire. The tiles having been burned in the making do not warp or shrink after being placed in position, and elaborate decorations can be made directly to them without danger from cracking or warping,

A similar dome of less size and ambition has been built on the new Madison Square Presbyterian Church, which recently has been completed. The same size flat tiles are used there, and the dome is built and surmounted by a small tower. The crushing strength of the tiles is upward of 2,000 pounds to the square inch, and their cohesive strength is dependent chiefly upon the quality of the Portland cement used in building the dome. The major axis of this new dome is only 52 feet, but its shape and artistic appearance from either the inside or outside make it remarkable quite as much as the decorations placed on it by the architect. The dome springs direct from the walls of brick, and it thus completes a remarkable building independent of any iron or steel work.

Within the past few years a number of other similar domes of this same general character have been completed. In the new library building of the University of New York there is one with a major axis of 70 feet, and over the rotunda of the University of Virginia the Guastavino dome of flat fireproof tiles laid edgewise has a diameter of 69 feet. The Hall of Sciences, in Brooklyn, has a dome of flat tiles without any metal supporting work of 60 feet in diameter, and the new Minnesota State Capitol one of similar dimensions. The dome over the Bank of Montreal building is 72 feet in diameter, and is the largest, next to the new one over the rotunda of the New York custom house, yet finished by this new method of cohesive construction.

The construction of such fireproof, non-metal-supported domes represents a special branch of masonry designing which has slowly reached perfection in this country. It is based upon the principles of the early Roman architects who used heavy bricks and stones for their work, but with superior tiles and cement mortar to work with, the modern designers have secured strength and rigidity with materials much lighter and absolutely fireproof in character.

The high degree of skill and mathematical designing required to construct domes, arches, and stairways of tiles by the cohesive system is probably even better illustrated in the two pairs of stairs built in the new custom house facing Bowling Green in New York. These stairs spring from the basement of the building and terminate at the roof. No metal whatever is employed for supporting them. On the contrary, heavy balustrades of metal, and equally heavy marble treads, only add to the dead load carried by the tiles. Rather larger tiles are used for the stairs than for the dome construction, but they are all light and apparently frail for this work. From the basement to the main floor a circular wall of brick masonry is built, and the tiles are attached at one end to this wall; but each semi-circular flight depends for its strength and rigidity upon the cohesive strength of the tiles and the scientific strength of a curve when the load is so distributed that the pressure to the arch is continuous. Above the main floor each flight springs to the floor above without any support other than that derived from the top and bottom. The stairs are formed by a number of thicknesses of flat tiles at the base which gradually diminish toward the middle of the arch, and then thicken again toward the top.

The construction of spiral and semi-circular stairways with hard flat tiles requires independent and careful study of each individual case. No definite rule or principles can be laid down to apply to all cases, but each problem has to be worked out by itself. The combination of the spring of the arch with the continuous curve under each platform to adjust the adjoining flight are questions of mechanical skill. Such stairways of hard, fireproof clay tiles are constructed to carry loads which will suffice for any kind of public buildings, and those recently constructed in the custom house (or rather in the course of construction at this writing) are designed to carry heavy marble treads and ornamental iron and bronze work besides the weight of those who will constantly use them for ascending and descending. The fireproof quality of such stairs is of particular force in view of the modern effort being made to eliminate everything possible from public buildings which will crumble or disintegrate when attacked by a hot interior fire. The difficulty of protecting an iron stairway by terra-cotta casing as commonly practised in protecting beams and girders is quite apparent. If left unprotected a sharp interior fire will cause a collapse of the stairs and greatly increase the damage to the building. A tile stairway on the contrary would not be affected by a fire unless the temperature reached 2,000 and more degrees, and a collapse would not follow.

The use of the cohesive tile construction for floors and ceilings is well illustrated in two other notable buildings recently built in New York. The domic ceiling of the new Tiffany building is constructed of hard, flat tiles laid on edge and sprung from rotunda columns and terminating in a large skylight. In these domic ceilings the curve is less than in the domes, and the effect is of a slightly arched ceiling of great beauty. The decorations are sometimes laid directly on the tiles and in other cases ornamental faced tiles are cemented to the hard supporting tiles for interior effect. In the new Gorham building all of the different floors and ceilings are made of hard tiles. A series of arches spring from the steel columns and terminate in points in the ceiling. The compression on the tiles is uniform, so that the load is carried without any undue stress upon any part. The tiles are laid on edge, with several courses forming the arch, breaking joints at each course, and cemented together with the best Portland cement mortar. The decorations are either made directly on these fireproof tiles or ornamental tiles cemented to them. No metal work is employed to support the domic ceilings other than the series of steel columns from which the arches spring. No steel reinforcements or tension rods whatever are employed in the construction. The remarkable lightness of the floors and ceilings built in this way is one of the chief virtues ascribed to the new method of fireproof building. The carrying capacity of a floor built of cohesive tile masonry is certainly sufficient to warrant their construction in some of the finest public and commercial buildings of the country. As an interesting development of the fireproof question cohesive tile construction is without a peer, and its adaptation to new work and fields is a matter that should be of inestimable value to the building trades. In cases where lightness of structure is an important consideration hard flat tiles may prove far more desirable than iron skeleton work, and also where it is desirable to use fireproof clay materials owing to the difficulty of covering the iron work with terra cotta.

INTERNATIONAL MARITIME EXPOSITION COMMEMORATING ANNIVERSARY OF STEAM NAVIGATION IN BORDEAUX, FRANCE.

