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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 406,

For the Week ending October 13, 1883.

Price 10 cents. For sale by all newsdealers.

A NEW YORK OFFICE BUILDING.

We have carefully noted the work on the new building for the Mutual Life Insurance Company now in course of erection, on the site of the old Post Office, under the charge of Mr. Charles W. Clinton, architect. It will be a fine representative building, embodying all the modern improvements that have been developed in this country up to the present time, and it is because of these characteristics that we have compiled the following description.

The building fronts on Nassau, Cedar, and Liberty Streets, the entrance front, on Nassau Street, being 186 feet in length, and the fronts on Cedar and Liberty Streets being 111 feet and 115 feet, respectively. It will be eight stories in height, exclusive of the basement. It is to be regretted that so fine a building should be handicapped by its location, the streets upon which it fronts being so narrow that it is impossible to obtain a good view of the whole. To overcome this defect of sight the propriety of setting it back from the line on Nassau Street is so obvious that it must have occurred to the company, who, on the other hand, might with some reason not have felt satisfied in sacrificing the valuable renting space for what their patrons would perhaps judge to be purely æsthetic reasons.

The work so far is of the most solid and enduring character. The foundations have been designed with great care to insure equal pressures under every part of the superstructure. The piers are properly proportioned to sustain the weights, in their sectional areas and heights, according to the several materials of which they are built. The basement and first stories are of granite, the piers being built solidly of that material, not simply faced with it and backed up with brick, as is usually done. This mode prevents the evils resulting from unequal compression. The other stories, up to the eighth, are of a beautiful limestone from Indiana.

The interior construction is mainly of iron, consisting of rolled beams supported on plate girders which rest on cast and Phœnix wrought iron columns. A distinctive feature in the construction of the building lies in the fact that a separate iron girder spans the window heads of each story, which does not show on the exterior, however. These girders transfer the weight of the story above to the main pier, thus relieving the mullions of the weight and avoiding all danger of cracking the stone lintels.

The building is entirely fireproof, the spaces between the beams being spanned with fire brick, and the bottoms of the beams being protected with the same material, which is an unusual precaution. Most particular attention has been given to ventilation, and the heating will be complete, although by direct radiating coils, yet from the manner of introducing fresh air the best effects will be obtained. Steam will be furnished by the Steam Heating Company, although boilers will also be provided. Provision will be made for both gas and electric lighting, as well as for all the latest appliances, such as telephones, electric call bells, etc. An artesian well will assist in supplying the building with water.

Although the work has now reached only the sixth story, still enough is seen to show what its character will be. The style is an adaptation of the Italian Renaissance. The façade is divided into three features, the central part recessed and flanked by pavilions on Cedar and Liberty Streets. The stories are grouped so that they form three grand divisions, separated by horizontal belt or cornice courses. The basement and first story comprise the first division, the second and third stories the second, and the fourth, fifth, sixth, and seventh will form the upper division, and are to be inclosed in an arcade, the pilasters of which will be ornamented with flutings and richly carved capitals, the arches spanning the spaces between, strongly marked and elaborately enriched. The main cornice will surmount this feature. It is bold in design and contains all the complete enrichments, such as modillions, dentals, etc., according to the best examples found in Italian palaces.

As all the stories of the portico are in place, although not yet completed, a fair interpretation of the architect's idea may be seen. It is the most highly wrought feature of the façade, and is both striking and imposing. It is two stories in height, the first story being formed by large square granite piers with alternate polished courses in "rustica," flanked by massive granite columns. The capitals of both columns and piers are elegant in design and beautifully executed in white marble. The second story of the portico is similar in its distribution of parts, but with an arch springing from the entablature of the small columns, is more highly elaborated and carved in detail. The ceiling is vaulted and paneled, and the piers are covered with Renaissance carving. The capitals of the piers have heads typical of Europe, Asia, Africa, and America carved upon them, modeled and executed in a masterly style. This work was done by Mr. Samuel Kitson, from Rome.

These two stories taken together form a composition organic in its development, while the whole is fully sufficient to dominate the other large features of the work and accentuate and mark it as the main entrance of the building. The transmission from the plain severity of the pavilions to the concentrated enrichment of this portico is not violent, as the intermediate features, the arched windows on either side, carry the enrichment through, leading gradually up to the central feature. There will be an ornamental bronze gate at the portico entrance.

