Scientific American.

ESTABLISHED 1845.

MUNN & CO.. Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.

(Established 1845.)

One copy, one year. for the U. S., Canada or Mexico.................	$3 00
One copy, six months, for the U. S., Canada or Mexico...	1 50
One copy, one year, to any foreign country belonging to Postal Union	4 00

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

(Established 1876)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year*.

Building Edition of Scientific American.

(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To architects, builders and all who contemplate building this work is invaluable.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American

(Established 1878)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

MUNN & CO., Publishers, 361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JUNE 27, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 1069.

For the Week Ending June 27, 1896.

Price 10 cents. For sale by all newsdealers.

THE ELEVATOR PROBLEM IN TALL OFFICE BUILDINGS.

Few manifestations of the capabilities of the modern engineer in this the age of steel are more impressive than the tall office building of our great cities. These structures from their size appeal to the public. Groups of people may often be observed standing on the sidewalks in the vicinity of especially striking examples, looking up at them as at one of the wonders of the day. The same class of building interests the engineer. In them he finds embodied some of the boldest conceptions of his science. The carpenter in erecting a fully framed wooden building first makes a self-sustaining skeleton of beams, and then incloses it by boards. The modern tall office building is of analogous construction. A frame of steel is set up which is self-sustaining, or rather independent, for it is made strong enough to carry hundreds of tons more than its own weight. This frame is open. Its interstices are filled in with brick and stone, material which here departs from its ordinary principal function of sustaining great loads, and whose new office is to act as a screen or a sheathing. The enormous mass of a building of this type may be entirely supported by a few steel columns; the brick and stone could be completely removed from any story without disturbing the floors above it. The entire upper stories, fifteen or twenty in number, could be left standing on a few comparatively slender steel pillars.

The new construction, in its use of cantilevers for distributing weight evenly, and in its rapid methods of construction, has gone far to create the tendency of the day toward great height in buildings. A steel frame is raised with great rapidity. Steel derricks lift an entire truckload of steel beams at a very high speed, and so much of the work has been done and is in process of execution that a new trade, that of housesmith, has been evolved within the last few years. Many new methods or new developments concur to increase rapidity of construction. There is even discernible a sort of rivalry among cities as to which shall have the most impressive tall office building.

The justification of the construction of a tall office building, twenty to twenty-five stories in height, is sought for in the high price of land. It seems a truism that a building twenty stories high gets twice as much out of the land occupied in the way of office area as a building does which is only ten stories high. But such truism does not exist, owing to the necessity for increasing the number of elevators as floors are added, so that twenty floors do not give by any means twice the area of ten floors.

There is one element in the problem of the maintenance of high buildings, one we have just alluded to, of which but little has been said, and which is in very definite need of solution, were such solution possible. It is the elevator problem. One of these great buildings is a concentrated city, and has to be provided with rapid transit for its tenants and for their clients and visitors. Due regard for the comfort of those using the elevators operates to impose a restriction upon their speed.

Already many elevators run so fast as to be very uncomfortable. The high speed is adopted to make each elevator do a better day's work. But in spite of high speed, the elevator service in some cases is proving inadequate. Twenty or more floors, each full of offices, are to be served, and even high speed elevators have to be disadvantageously multiplied for the work to be done. If insufficient in number, they go up crowded with passengers, and the discomfort is very great.

It is the last few stories that tell the most. A ten story building is easily served; the problem becomes serious in one of twenty stories. So many passengers have to be carried to so great an average height that elevators have to be greatly increased in number.

It is here that the trouble begins. It would be very simple to put in a large number of elevators, and the expense of running them could be easily borne, but the room which they occupy is a more serious matter. In the case of buildings of large area, it is easy to surrender to the elevator shafts the less available portions of the building, such as the portion lying in the center. Here offices cannot be placed advantageously for want of light and ventilation. But the tendency to erect exceedingly tall buildings on small areas intensifies the trouble. Practically every portion of the floor space may be of value, and each elevator destroys its own area on as many floors as it goes through.

