SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico.........$3.00
One copy, one year, to any foreign country, postage prepaid, £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845)	$3.00 a year
Scientific American Supplement (Established 1876)	5.00 "
American Homes and Gardens	3.00 "
Scientific American Export Edition (Established 1878)	3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 13, 1907.

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.

ELECTROLYSIS IN ARMORED CONCRETE.

One of the strongest recommendations for the use of armored concrete, and for the use of concrete as a protective envelope for structural steel in tall buildings, is the fact, or the belief, that concrete effectually prevents the corrosion of the imbedded material. As far as we are aware, nothing has transpired where concrete has been used for structural or protective purposes under normal conditions, to shake this confidence.

The question has recently been raised, or rather revived, as to whether, under certain conditions, the steel of reinforced concrete may not be subject to the destructive effects of electrolysis. The revival of interest is due to some experiments recently made by Mr. A. A. Knudson, of this city, and reported a few weeks ago to the American Institute of Electrical Engineers. The experiments were carried out as follows: Some blocks of one-to-one Portland cement sand concrete were molded in a common metal water pail, with a piece of 2-inch wrought iron pipe placed vertically within the blocks to a depth of about 8 inches. When the blocks were three years old, one of them was placed in a tank of sea water, and another in a tank of fresh water, and direct current was fed to the iron pipes in the center of each block, the negative electrode consisting of a piece of sheet iron placed in the tank. A third block, similar to the other two, was placed in a tank of sea water but was not subjected to the electric current. After a period of thirty days the last-named block was found to be in perfect condition and the imbedded pipe was perfectly bright. But the two other blocks, which had developed cracks during the test, were easily broken open; yellowish deposits were found in the cracks, where the concrete had deteriorated to such a degree that it could be cut easily with a knife; and the pipes were considerably corroded, showing a loss of weight of over 2 per cent. Similar results were obtained in tests with blocks of standard Rosendale cement, made in the same mold, although in this case the blocks were tested thirty days after they had been made. The cracking of the concrete appeared as early as the sixth day of the test, and by the eighteenth day they looked as though they might fall apart. One of the pipes showed a corrosion similar to the pitting action of underground electrolysis, a hole ⅜ by 1 inch being formed through the wall of the pipe.

It cannot be denied that these results are of profound significance. They call for careful investigation on the part of concrete engineers, and the provision of special means of insulation in all cases where imbedded structural steel, or the reinforcing material of armored concrete, is liable to attack by stray currents in the neighborhood of wet foundations. The whole subject of electrolysis which, because of the exaggerated use to which it has been put by a sensational press, has not received from technical men the attention which it deserves, should be made the subject of a searching investigation with a view to determining the laws and limits of this form of corrosion.

IN TOUCH WITH THE CONDITIONS.

The method of studying transit conditions in this city adopted by Mr. Shonts, who lately exchanged the presidency of the Panama Canal for that of the Interborough Metropolitan Company, cannot be too highly commended. In order to acquaint himself with conditions, he has mingled with the crowds which overflow the various lines of travel during the hours of heaviest travel, and has thus been able personally to experience the intolerable discomforts to which those who are "caught in the rush" are daily exposed. As the result of his experiences he has frankly admitted in one of our contemporaries that "there is reason for the dissatisfaction of the people with the present transit system." As a means of relieving the congestion Mr. Shonts makes the following suggestions:

First: A seat for every passenger. Second: An effort to enforce a car-full-no-more-passengers rule. Third: A trial of the pay-as-you-get-on plan. Fourth: Two more tracks on the Second Avenue elevated road. Fifth: The addition of side entrances to the Subway cars. Sixth: Wider car platforms, with doors for the exclusive use of boarding passengers, and others for those alighting. Seventh: Such restrictions of street traffic where congestion is greatest as will allow the surface lines a reasonable, although not exclusive, use of the tracks.

Taking these suggestions *seriatim:*

The provision of a seat for every passenger except, perhaps, at the height of the morning and evening "rush," depends absolutely upon the Interborough Company. It is merely a question of the provision of more cars, or shall we say, of the abolishing of the present practice of withdrawing cars from service between the rush hours to such an extent that there must of necessity be a large number of unseated passengers. If the company is sincere in the wish thus expressed through its president, it can, with its present facilities, provide every passenger with a seat—on some lines at every hour of the day, and on all lines except at the height of the rush hour.

It is questionable whether the enforcement of a car-full-no-more-passengers rule, as adopted in European cities, would meet with favor in America. Excellent in theory, it would scarcely be workable in practice, at least in a city like New York, where the tide of travel is always overflowing the transit facilities. But the principle back of such a rule is a good one, and it should certainly be applied to the extent of limiting the number of standing passengers to those who can conveniently be accommodated in the aisles of the cars, leaving the platforms free for ingress and egress.