The drawings of the interior, which were shown us, indicate that the finish of this portion of the work will correspond in character with the exterior. The main entrance hall leading to the elevators will be finished most substantially in white marble, to make it as light as possible. The elevator doorways will be trimmed with the above named material, and the openings guarded by strong and ornamental brass grill work. The finish of the main office of the company, on second and third floors, will be handsome and dignified, while being free from extravagance. The columns will be of scagliola, with Corinthian capitals; and the ceiling will be paneled in plaster. A white marble wainscot of plain design will surround the room. The offices for renting will be most attractive in finish. A noticeable feature is the ample provision for light and air, the windows being unusually large in proportion to the piers, although the grouping and the depth of joints of the piers are so arranged as to give them great solidity in appearance as well as in fact.

The engineering throughout the work has been most thorough, the architect having placed Thomas E. Brown, Jr., C.E., in charge of this work.

The impression produced so far gives promise that the work when finished will be imposing and elegant, with sufficient plainness or severity to give dignity, relieved in certain parts with enrichments, giving value to the rest; a work of which the city may well be proud.

RAISING BREAD.

The elastic gas which is the agent employed in causing dough to "rise," so that it can produce light and palatable bread, is as a rule carbonic acid. In practical fact there are two distinct methods of introducing the acid into the dough. In the first we form it within the dough, *de novo;* in the second we mix it in a solid form and then set it free as a gas. For the first we use fermentation; for the second we use baking powder or its equivalent.

In fermentation the yeast, from the materials which it finds in the dough, forms two new substances (neither of them having been there before)—alcohol and carbonic acid. The presence of the alcohol is of decided importance, though it is not commonly recognized. Very few persons are aware of the amount of it which is produced in bread making. Of course, in the process of baking the greater part of it is evaporated, but it is a safe estimate to reckon that very nearly a thousand gallons are lost daily from the bread baked in New York alone. Some twenty-five years ago a company was formed in London and erected works for baking bread in such a way that the alcohol should be condensed and saved. It was easily done; the alcohol was made and sold to good advantage, but after expending at least $100,000 the company failed. Why? The alcohol was a clear profit. Yes, but they *could not sell their bread!* They evaporated the alcohol from it so closely that the people pronounced it unpalatable, and would not use it.

In fact, all good yeast bread contains still a very appreciable quantity of alcohol, and owes a part of its excellence to its presence. We may reckon the quantity at ten to twenty drops in an ordinary loaf of bread. Not enough, of course, to produce any physiological effect, and yet enough to affect the quality of the bread.

The carbonic acid, which is formed by the fermentation at the same time with the alcohol, not only acts mechanically as an elastic gas, but also by its refreshing and invigorating effect upon the stomach it assists digestion directly. The small quantity of yeast introduced multiplies itself rapidly, until when the process is well completed it has permeated every part of the dough, and "the whole is leavened." Wherever it goes it produces minute bubbles of gas; and each bubble at once tries to escape because of its elasticity, which is held under pressure. They struggle hither and thither, uniting together to form larger bubbles, until the whole mass has become porous and spongy; that is, the bread is "raised." The heat of baking stops the growth of the yeast, and the process is ended.

We have thus far formed our gas by fermentation, but we can do it much more quickly, on the instant, as it were, in another way. Any carbonate, acted upon by an acid, yields carbonic acid. Bicarbonate of soda is very cheap, and when decomposed affords a large bulk of gas. If therefore we can combine it with an acid which is of solid form, is cheap, and is both in itself and in its compounds harmless, we shall be able to work it into the dough, and the quickly resulting gas will "raise" the mass in a very few minutes.

The most convenient article for this purpose with which we are as yet acquainted is probably cream tartar, which is a bitartrate of potassa; at all events, this so completely satisfies the requirements, that it has come into very general use. Formerly the cream tartar and soda were mixed in the using, and this custom has not altogether passed away; but it was found convenient and profitable to blend them into one, and baking powder was the result, and no fault could be found with it, or the bread which it raised, so long as baking powder was honest. But alas for what is now sold us!

Good cream tartar bread is perfectly wholesome, but it lacks the alcohol, and can commonly be distinguished from yeast bread even by the taste, and this mode of "raising" is used chiefly for those forms which we will so unwisely persist in eating hot.

For herein comes to light the most important distinction between the two modes of raising dough. As formerly remarked, hot bread, biscuit, etc., ought never to be eaten by any one. But if we are bound at any rate to do it, there is much greater safety, and much more ease of digestion secured by the use of the cream tartar. The biscuit, etc., made with it can within a very few minutes after baking pass through all the changes which in the other case require five or six hours. And until these molecular transformations have ceased, the bread is a fearful burden to a weak stomach.