As the height increases, the number of elevator shafts, penetrating the floors and occupying rentable space, increases, and a balance will eventually be reached when the addition of floors would so magnify the elevator difficulty that more would be lost than gained by the increase in number. It is probable that this balance is reached now if it has not been exceeded. Possibly the utilization for elevators of the least desirable portions of buildings involving the location of elevator shafts near the center of blocks will effect a partial cure. Buildings standing on valuable land of small area have an immense sacrifice to make if elevators are placed within their available office area. In some cases less valuable land near the center of the block might be specially utilized for the elevator system.

Carving Before or After Placed.

It would be interesting to learn just why so many stone carvers prefer to work on the material after it has been built into a structure rather than on the block before placing. When interrogated as to this preference the usual answer is that it is thus easier to match the cutting on adjoining blocks, or that one gets a better idea of the effect in this way. Or perhaps it may be argued that there is danger of damage to delicate reliefs in handling the blocks and getting them into position. Yet neither or all of these appear to be sufficient reasons—sufficient, that is, to offset the disadvantage of working in awkward positions, of not having spare tools handy and of the danger of mutilation of a placed stone by a slip. As to the latter, which would apparently be a very serious and expensive matter usually, one carver, whose specialty is scroll and leaf cutting, medallions, pilaster and column capitals, etc., says that he can generally get over or conceal small breaks by slightly altering the design. But after all the practice does not seem reasonable, and none of the explanations are quite satisfying. Of course there are cases where there is no choice, but for the most part the ornamental work could, it would seem, be done to better advantage in the yard or under cover than when the workman is slung up on a staging. All the delicate reliefs, even in limestone and sandstone, or soft material in general, could be crated and otherwise protected for handling in setting up.

Both systems seem to have been followed by the ancient Egyptian and Greek cutters, though it is not always easy to determine the method. From what is known of the skill of the old constructors in getting heavy material into place, making close joints and perfect matching, it may be concluded that a large part of the carving was done before erection. We degenerate moderns, too, have some tricks of our own, going so far now in good practice as to have pressed and ornamental brick snugly packed in crates at the brick yards, transported in these crates, and finally swung up in them to the level where the brick are to be set, and not for convenience in handling merely, but to avoid chipping of corners and edges, thus effecting quite a little saving. Finished stone also can be protected against rough usage in transportation, as is being done daily everywhere.

It was suggested to an expert carver who favored the plan of working on the building rather than on the unassembled parts of it, that his preference was perhaps only the outcome of convention and habit, and it was delicately intimated that possibly he had not ever considered the matter seriously. But he would not have it that way at all, though he could not make the meddlesome outsider understand why he liked to work lying down or doubled up rather than in the normal posture of other artisans.—Stone.

Children's Inverted Drawings.

The crystalline lens in the eye, like the lens of a camera, causes the image of an object to be inverted upon the retina. Psychologists have yet to explain in detail, however, why we see things right side up, instead of in the inverted position corresponding to the retinal image; though it is believed that the reinversion is effected mentally, and is determined and controlled by sensations of touch. There is no difficulty in accepting this explanation, for every photographer gets so familiar with the inverted positions of things, as seen upon the screen of his camera, that he never thinks there is anything strange about the topsy-turvy picture which he focuses. In connection with this question it has lately been pointed out that many young children draw things upside down. Whether this habit depends upon the inversion of the retinal image is, however, difficult to say. Mrs. D. H. Scott states in Nature that if a child who draws things upside down, when drawing on a horizontal table, is asked to draw on a blackboard placed vertically, he will draw everything the right way up. Thus the explanation of inverted drawings seems to be that some children have a difficulty in drawing upon a horizontal surface things they always see vertically.

Substitute for Diamond for Cutting Glass.

The time honored glazier's diamond seems in danger of being displaced by a cheaper substitute, even more efficient than the original instrument. It is reported that M. Moissan has discovered a means of forming a compound of boron and carbon by heating boracic acid and carbon in an electric furnace, the intense heat of which has already been the means of introducing into every-day use substances that hitherto were either unattainable or too costly. The new substance in appearance is black, something like zoophite; and its hardness is so great as to enable it to cut diamonds with ease. Unlike the results of previous experiments in artificial diamond making, which were in minute particles, the new cutting material can be produced in pieces of any size required.