The pay-as-you-get-on plan, we presume, includes the use of tickets which could be obtained of agents or at booths on the street corners. If passengers were encouraged to buy tickets in sets of a dozen at a time, the institution of ticket booths could be limited to the more congested districts, and the use of tickets would have the great advantage of allowing the conductor to remain where he properly belongs, on the rear platform. The passengers would thus be saved from the great inconvenience of the conductor crowding his way through the aisles to collect fares; and he would be free to attend to his duties of starting and stopping the car from a position where he could properly take care of the embarking and alighting passengers.

Although the construction of two additional tracks on Second Avenue would greatly relieve the congestion, the objection on the ground of unsightly appearance must be considered to be insuperable. All future tracks must be built in subways.

The next two suggestions are the most valuable of all; for nothing would increase the carrying capacity of the Subway and surface cars more effectually than the provision of side entrances on Subway cars, and wider car platforms with separate doors for boarding and alighting passengers on both Subway and surface cars. It is not the speed between stations but the duration of stops at the stations which determines the average speed of the trains and the number of trains which can pass over a certain line in a given time; and the length of the stops is determined entirely by the facilities for loading and unloading. As we have often pointed out, the present end doors and narrow platforms are about the crudest and most absurd arrangement that could possibly be imagined for rapid transit or even street railways. We believe that the express service on the Subway during rush hours could be made to show an increase in capacity of twenty per cent, and the local service of forty per cent, by the provision of central doors and platforms of double the present width, with separate doors for entrance and exit.

The last suggestion of Mr. Shonts, that street traffic be restricted where the congestion is greatest, should receive the most careful consideration of the authorities. Such restriction presupposes a due consideration of the interests both of the traveling public and of the owners of the vehicles—carriages, automobiles, and trucks—which would be affected, and in some cases seriously affected, by such restriction. Judged on the grounds that the greatest good of the greatest number should always be sought in adjustments of this kind, it would seem that some form of restriction on the more crowded thoroughfares, particularly during the rush hours, ought to be imposed. As matters now stand, the inconvenience suffered by the public, as the result of the interference of trucks and slow-moving vehicles with the movement of the surface cars, is simply enormous. In fact, on some stretches of line, the number of passengers carried per hour must be fully 75 per cent below that which could be carried, if vehicular obstruction were removed.

The President of the Interborough Company is to be congratulated both upon the common-sense method which he has adopted in his investigation of the transit situation, and upon the general excellence of the remedies proposed. His action will go far toward restoring that mutual confidence and sense of mutual interest between the corporations and the public, which will form the best guarantee of an early reversal, or at least amelioration, of the present conditions.

A NEW THEORY OF GUN EROSION.

One would have thought that at this late day, after so many years of painstaking investigation, all the conditions that produce gun erosion would be well understood. Erosion of the bore began to cause anxiety to the artillerist as far back as the days of black powder; it was present in more marked degree in the days of brown powder; and smokeless powder, with its higher temperatures and pressures, has increased the trouble to such a degree that it has been accepted by the Bureau of Ordnance of the army as the controlling factor in the design of artillery; as witness the fact that three coast defense guns have been ordered whose caliber, pressures, and velocity have been determined entirely by the necessity of keeping down erosion and so prolonging the life of the gun. Throughout the whole of this period of the development of modern ordnance, the trouble of erosion, because of its magnitude, has received as much, if not more, attention than any other element connected with the construction of high-powered guns. The announcement that the erosion question must predominate absolutely the design of our guns might reasonably be taken to indicate that the subject was now thoroughly understood in all its bearings; that its causes were clearly defined; and that, except in unimportant particulars, there is nothing further to be learned about it.

And yet at this late hour, a theory of the fundamental cause of erosion is advanced which is so simple and reasonable that one fails to understand how it could have been overlooked for all these years. We refer to the theory advanced by our correspondent in a letter published elsewhere in this issue, that it is the stretch of the metal and enlargement of the diameter of the bore under the pressure of the powder gases, which, by providing an annular opening between gun and projectile at the instant of explosion, permits the gases to escape past the projectile, that causes the erosion of the bore. Whether the gun be built of hoops shrunk one upon another over a central tube, or of miles of wire wrapped under high tension around the tube, the walls of the gun consist in either case of highly-elastic material overlaid on and gripping a tube of elastic material, the latter being thrown by the tension of the former into a condition of permanent compression. When a charge, no matter how small, is fired, the pressure produces a corresponding stretch of the walls of the gun. The amount of stretch will increase with the increase of powder pressure, until, under the 18 to 20 tons to the square inch which exists in the powder chambers of modern smokeless powder guns, it becomes sufficient to spring the bore of the gun away from the projectile and allow the gases, particularly in the first few feet of the movement of the projectile down the bore, to escape freely past the shell. Moreover, at these high pressures there must be a proportionate compression of the projectile. When to the annular opening thus formed is added the vents which are due to imperfect seating of the copper rifling band, it can readily be understood that there must be a considerable escape of gases, particularly under the high initial pressures of discharge.

