

Scientific American,

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

G. D. MUNN, S. H. WALES, A. E. BEACH.

For "The American News Company," Agents, 121 Nassau street, New York.
For "The New York News Company," 8 Spruce street.
For A. Asher & Co., 20 Unter den Linden, Berlin, are Agents for the German States.
Messrs. Sampson, Low, Son & Marston, Crown Building 188 Fleet st. Trubner & Co., 40 Paternoster Row, and Gordon & Gotch, 121 Holborn Hill, London are the Agents to receive European subscriptions. Orders sent to them will be promptly attended to.

VOL. XXIII, NO. 1. [NEW SERIES.] . . Twenty-fifth Year.

NEW YORK, SATURDAY, JULY 2, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

*The Peters Process of Manufacturing Steel from Pig Iron.....	7
*Improved Oil-stone Holder.....	8
Zinc as a Building Material.....	8
*Pacific Hotel, Chicago.....	8
Scientific Intelligence.....	8
*Tussock Moths.....	8
Liliputian Firemen.....	8
Singular Phenomenon in Heating Diamonds.....	8
Floriculture at Erfurt in Germany.....	8
The Friction of Steam Engines.....	8
A curious Exhibition.....	8
Jeddo.....	8
Twist Drills, and recent improvements in their manufacture.....	10
Dead Weight.....	10
The Volcano Fish.....	10
*Machine for Manufacturing Screw Bolts, Nuts, and Shafting.....	10
How to Prepare Mortar.....	11
Fog Signals.....	11
The Management of Railways.....	11
Recent Progress in Chemistry.....	11
Other Worlds than ours.....	7
Macie the irrepressible upon Patent Law.....	8
Uses of Mica.....	8
Patent Rights in Congress.....	8
Uses of Fluor Spar.....	8
A Warning to Thieves.....	8
A new use for Oxygen.....	8
Compressed fish offal for Manure.....	8
Patent Office Affairs.....	8
The Report of Col. W. A. Roebling, Chief Engineer of the N. Y. Bridge Co.....	8
Ice Pitcher—in the U. S. Circuit Court, Eastern District of Pennsylvania.....	10
New Books and Publications.....	10
Inventions Patented in England by Americans.....	10
Answers to Correspondents.....	10
Receipt of American and Foreign Patents.....	10
List of Patents.....	11
Applications for the Extension of Patents.....	13

To Advertisers,

The circulation of the SCIENTIFIC AMERICAN is from 25,000 to 30,000 copies per week larger than any other journal of the same class in the world. Indeed, there are but few papers whose weekly circulation equals that of the SCIENTIFIC AMERICAN, which establishes the fact now generally well known, that this journal is one of the very best advertising mediums in the country.

THE MANAGEMENT OF RAILWAYS.

It has often been said that it is easy to discover that a man is sick, but not so easy to tell what will cure him. It is easy to see that our railroad system is giving birth to enormous monopolies, but it is not easy to say how this can be helped now. Yet we find editors who think themselves able at a single sitting to concoct a plan which shall meet all the exigencies of the case. We confess we are unable to do this. The subject appears to us beset with difficulties; difficulties only to be discovered by long and able thinking, and which render the application of the proper remedies a task only to be accomplished by experienced and careful legislators.

We have been led to these remarks by the perusal of an editorial in *Hunt's Merchants' Magazine*, wherein the evils of the present system are pointed out and a remedy, which the author confidently pronounces adequate, is suggested.

That journal says justly: "The temptations to fraud on the part of railway directors are now enormous, and the checks upon them are trifling. For instance, a secret compact is made between the boards of two competing or connecting roads, by which one is sold or leased to the other at an enormous price; the directors and their friends at once buy up the one stock, and perhaps sell immensely of the other, and then publish the contract which changes the value of the stocks, and close their speculations in the market with large profits. Or, a secret arrangement is made for an unusual stock dividend out of profits which have been carefully concealed from the public, and even denied on oath by the officers of the road, and the stock bought at low prices by the 'ring' is, after the dividend, sold at a vast advance to the public. In many such instances the value of their own property has been depressed by the secret compacts of the directors who hold it in trust, or immense issues of new shares have been privately sold to an unsuspecting public; and when the exposure was made, the stock has suddenly fallen, and the conspirators, by their breach of trust, have enriched themselves with the spoils of those they pretended to represent."