"Barisal Guns" and "Mist Pouffers."

Travelers in passing through the delta of the Ganges, India, have occasionally heard dull, subdued sounds, not unlike the reverberation of distant artillery. As these sounds have been heard when it was positively known that no artillery practice was being carried out, this mysterious phenomenon, which is known as the "Barisal guns," has given rise to much curiosity and speculation. A similar phenomenon occurs in two different countries in Europe, regarding which, in a letter upon the subject to Prof. G. H. Darwin, M. Van der Broeck, conservator of the Museum of Natural History of Belgium, writes:

"I have constantly noticed these sounds in the plain of Limburg since 1880, and my colleague of the geological survey, M. Rutot, has heard them very frequently along the Belgian coast, where our sailors call them 'mist pouffers' or fog dissipators.

"The keeper of the lighthouse at Ostend has heard these noises for several years past; they are known near Boulogne, and the late M. Houzeau spoke of them to my friend M. Lancaster. More than ten of my personal acquaintances have observed the fact.

"The detonations are dull and distant, and are repeated a dozen times or more at irregular intervals. They are usually heard in the daytime when the sky is clear, and especially toward evening after a very hot day. The noise does not at all resemble artillery, blasting in mines, or the growling of distant thunder."

M. Van der Broeck attributes these noises to "some peculiar discharge of atmospheric electricity." M. Rutot thinks they are "internal to the earth," and might be caused by "the shock which the internal fluid mass might give to the earth's crust."

Similar unexplained noises have been heard among the Dartmoor Hills, England, and in Scotland. Since the publication of Prof. Darwin's letter in Nature last October, there has been a considerable amount of correspondence relative to this unexplained phenomenon, one of the later letters drawing attention to a reference by the late Dean Stanley in his "Sinai and Palestine" to "the mysterious noises which have from time to time been heard on the summit of Jebel Musa, in the neighborhood of Um Shaumer, and in the mountain of Nakus or the Bell, so called from the legend that the sounds proceed from the bells of a convent inclosed within the mountain. In this last instance the sound is supposed to originate in the rush of sound down the mountain side. . . . In the case of Jebel Musa, where it is said that the monks had originally settled on the highest peak, but were by these strange noises driven down to their present seat in the valley, and in the case of Um Shaumer, whereit was described to Burckhardt as like the sound of artillery, the precise cause has never been ascertained." The same correspondent, Mr. Edw. Fry, mentions that Burckhardt ("Travels in Syria and the Holy Land," 1822, p. 591) refers to these noises and says "the wind and weather are not believed to have any effect upon the sound."

In the course of a series of "Notes upon the Natural History of New Brunswick," Prof. W. F. Ganong, writing of certain "gun reports" heard upon the southern coasts, says:

"Everybody who has been much upon our Charlotte County coast must remember that upon the still summer days, when the heat hovers upon the ocean, what seem to be gun or even cannon reports are heard at intervals coming from seaward. The residents always say in answer to one's question: 'Indians shooting porpoise off Grand Manan.' This explanation I never believed; the sound of a gun report could not come so far, and, besides, the noise is of too deep and booming a character."

Mr. Samuel W. Kain, secretary of the Natural History Society, of St. John, N. B., has written us that these local noises, and the "Barisal guns" and "mist pouffers," were discussed at a meeting of the society, when "some additional information of interest was elicited. A letter was read from Edward Jack, C. E., stating that he had heard these peculiar sounds on Passamaquoddy Bay years ago. It was also announced that a similar phenomenon occurs in the warm days of summer on the Kennebecasis, a lake-like affluent of the St. John River, of great depth and about seven miles from the city of St. John. This has been observed by several competent observers."

The secretary also read a letter from Captain Bishop, of the schooner Susie Prescott, stating that similar sounds were heard on warm summer days between Grand Manan and Mount Desert Rock.

Referring to the theory that these sounds may be due to geological disturbances, Mr. Kain adds: "It is worthy of note that the land in this region is subsiding at a slow rate, and that two slight earthquake shocks have occurred here lately. These were felt on March 22 and May 16, and were probably due to subsidence."