Now herein, in this stretching of the walls of the gun away from the projectile, is a strong argument in favor of the contention that it is insufficient obturation or sealing which lies at the bottom of the erosion trouble, and if this be the case, we certainly fail to see how the proposed army 14-inch gun, whose walls will be reduced in thickness proportionately to the reduction in pressure, can be expected to cure erosion. The amount of stretch of the gun is determined by the relation between the degree of pressure and the amount of metal opposed to it; and since, in all well-designed guns, this ratio is fairly constant, we may look for the same, if not more stretch, or enlargement of the bore in the new 14-inch guns, and the same escape of gases, with its inevitable eroding effects. The erosion will not be so great as in the present 12-inch guns, for the reason that the temperatures will be less; but we believe that it will be sufficient to greatly disappoint the hopes of those who look for a considerable prolongation of the life of the gun.

It is evident, from what has been stated above, that the formation of an annular vent between bore and projectile is inevitable, being inherent in the principles upon which guns are constructed. Therefore, the cure for erosion seems more than ever to lie in the direction of the proper sealing of the base of the projectile. We know of no subject to-day in the field of ordnance construction that is more worthy of the efforts of properly-qualified inventors than that of devising some adequate means of meeting this greatest of all artillery problems.

THE VALUE OF THE NILE BARRAGES TO EGYPT.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A considerable amount of criticism has been made in many quarters regarding the utility and value of the expensive barrages that were thrown across the River Nile at Aswan and Asyut respectively, for the purpose of damming back the waters during the season of plenty and for the purpose of improving irrigation conditions during the season of drought, the necessity of which improvement has been so severely felt in Egypt for many years past. These barrages were erected at enormous expense, and it is contended that the benefits that they have succeeded in rendering to the country are insignificant in proportion to the amount of money devoted to their construction. But the pessimistic contentions have been refuted conclusively by Sir William Garstin, G.C.M.G., the Adviser to the Ministry of Public Works, in the course of his report concerning the administration of his department for 1905, recently published.

The year under review was a particularly suitable one for testing the value of the barrages and reservoirs to their utmost, since the country was in dire distress owing to the low state of the Nile, the supply from which river was bad during the whole year. The season started ominously, the level at Aswan being abnormally low, while during the months of June and July the readings at the gage station upon the upper reaches of the river between Aswan and Khartoum were the lowest that have ever been recorded. The crops were in serious danger; and had it not been for the water impounded above the dam, a very considerable proportion must inevitably have been lost. Sir William Garstin steadfastly asserts that "it is impossible to overestimate the benefits caused to Egypt by the Nile reservoir in 1905, and that the services it rendered to the country in this year alone have fully justified the cost of its construction."

For some few years past the country has been passing through seasons of severe drought in accordance with the well-known cycles of scarcity and plenty, which in this country alternate with infallible regularity; but the year 1905 appears to have been one of the worst ever recorded. The flood was altogether unsatisfactory. It was not only exceptionally late in arrival, but even when it did arrive was very poor. At one time the readings of the gages were so bad that the prospects, so far as Upper Egypt was concerned, appeared to be little short of disastrous. The maximum reading of the gage at Aswan was not reached until as late as September 18, and then it was not less than 35.43 inches below the average. The river fell rapidly, but in the last days of November the fall slacked off, and by the end of the year the levels at Wadi-Halfa were very similar to those obtaining in 1904.

At Wadi-Halfa the gage throughout the year was considerably lower than the average of the fifteen previous years. At Aswan the rise did not arrive until July 20, which was a very late date. The maximum reading R. L. 91.90 was not attained until September 18, and even then it was 35.43 inches below the average as already mentioned.