This picture is not in the least overdrawn, but the question is, what are we going to do about it?

The author of the article referred to, says: "The one condition of success in such intrigues is secrecy. Secure to the public at large the opportunity of knowing all that a director can know of the value and prospects of his own stock, and the occupation of the 'speculative director' is gone."

To meet these difficulties he proposes that railway companies shall be compelled to publish all their financial statistics in a clear and intelligible form as soon as they can make them up. But how compel them? Surely this must be done by legislation, and we have seen in this State how extremely easy it is to legislate power into the hands of these corporations, but how hard it is to get the power away from them.

Is not the fault somewhat further back than corporations? and is it not rather in our own vicious system of legislation upon private interests? Limit the power of the legislature to bills of an entirely public character, and open the way to free competition, and would not the corporations find themselves powerless to injure public interests?

As to the stockholders, each man knew or ought to have known, when he bought his stock, the conditions under which he holds such property, and expected, or ought to have expected, that the larger stock-holders would control their own shares as well as those of the smaller. Therefore they who

thus willingly or ignorantly entered into such a copartnership cannot complain if its terms are carried out to their full extent.

The writer referred to also suggests the prohibition of "every form of railway sale or consolidation by the companies," and thinks that only by this means can swindling be prevented. How this suggestion is to be carried out he does not tell us. It certainly seems to us not only impracticable, but contrary to all the fundamental principles upon which property is now held under the control of its legal possessors. Once let it be granted that those who own property may be legislated out of the power to control or sell it, and where will the end be? Clearly in the setting of limits beyond which neither individuals nor associations can acquire and hold property. For to lose the power to control and sell is, in effect, to cease ownership.

The solution of this question, if it ever reach a solution, will never be arrived at by any such loose and ill-considered propositions as this.

Monopolies can hardly endanger the right of the public so long as they encounter free competition. We do not pretend to set forth any plan by which this free competition can be secured, we leave that for those who are more competent to deal with it.

RECENT PROGRESS IN CHEMISTRY.

The past year has witnessed the introduction of a large number of new compounds into daily use, and the consequent increase of our knowledge of the best methods of manufacture, and the properties of bodies about which we could hitherto obtain very little information, even in the most complete works on chemistry. A recent bulletin, published by the extensive chemical manufactory of E. Schering, in Berlin, affords matter not to be found in any books, and hence we propose to condense the information for the benefit of our readers.

The hydrate of bromal, to which the formula of $C_2Br_3HO + 2H_2O$ is given, crystallizes in white needles, or by slow crystallization in the same form as blue vitriol, though colorless. It has a similar taste and smell to the hydrate of chloral, and is easily soluble in water and alcohol. Salts of silver ought not to produce a precipitate with these solutions.

The hydrate of bromal has hitherto been confined to scientific investigations, as experiments upon animals have shown that its effects are more anæsthetic than hypnotic. Chloral, originally discovered by Liebig nearly forty years ago, was not fully studied until recently. It is a perfectly colorless liquid, having the same boiling point as water, with a specific gravity of 1.5, and a sharp, biting taste, and undergoes spontaneous decomposition, so that it cannot be kept for any length of time. If one equivalent of water be added to it, it forms a dry crystalline mass known as the hydrate of chloral, and one equivalent of alcohol produces similar crystals of an alcoholate of chloral; the chloral has at present merely a scientific interest.