But where it is to be eaten cold, as it should always be, yeast fermentation is what it has in all ages been, the *one* way to raise bread.

STEEL CASTINGS.

The qualities that steel castings should possess in order to fit them for safely replacing the main forgings now used in marine construction is a subject now being very generally studied, both in this country and Europe. It is well known that large forged stern frames are seldom absolutely sound, while the frequent breaking of wrought iron crank shafts proves that they cannot be relied upon, taken as a whole. If these parts can be made of cast steel which will be sound, homogeneous, free from internal strain, and having the requisite strength and ductility, it behooves ship builders to adopt that material. A paper on this subject, containing much information from various eminent steel makers in Europe, was recently compiled by Mr. William Parker, chief engineer surveyor of Lloyd's Register of Shipping.

The superiority of mild steel over iron for the principal structural parts is acknowledged, but in proof of this it is stated that last year seventy-three large steamships were built of steel and 116 vessels were being built of steel last January. During the course of the inquiry visits were made to three firms in England who make large castings, in addition to those who make heavy forgings, and the prominent steelmakers of France were consulted. Tests were made upon samples cut from castings and also upon the castings themselves, and similar tests were conducted upon pieces of forged iron and forged steel. The report says: "The result is that we are now convinced that structures can be made of cast steel quite as fit for the purpose intended as those usually constructed of wrought iron, and that they can, at the same time, be made in such a manner as to avoid the uncertainty inevitably associated with large iron forgings owing to the large number of weldings necessitated in them."

Messrs. Jessop hold that it is absolutely necessary to melt the steel in crucibles in order to secure a definite composition of the material and to obtain thorough homogeneity throughout a large casting. Messrs. Spencer & Sons use both crucibles and open-hearth furnaces, the size of the castings being the only guide, and they find no difference in the material. The Steel Company of Scotland use open-hearth furnaces for every purpose. The first two firms think that careful attention to the materials used will insure strength, ductility, solidity, and soundness. At the works of the Steel Company the metal is melted in an open-hearth Siemens furnace, the bath being a mixture of manganiferous pig iron and steel scrap. Hot steel scrap is then added until the bath contains a sufficiently low amount of carbon to give the product the desired hardness. Then is added an alloy called silicide of manganese, to insure solidity of of the steel and freedom from blow holes, the metal being finally tapped into a ladle and run into moulds in the usual way. Oxidation, during the operation, is prevented as much as possible.

At Messrs. Jessop's the opinion is held that a uniform cooling of the original casting is the only means of insuring molecular equilibrium; but the other makers think that this cooling cannot be so uniformly performed as to leave the casting free from internal strains, which, they think, can only be got rid of by careful annealing. This annealing consists in slowly raising the temperature of the casting to a bright red heat, keeping it at that temperature for a time, and slowly cooling it. M. Pourcel, of Terre-Noire, attaches great importance to tempering castings in oil, in addition to annealing, in order to give them greater ductility. The first operation transforms the large crystalline grain of the metal into a finer and more homogeneous grain, and each repetition adds to the homogeneity, tenacity, and ductility. To prove this experiments were made upon four specimens cut from the same casting. The first was in the same condition as the casting, and broke with a tensile stress of 32·07 tons per square inch and an elongation of 16 per cent in a length of 5 inches; the second, which was annealed, broke at 33·7 tons per square inch with an elongation of 17 per cent; the third, which was annealed and tempered in oil, broke at 38·6 tons, with an elongation of 17 per cent; the fourth, which was twice tempered in oil, broke at 41·1 tons per square inch, with an elongation of 15 per cent.

Large shafts can only be made by a few firms possessing the necessary appliances for heavy work, and they are of various opinions as to the most suitable materials to be used and the best methods. It is almost universally thought that mechanical work done upon steel greatly improves its ductility. Sir Joseph Whitworth believes that the ductility of steel would reach its maximum if it were possible to subject it to a great pressure while in a fluid state, say a pressure of 20 tons to the square inch. He prefers steel of a tensile strength of 40 tons per square inch, having a ductility enabling it to elongate 30 per cent in a length of two inches.