The water commenced to fill the reservoir upon November 3, 1904, when the Aswan gage had reached R. L. 88.50, being the level at which it becomes practically free from silt. The full level of R. L. 106.00 was attained on January 3, 1905, and the reservoir was then kept constant at that level until the commencement of the discharge. Owing to the indifferent readings indicated by the more southerly gages and the prospects of a very late, poor, and slow rise of flood, it was deemed advisable to maintain the reservoir water in reserve until May 1, when the discharge was carried out upon the following basis:

	Cubic feet per day.
May 1 to 31	282,512,000
June 1 to 15	494,396,000
June 16 to 30	565,024,000
July 1 to 12	706,280,000
July 13 to 18	494,396,000

The gradual reduction during the last six days kept the gage readings at Aswan practically steady until the approaching flood commenced to raise the river level. In the regulation of this supply passing out of the reservoir, the object in view was to maintain a steady rise in the river, so as to meet the steadily increasing demand in Middle and Lower Egypt by at least an increasing supply.

To what extent this regulation attained the desired object may be gathered from the report of Mr. Verschoyle, I. G. I., who asserts therein that one-third of the total canal supply of Middle and Lower Egypt was derived from the reservoir during June and July. There was a severe dearth of water during the latter month, which without the aid of the reservoir would have been disastrous. The regulation of the discharge through the sluices of the barrage is always a delicate and difficult operation, entailing very careful calculations and observations. During this year under review the difficulties in this direction were considerably augmented, owing to the fact that operations upon the construction of the extensive aprons for protecting the dam were in progress, so that only part of the sluices could be used.

The division of the summer supply of the river between Middle and Lower Egypt differs each year, owing to the annually increasing perennial area added to the former district by the conversion of the basins. An estimate was made of the "Sefi" areas, upon which was based the proportion of the supply to be given to each. It was thus arranged that the discharge withdrawn at Asyut for Middle Egypt should be 30 per cent of the discharge of the Delta canals plus 35,314,000 cubic feet of water per day. To render this arrangement practicable, the discharges of the Ibrahimiyah and Delta canals were interchanged. It was found feasible to adhere to this arrangement fairly closely until the end of the rotations, when the Ibrahimiyah canal took all it could draw with the level permissible above the Asyut barrage.

The regulation of the latter barrage was commenced early in February, and the maximum head attained during the summer irrigation was 62.9 inches. Regulation was continued throughout the flood on both the Delta and Asyut barrages. The whole of the gates, both upper and lower, of the Asyut dam were completely shut down during a great part of the flood.

Owing to the indifferent conditions prevailing, a decree was issued whereby the irrigation of fallow lands for the planting of flood durrah crops was prohibited from May 15 to July 28, before which date it was impossible to remove the restriction. The late date at which it was suspended was productive of several complaints, but it was found impossible to remedy the matter by a single day. The discharge from the Delta canals on the date of its removal was nearly double the minimum discharge, and yet the most difficult time of the whole year was the following week. The same decree was attempted in Middle Egypt; but owing to its novelty, due to the fact that this was the first time it was attempted, combined with the shortness of the notice, it was not successful, though it will be imperative to enforce it during subsequent years.

The summer rotations in Lower Egypt commenced generally on May 1, and ended between August 26 and September 1. A start was made with a 21-day rotation, that is to say, 6 days' watering followed by 15 days' stoppage, for ordinary crops, and a 9 days' rotation comprising a 4 days' watering followed by 5 days' stoppage for rice crops, respectively. As this supply fell short of the actual requirements, these periods between waterings had to be increased, and the periods of working reduced at the tails of sections. It is calculated that for a 21-day rotation the discharge at the Delta canals should not be less than 1,536 million cubic feet of water per day. As this discharge could not be attained until July 10 the greatest difficulty was experienced in distributing the supply. Had the cultivation of rice been suppressed—a step which would have promoted considerable dissatisfaction—a discharge at the Delta of 1,306,618,000 cubic feet would have been adequate, and Mr. Verschoyle contends that the only means of insuring this end is the restriction of the rice area.

In Middle Egypt summer rotations were commenced between April 1 and 15, and continued until nearly the end of July. In the old perennial area a 19-day rotation was started, which was gradually increased to 22 days, and once in July to 23 days.

During the period of 88 days from May 1 to July 28, when the rotations were in force, it is estimated that the mean discharge available in the Delta was 1,563,467,381 cubic feet per day. The area under ordinary crop was 1,414,642 acres, and under rice 178,142 acres. On the basis that each acre of rice is equivalent to 2 acres of ordinary crops, this gives an average of roughly 890 cubic feet per acre of rice, and 1,780 cubic feet per acre of ordinary crops per day. Such a maximum and minimum, as Mr. Verschoyle rightly points out, is very short commons; and it means, he continues, that in three years' time, if no extra source of supply is available meanwhile, in a year like 1905 the summer rice cultivation will have to be totally suppressed and a very severe rotation adopted for other crops.