The attention of the readers of the SCIENTIFIC AMERICAN is drawn to this unexplained phenomenon, with the request that if they know, either personally or by report, of the occurrence of any similar sounds **in their localities, they will communicate the facts to us** for publication. Such information will be rendered specially interesting, if details as to the frequency of the occurrence of these noises can be given, with any accompanying circumstances which might serve to account for their origin.

Aerial Irrigation.

BY H. M. CHITTENDEN, C.E., U.S.A.

The tract of country extending from central Ohio in a northerly and westerly direction into Michigan and Indiana is perhaps more thoroughly supplied with artificial drainage than any other tract of similar extent in the United States. In topography this region is mostly prairie land, often with no discernible slope, and in its original condition was largely covered with timber. The surface water from rain and snow flowed off with difficulty, and much of it remained on the ground until dried up by the sun. The soil is of a clayey character, but slightly permeable to water, and there are comparatively few permanent springs. Around the sources of many of the larger streams there were formerly extensive marshes, covering thousands of acres, which in their natural state seemed to forbid the possibility of reclamation for industrial uses.

In the course of the settlement of the country the necessity of doing something to ameliorate this untoward condition led to the introduction of an extensive system of drainage. The rich clays of the State furnished a cheap and convenient tile material which became the basis of the system. The tiles were connected with large open ditches, and in some cases, as in the great Scioto swamp, with extensive canals constructed at the expense of the State. Of this entire section of country, it is probable that tile drainage and open ditching overspread forty per cent.

It is not intended here to describe the methods or results of this drainage so far as its original purpose is concerned. Suffice it to say that it has reclaimed many thousands of acres of marshes entirely outside the pale of agricultural use, and has vastly improved the condition of extensive semi-swampy tracts. The purpose of this brief notice is simply to call attention to a secondary though very important result of tile drainage, little enough foreseen by the projectors of the system, since it is of a character quite the reverse of any consideration of drainage. This feature may be described as aerial irrigation, by which it results that the severity of mid-summer droughts in the tile-drained areas is largely mitigated.

To quote from a recent government report,* experience in tile drainage early showed that the tiles produced other beneficial effects than those resulting from the drainage of the land. It was found that tiled land resisted drought better than untiled, and it was constantly noted that along the lines of the tiles there was a freshness of growth that indicated the presence of more moisture than the adjacent ground enjoyed. Tile drainage gradually found its way into areas where no real necessity for drainage existed, and always with advantage to the crops, until now the function of the tiles is by no means exclusively to drain the land, but to secure this beneficial influence, the nature of which is not yet fully understood.

There are several minor contributing causes which produce this result, but the real explanation is to be found in the circulation of the air through the tile and the aeration of the soil in its vicinity. Given a tile drain of known length, size, and gradient, and established data in regard to the specific gravity of air, the deposition of moisture with a fall of temperature, and the difference between surface and subsurface temperatures, it becomes a simple matter to determine the amount of moisture which would be deposited in such a tile under assumed conditions of temperature and humidity. At times it is undoubtedly large, and instances are recorded where an examination of the tiles on hot days has found them dripping with water.

The system of tile drainage which is now being so extensively adopted is thus seen to subserve two distinct, contrary, and important purposes—that of removing promptly the surplus water of spring and that of irrigating the soil during the season of drought. It is not improbable that this method of subirrigation by means of circulating currents of air may furnish a satisfactory solution of the problem involved in recent experiments for the artificial production of rain.

It may be stated that this secondary function of tile drains is now so fully recognized that tracts have been recently underlain with tiles for irrigation purposes alone, and that the results of these special experiments have fully justified expectations.

A DISPATCH from Berlin dated May 28 says that the General Electrical Society announce that an improvement has been made in the Roentgen process, and enables the interior of the head, the larynx and the action of the lungs and heart to be observed on a fluorescent screen. The statement has not, however, been well authenticated.

* Survey of the Miami and Erie Canal, the Ohio Canal, etc. H. R. Ex. Doc., No. 278, 54th Congress, 1st Session, p. 78.