Messrs. Vickers & Sons, at present the largest makers of steel crank shafts for marine purposes in the world, use a mild steel, having a tensile strength of only 24 tons per square inch, and the writer states that he knows of but one shaft of their manufacture that has broken. "And this to my mind is conclusive, seeing that shafts of hard steel are made of the same size as those of mild steel, that the relatively mild steel used by that firm has, by its ductility, a greater amount of *endurance* than harder steel, which enables it to better withstand the great and oft-repeated strains brought upon all marine crank shafts from the nature of their work."

Hammering increased the strength of a piece of steel casting 36 per cent and the elongation 10 per cent, while rolling it until the section was reduced to one-fifth increased the strength 30 per cent and the elongation 130 per cent. Other experiments show very little difference in regard to tensile strength, but show that ductility is greater in cases where the most work is put upon the material.

The German Carp and its Introduction into the United States.

In a paper read before the American Association, Mr. C. W. Smiley, of Washington, D. C., said he had some years ago imported from Germany thirty or forty pairs of this fish. They were placed in breeding ponds in Washington, and have increased manyfold, the number spawned this year being 400,000. The carp is naturally a warm water fish, and in the waters of the Southern States grows with astonishing rapidity, and to great size. They will also do well in the cold water of the North, even in Minnesota. Nearly every State and county in the United States has a fish commission, and they are all propagating carp. It has also been taken up as a private speculation, and carp are sold for breeding purposes as high as $5 per pair.

The carp roots about in the mud for aliment, and much resembles poultry in its manner of getting food. Carp aged three years are often found to weigh twelve to fifteen pounds, and a gain in weight of four pounds has been observed in a carp in one year. The carp is sluggish; while trout, bass, and other lively fish frisk about, and do not fatten so fast as the carp. Experiments have shown that female carp spawn at the age of one year in southern waters, at two years in colder waters, and in the extreme northern waters of the United States at three years. Other fish, turtles, muskrats, snakes, and even birds, eat young carp. A bird shot in Washington recently had in its stomach the heads of seventy-nine young carp. The United States Fish Commissioner recently sent out requests for information about carp experimented with in this country; most of the replies placing the carp on an equality with trout, bass, and shad as a food fish, while a few classed them with pike, and a very few said they had a muddy taste. The carp is the best pond fish yet known, and in a very small pond will thrive well, so that families may easily have their own fish garden if they have enough water to make a permanent pond. The carp is a very hardy fish for shipment, requiring little water to keep alive in. The United States Fish Commissioner is giving away carp, sending them by express to any point, the receiver paying express charges. The fish will thrive on table refuse and almost anything edible. Carp can be kept in winter in a tub in the cellar, the water requiring to be kept fresh. Care should be taken to keep poisonous substances out of carp ponds, and too much food should not be thrown in. In cooking carp, thorough cleansing is needed; and frying should be done in hot pans and hot grease.

As to the economics of this subject, Mr. Smiley said that fish culture was more and more becoming a part of the farmer's occupation, and thought that, not very long in the future, most of the farmers of the country would have little fish ponds in their door yards, both as a method of obtaining food and as an ornament to the homestead.

Electrical Appliances on Austrian Railroads.

A number of important apparatus are used by the Imperial Austrian State railways, and invented by the Chief Inspector of Railroads, Herr Pollitzer. They are:

(1) A central point blocking apparatus. The object of this apparatus is to control any pointsman from a central office and to prevent him from showing the line clear until ordered to do so by the central office. It consists of a small box and a manipulator. The box has an electric bell at the top and two circular openings in front, exhibiting, in their turn, the two different directions of a train. On the train being announced from the nearest station, the person in charge at the office presses a stud beneath the opening indicating the direction of the train. The pointsman answers the signal. The points are now set by the manipulator from the central office and simultaneously the lever for the semaphore signal is electrically released, enabling the pointsman to show the line clear.

(2) Intermediary blocking apparatus and speed measurer. The apparatus consists of a clock case containing a clock-work and sector of a dial and two glass covered circular openings above the clock. The train—generally the last carriage—has a small brush attached to a lever which presses the brush against a brass contact piece placed on the line, close to the rail, at the beginning of one section. When contact is made, a red disk appears in one of the openings, and the clock begins to move. At the end of the section a similar contact piece causes another red disk to appear on its respective apparatus, stops the clock movement, and removes the disk of the preceding one. The distance through which the clock hand has moved over the sector indicates the speed of the train. As long as the red disk is exhibited, no train can move in either direction.