BY CHARLES A. SIDMAN.

That great interest is being manifested in the International Maritime Exposition which is to be held in Bordeaux in May is evidenced by the great progress that has been made in the construction of the several buildings, and the fact that the contractors promise to have them all ready some time before the opening on May 1.

This exposition is designed to commemorate the centennial anniversary of the successful application of steam to navigation by Robert Fulton. The motive for the celebration of this great event may be found in the fact that in 1803—four years before his success on the Hudson with the "Clermont"—Fulton made his initial trials in steam navigation in France. Fulton's experiments appear to have been at first with a submarine boat, which he christened the "Nautilus," and in which he was submerged for five consecutive hours on one occasion in 1801. This demonstration appears to have been at Brest, in the presence of the French Admiral Villaret, and it is recorded that by the use of torpedoes Fulton managed to blow up a boat in the harbor.

He made a second submarine boat, and gave a demonstration on the river Seine at Paris, on which a commission appointed by Napoleon reported favorably. Nothing, however, came of the submarine boat, and it was subsequently, in 1803, that Fulton treated the Parisians to the spectacle of a small boat propelled by steam on the river Seine with two bateaux tied astern. A chronicler of that time describes it as "un bateau mú par des roues comme un chariot" (a boat moved by wheels like a chariot).

The exposition, as officially stated, is to be international in character, and to illustrate the history of navigation. The world's marvelous progress in the art of shipbuilding and the science of navigation is to be shown by a collection of models of every kind of water craft, ancient and modern. All that pertains to ocean geography and all industrial and artistic products having relation to maritime affairs are to find a prominent place. There is to be a congress of naval architects, with lectures on science, art, industry, commerce, and political and social economy. There will be boat races on the river Garonne, in which the management hopes that crews from the several nations will compete.

The grand palace and the main buildings, covering an area of about ten acres, are all so connected by arcades that they form practically one great building. The grand palace is to be devoted to the illustration of maritime history, ocean geography, ancient and modern painting, sculpture, architecture, and horticulture. Materials for the construction of boats and ships, diving and life-saving apparatus, fishing appliances, ship's provisions, sea food, and motor machines (land and water) will have considerable space devoted to their exposition. In the place allotted to the navy there is to be a special exhibit of submarine boats, guns, torpedoes, ship's armor and equipment. Aeronautics, electrical apparatus, signals, wireless telegraphy, telephones, pumps, refrigerating apparatus, heating and ventilating appliances, port and harbor works, sea and river sports, art bronzes, lace tissues, linen and tapestry, glassware, china, cutlery, and musical instruments are also to have spaces devoted to them.

This exposition should afford excellent opportunities for American manufacturers to show the superiority of their products and extend their trade. Manufacturers of motor boats, light motors and dynamos, canoes, lifeboats, diving and life-saving appliances, fishing apparatus, optical and nautical instruments, or those who make anything that relates to navigation or ships, will find a good chance here to advertise their goods and increase their business.

An appropriation of $15,000 was made at the recent session of Congress to enable the government of the United States to be properly represented at the exposition. There will be a pavilion erected especially for the American exhibitors.

The Secretary of the Navy has ordered several of our finest warships to attend, and the members of the American Committee of Honor comprise men well versed in these matters.

It is especially fitting therefore that France in taking the initiative shows once more her thankfulness to the artisans of progress, and her sincere friendship for the United States, in commemorating the century anniversary of Robert Fulton's victory, for it was in France that a great many of his experiments were made.

BURCHELL'S ZEBRA.

One of the larger South African mammals now verging on extinction, if, indeed, it has not already ceased to exist, is the typical race of Burchell's zebra, the bontequagga of the Boers, and the *Equus burchelli typicus* of zoologists, writes Mr. Lydekker in Knowledge. This race apparently inhabited the plains to the north of the Vaal River, now forming British Bechuanaland. It is characterized by the complete absence of barring on the legs and of stripes on the lower part of the hindquarters; while between the dark brown body-stripes were faint "shadow-stripes" on the still paler ground-color. The original specimen in the British Museum brought home by the great African traveler, Dr. Burchell, was, unfortunately, destroyed at a time when but little attention was paid to the priceless value of "types," and there is now no example of this race of the species in the national collection. According, however, to a paper published by Mr. R. I. Pocock in the Annals and Magazine of Natural History for 1897, there is, however, one specimen in the museum at Tring, and a second in the Bristol Museum, both of which come very close to the typical form, although neither is exactly similar, and each differs slightly from the other. In these circumstances it is interesting to learn that a specimen exists in the American Museum of Natural History.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1629, opens with an excellent article by the English correspondent of the SCIENTIFIC AMERICAN. This is one of the most important undertakings in connection with the development of transportation facilities in the African continent, and second in magnitude and character to the Cape to Cairo Railroad only. Many illustrations accompany the article. Poulsen's system of radiotelegraphy by continuous electrical oscillations is described. John B. C. Kershaw writes on the development of the electrochemical and electro-metallurgical industries in 1906. A very excellent discussion of the recent accident on the electrified portion of the New York Central Railroad is published, and helpful diagrams are printed, which give one a very clear idea of the cause of the catastrophe. The limits of thermal efficiency in internal-combustion engines are discussed. Dr. D. T. MacDougal presents a thoughtful article on the hybridization of the oaks. Dr. Charles Mercier contributes a very curious paper on the fear of open and closed spaces.

The Jiji Shimpo states that, according to the government's present plans, the efficiency of the Japanese navy in 1915 will be double what it was before the Russo-Japanese war.