Berlin's Sewage Problem Solved.

Berlin has dealt successfully with the drainage question, says the London Health News. Until about a quarter of a century ago the disposal of sewage was effected in primitive fashion, open drain courses, badly built and with inadequate fall, ran through many of the streets, discharging finally into the river Spree, for whose condition contamination would be far too mild a word. A commission was appointed, which, after visiting various countries, especially England, with the view of practically studying different systems, reported in favor of sewage irrigation on land at a distance from the city. The flatness of the plain on which Berlin is built would not allow of any gravitation scheme, and, consequently, it was found necessary to adopt steam pumping. For the same reason the sewage could not all be collected at one spot, and it was, therefore, decided to divide the city into twelve drainage areas. The ground at the seven sewage farms was well suited for the purpose, consisting only of sandy wastes, then growing only stunted firs and birches, but now converted into fertile fields. The total area of the land which could be devoted to sewage irrigation is 22,500 acres; only about 11,000 acres are at present needed. The following extract is from Dr. Legge's account of these Berlin farms:

"No deleterious effect has been noticed on the health of those living on the sewage farms, and, indeed, at some of them, as at Blankenburg and Malchow, the city has built various hospitals for convalescents, for consumptives, and for women recovering after childbed, and the patients seem to thrive in them as well as they would anywhere else."

The question whether the germs of typhoid fever and cholera pass through the soil into the drainage water has naturally formed a subject of inquiry, but many bacteriological examinations conducted specially with the view of clearing up this point have answered the question in the negative. Until 1892 the laborers working on the sewage farms were remarkably free from typhoid fever, although in 1889 Berlin itself was visited by a severe epidemic; in 1892 a few cases occurred among some farm workers, who were alleged to have drunk largely of the effluent from the farm, but in these instances other possible sources of infection could not be excluded. It is satisfactory to note that, notwithstanding the necessarily enormous cost of working these Berlin sewage farms, the expenses have, in most years, been covered by the sale of the produce, and in one year (1889) the surplus amounted to £11,511.

Balloons in Scientific Observation.

The last number of the Proceedings of the German Geographical Society, says Ciel et Terre, contains a paper by Dr. A. Berson on the use of balloons in geographical explorations. As Dr. Berson has made numerous scientific ascensions, both in free and in captive balloons, his observations are extremely interesting. He notes the importance of captive balloons in Arctic exploration, and regrets that Dr. Nansen abandoned this method of investigation, which he had at first intended to employ. Dr. Berson condemns energetically the project of M. Andree, of trying to reach the pole in a free balloon. He is convinced that this aerial trip, if it should be carried out, will lead to a disaster. In his many ascensions, M. Berson has met with every kind of meteorologic condition, and in all seasons he has found that the temperature at high altitudes decreases more rapidly, or at least quite as rapidly, as at low altitudes, and that at heights exceeding 5,000 meters [16,400 feet] there exist temperatures lower than those deduced from the ascensions of Glaisher. Likewise the increase in the speed of the currents, as one gets higher and higher, is greater than has been supposed. In one ascension, when the velocity of the air was only 11 kilometers [7 miles] an hour between the height of 1,000 meters [3,280 feet] and 3,000 meters [9,840 feet], this velocity attained, between 4,000 and 6,000 meters, to nearly 60 kilometers [37 miles] an hour. A marked preponderance of winds with a westerly component was also proved at great altitudes—a fact which confirms the observations of clouds made from the surface of the earth.

The Beginning of a New Volume.

The present number closes the volume for the first half of the year, and we would urge upon those who are readers but not subscribers of the paper that this is the time to have their names entered on our subscription book and thus make sure of procuring the paper without interruption every week. Those who subscribe now will be entitled to our special number, which will be issued on July 25 and will be an historical review of the progress of inventions during the past fifty years. This number will practically be a volume in itself, and if published in book form would probably cost as much as the subscription price of the paper for a whole year. When remitting for the SCIENTIFIC AMERICAN it would be well not to forget the SUPPLEMENT, published concurrently therewith, and which in conjunction with the parent paper provides a weekly compendium of science of surpassing interest.