With regard to the flood, the commencement of the rise was very late and the levels during August very bad. In September the levels improved and saved the situation, but the fall in October was very rapid. The maximum levels on the Aswan gage for 1905 and the five previous floods are as follows:

	Inches.
1877	287.5
1888	315.5
1899	301
1902	297.5
1904	309.875
1905	306.5

Thus it will be seen that though the flood of 1905 was not so bad as the very low floods of 1877, 1899, and 1902, it was worse than those of 1888 and 1904. Warning of the pending state of affairs was duly extended in full time, and the instructions obtaining for the regulation of supplies to the basins in such times of drought were issued. The Irrigation Department, however, have now become so skillful in their dealings with bad floods, that it is scarcely possible for any improvements in their methods to be made, but at the same time such contingencies tax their skill to the utmost, cause considerable anxiety, and entail ceaseless vigilance on their part, since the slightest mistake might promote serious consequences.

The areas of Sharaki, despite the abnormal conditions prevailing, were considerably reduced, as comparison with the previous low years will show:

	Acres.
1877	776,611
1888	277,183
1899	193,781
1902	132,522
1904	48,277
1905	34,052

The doubt is expressed as to whether under existing conditions this could by any means be reduced in extent. Although the area actually left unirrigated is comparatively small, still there is a very much larger area which receives very inadequate irrigation in a bad flood, and the series of low floods during recent years has resulted in a deterioration of a considerable amount of basin land. Attempts are to be made to remedy this defect in the Keneh province, which suffers severely, by a barrage now in course of construction by Sir John Aird & Co., of London, who carried out the dams at Aswan and Asyut, across the river at Isna for regulating the flood levels. This work and the subsidiary canals will be completed about the end of the year 1909. The greater part of the unwatered area in 1905 was on islands and on the river foreshores. Such localities lying outside the basin area are consequently impossible to protect.

Sir William Garstin considers that for the country to have passed through such a critical year with no loss of the summer crop, and with such an insignificant area of "sharaki," constitutes a remarkable achievement, and reflects great credit upon the Irrigation Department, at the same time conclusively testifying to the fact that the costly barrages of Aswan and Asyut, far from being the failures the pessimists would have us believe, are slowly but surely working out the salvation of Egypt.

A Curious Madagascar Plant.

In a paper presented to the Académie des Sciences, M. Hanriot gives an account of the active substances which are contained in the *Tephrosia Vogelii*. The leaves of this plant and neighboring species are used for fishing by the natives of Madagascar and the east coast of Africa. The plant is crushed and the pulp macerated with a little water; then it is put in the pond or river at different places, especially in slow streams. Soon the fish become paralyzed and mount to the surface. They can then be caught by hand and eaten without danger. M. Hanriot secured a quantity of the dried plants and isolated the different principles, first making a study of the leaves. The dried leaves are somewhat less active, however, than the green ones, but retain most of their properties. He distills the alcoholic extract of the leaves in a current of water vapor, and this brings over a liquid which is separated in part by decanting. This oily liquid he calls *tephrosal*. The non-distilled part is evaporated *in vacuo*, and from it, by means of chloroform and ether, he obtains a colorless crystalline substance called *tephrosine*. As regards the liquid substance tephrosal, it is a strong-smelling liquid having the formula $C_{10}H_{10}O$ and is volatile. It begins to distill in a vacuum at about 60 deg. C. It is but slightly soluble in water, but more so in alcohol and ether. Its aqueous solution reduces ammoniacal silver nitrate and cupro-potassic liquid in the cold, and it restores the color to fuchsine when it has been removed by sulphurous acid. Coming to the solid substance tephrosine, it is formed of small, brilliant prismatic crystals, melting at 187 deg. C. and volatile at a high temperature with partial decomposition. It can be distilled *in vacuo* without changing. Water will hardly dissolve it, nor alcohol, but it is easily dissolved in acetone or chloroform. Tephrosine does not contain nitrogen, and it answers to the formula $C_{31}H_{26}O_{10}$, being a neutral body. In chloroform solution, it will combine with bromine. This solution, when evaporated, gives a yellow residue which is very soluble in ether, whence methyl spirit precipitates it. Different experimenters have isolated, even from the *Tephrosia*, a number of analogous principles having toxic properties for fish. Among these are timboïne, taken by Pfaff from the Timbo plant, also the dorride and the pachyrizide, isolated by Van Sillevold from the *Derris elliptica* and the *Pachyrizus angulatus*, but these bodies, although analogous, are not identical with the above.