The alcoholate of chloral yields white, transparent, hygroscopic crystals, closely resembling the hydrate of chloral in taste and smell, but less soluble than the latter in water—a reaction that will enable chemists to detect a mixture of the two compounds. If we heat the alcoholate of chloral in twice its volume of water, it melts without dissolving and immediately crystallizes out under the water on cooling, while the hydrate of chloral at once goes into solution and remains dissolved. Sulphuric acid heated with the alcoholate becomes brown, but with hydrate of chloral remains colorless. Nitric acid of 1.2 specific gravity gives ruddy fumes of nitrous acid when heated with the alcoholate, but no fumes are produced under similar circumstances with the hydrate of chloral. It is of the utmost importance to know these reactions as the close resemblance between the alcoholate and hydrate may lead to serious mistakes, as the properties are unlike and the alcoholate ultimately acts like alcohol itself. The hydrate of chloral has been pretty fully described in our columns, but some practical details remain to be recorded. Its manufacture has assumed enormous dimensions, especially in England and America, but no establishment is able to make large contracts on account of the difficulties which still arise in its preparation. The workmen are so much affected by the fumes of chlorine and hydrochloric acid that they require to be constantly relieved, and this occasions delay and annoyance. It is difficult for the American manufacturer to compete with the German, owing to the high price of alcohol in this country and the revenue tax imposed upon it. The contradictory properties ascribed to the hydrate of chloral by different experimenters may be accounted for on the ground of the presence of the alcoholate in consequence of defective preparation. It is an agent not to be tampered with, and only to be trusted when coming from perfectly reliable sources. If it should be substantiated that in the hydrate of chloral we have a sure remedy for sea-sickness, as well as for the most obstinate cases of sleeplessness, it will prove one of the most important and beneficent contributions made by chemical science during the present century. In Germany the retail of this article is prohibited without the prescription of a physician.

A number of new and important compounds of carbolic acid have been discovered, which are prescribed in cases of putrid wounds for injections, and generally as disinfectants. Among those may be mentioned the sulpho-carbolate of zinc, which is inodorous, crystalline, and easily soluble in water and alcohol; the sulpho-carbolate of soda, a white crystalline powder; and the sulpho-carbolate of copper, resembling blue vitriol in color. A great objection to the employment of carbolic acid as a disinfectant is the persistent odor it has as usually sold for this purpose. This difficulty seems to be ob-

viated in the case of the compounds mentioned above, and it is to be hoped that they will come into general use. Chloræthyliden is a new anæsthetic, the properties of which have only partially been studied, but which promises to be valuable.

The above are a few of the most important of the recent contributions of chemistry to the every-day wants of man.

A few months ago they were utterly unknown, now they afford investment for a large amount of capital, and give employment to many skilled workmen, besides conferring untold blessings upon suffering humanity.

OTHER WORLDS THAN OURS.

Our readers are well aware that we do not regard mere speculation of any sort as likely to either add to man's knowledge or happiness. The question as to whatever other planets in the solar system besides our own are, or may be inhabited, is one which must be classed among fruitless and profitless speculations. We find on this earth enough of evil to surmount, enough of solid fact to discover, and enough recorded learning to acquire, to tax all our energies without wandering off to other planets in vain guesses that they are or may be inhabited.

If we grant that they are full to overflowing with all sorts of living things, and that creatures as highly organized as men are, or as angels are supposed to be, dwell thereon, what application of this assumption can be made that will better the condition of mankind in the least, or give him the slightest insight into anything it is desirable for us to know.

Wild speculations have been indulged in about the possibility of establishing communication with these suppositious inhabitants, and perhaps deriving from them knowledge beyond anything that science has yet dreamed of, or hath entered into the heart of philosopher to conceive. Nay, Emanuel Swedenborg claimed to communicate with the inhabitants of Jupiter, but so far as we know the world has never got any good from the communication.