(3) Central disk for signaling. On a disk are inscribed different numbers of signals for passenger and goods trains, and a switch-board above the disk exhibits these different numbers on the fall of an annunciator, which is caused by the setting of a contact arm, movable over the disk, on the respective number of the train. All the trains moving on the line are controlled by electric semaphores, which show the line clear only on the appearance of the number of signals characteristic of a special train. As soon as the train has left the section, the official at the station turns the contact arm to the place indicated on the disk for that train; the annunciator of the corresponding numbers on the switchboard falls, and all the semaphores of the section show the line clear.

(4) Apparatus for closing railway gates for foot passengers. The object of the apparatus is the automatic lowering or raising of a gate closing the footpath across a railway gate by a mechanism worked electrically. An electric bell, worked by a signalman at some distance from the gate, informs the foot passengers of the approach of the train; and, by the same operation, the gate is closed electrically by the release of a clock train, which moves a jointed lever arm through an angle of 90 degrees; when the train has passed, the same manipulation opens the gate by completing the movement of the lever arm.

(5) Station indicator. It is no small boon for passengers traveling by express train over long distances to know the name of the nearest station at which the train stops sufficiently long to take a meal, buy a paper, etc. Herr Pollitzer places in every carriage a small box exhibiting in the corner the name of the next station, with time allowed for stoppage. The guard has simply to press the stud of a similar box placed in his van some time before the station is reached, and every box shows the name of the next station, with the time allowed for stoppage. The battery for railway intercommunication, which is rarely used, can be employed for this purpose.—*London Times.*

Extension of American Telegraphic Connections.

To all who are interested in enlarging the commerce of the United States with the nations south of us—in Mexico, Central, and South America—the opening of the extensive telegraphic connections made recently is a matter of the utmost importance. Starting from Galveston, a cable in the Gulf of Mexico connects with Tampico, Vera Cruz, and Coatzacoalcos, on the coast, and thence with 267 miles of land line; crossing the Isthmus of Tehuantepec, the line extends down the Pacific coast as far as Valparaiso, in Chili, stopping at all principal points, making 4,872 lines of cable and 300 miles of land line. From Valparaiso the wires cross the Andes to Buenos Ayres and Montevideo, and thence by cable along the coast connect with the principal points in Brazil. A good proportion of these lines has been opened for business for a considerable time, but were not connected with the American system except as they might be used by telegraphing to Europe and thence back to Brazil, which frequently caused much delay and was very expensive. The cost of telegraphing over these long lines is not small now, being in the neighborhood of three dollars a word for points in the Argentine Republic, Uruguay, and Brazil; but, with the elaborate codes now used, there can be no doubt that our merchants will largely avail themselves of this means of closer connection with their customers in these sections.

The United States is now in direct telegraphic connection with all parts of North and South America and Europe. A direct cable to Australia, Africa, and Asia is now in order, to complete a circuit of the world.

Auxiliary to a Pumping Engine.

At one of the pumping shafts in a lignite mine in Germany an engine was put in for two sets of pressure pumps having 2·5 foot plungers and 7·22 feet stroke, the maximum lift being 236·2 feet. The pumps were driven by the engine through the intermediacy of a bob, without gearing. The engine itself is horizontal, with a 27·9 foot flywheel, weighing 30 tons. It had a 4·59 foot cylinder and 7·22 foot stroke. Its chief peculiarity was, that it was provided with a small special engine, intended to carry the main engine over the dead-center, when running slowly, the crank of the auxiliary engine being placed at right-angles to the main crank. When running without expansion, the engine could be worked at the rate of two revolutions per minute as a minimum, and nine as a maximum, without using the auxiliary engine. When cutting off at three-eighths of the stroke, the number of revolutions per minute could not be carried below five. They were, however, brought down to 3½ strokes by the aid of the auxiliary cylinder, which, by the way, had a diameter of 1·60 feet and a stroke of 3·9 feet. The contrivance in question is, therefore, useful and economical in fuel in those cases where the flow of water is so small that the pumping engine must be run at the lowest speed attainable. The lignite is obtained by stripping, and the quantity of water accumulating during rainy seasons is enormous.

THIS is a calculating age, says a contemporary. Counting is its favorite occupation. It worships figures. Nothing is considered valuable unless it can be counted. Quantity is the test of excellence, and vast numbers command the highest reverence. The popular mind has become insane on the subject of statistics; all our views of life, all our verdicts of success or failure, all our estimates of worth, are based on columns of figures.