In some respects the present is an age of strange incongruities. On the one hand we have a class of men who profess to walk solely by faith; on the other hand, there is a class who profess to walk solely by the light of demonstrated facts or logical inferences from the results of experience. Between these two classes lies another, to which we may apply the commercial term, "middle-men," who profess to be scientific yet who are willing to indulge in speculations which certainly exact as large a degree of faith, as the dogmas of those who would make faith the sole rule of action.

Mr. Richard A. Proctor, F.R.A.S., is one of this class. Having attained some reputation as an astronomer, he has of late been indulging in speculations upon the old never-to-be-settled question of the plurality of worlds, and Longmans, London, has published in a book entitled "Other Worlds than Ours," what might as well have been styled "The Visions of Proctor"—a work from his pen in which the subject is stated to have been studied (?) under the light of present scientific researches.

Our knowledge of the book is at present confined to what the English *Reviews* have said about it. These *Reviews*, so far as we have seen them, are very favorable to the work. Taking, therefore, what they have set forth as a fair index of the line of argument pursued by the author, we find that very few of the facts upon which he bases his speculations are new, and further, that all he says or can say upon the subject may be summarized thus:

It is not impossible, so far as we can ascertain the conditions which exist upon the surfaces of some of the planets, that living creatures may exist upon them, therefore it is quite probable they do exist there. It is possible that peculiarly organized beings may have a high degree of intelligence, and it is further possible that the probable beings which may exist upon—say Mars for instance—may be highly enough organized to possess a high degree of intelligence; therefore it is quite probable that some of the living beings upon that planet are highly intelligent.

This is, we think, a full and fair showing of the argument.

In the statement of facts from which the possibility of animated existence is inferred, we find very little that is new, and the claim that present astronomical science possesses facts warranting such an inference, that were not possessed fifty years since has very little to support it.

Such new and as have been obtained, and which are available for the purpose of such speculations, are confined principally to the planet Mars. There is little doubt that, on that planet, the conditions of climate and atmosphere are very analogous to that of our globe; but this admitted, the question again resolves itself into one of probabilities.

We grant the probabilities, and find that we get very little satisfaction from our liberality. We cannot send ships to Mars, and open up a commerce with its inhabitants. We do not know how they stand upon the Women's Rights question, or whether a jury of twelve intelligent sons of Mars would have convicted or acquitted McFarland. We cannot even send missionaries to convert the—in all probability—teeming population of that planet, or get up societies for the amelioration of his—it may be—oppressed multitudes.

We do not know whether all the people who dwell upon his face are suffering because the first man and woman would eat forbidden apples, or whether they are all in some huge garden of Eden, enjoying themselves in the most beatific manner.

Perhaps, however, it would be possible to get a word or two with them by making use of one of our vast prairies and adopting Dr. Dick's plan of drawing thereon huge geometrical figures.

Finding it thus possible to communicate we suggest the

first question be, "Are you happy?" With what breathless suspense shall we await the answer, and if it should be—as it is quite probable it might be—"NO!" how gratified we shall all feel that the benevolence of the Creator has not left this world alone in its misery. It would almost make this planet explode with envy should the reply be "Yes."

MACFIE THE IRREPRESSIBLE UPON PATENT LAW.

Even the London *Spectator*, which supports Mr. Macfie in his opposition to the patent laws, gives that irrepressible gentleman little credit for skill in argument, and acknowledges that very much of what he has said only tends to show defects in the present English system of patents, rather than any good reason for its abolition.

Not content with making absurd arguments and illogical speeches, Mr. Macfie has collected into a volume, speeches, papers, and expressions of opinion, which he no doubt considers as "squelchers," but which sensible, sober thinkers are prone to denominate as the most unmitigated bosh.

The only logical conclusion to which this gentleman's arguments tend, is one which he is too short-sighted himself to see, namely, the utter renunciation of individual rights to the possession of property, be the same patent rights, copyrights, or anything else that men are now able to procure for themselves by virtue of genius, tact, and industry.

In that Utopian state of society for which some long, and fewer hope, when every man shall live solely for the good of all men, when land, chattels, wives, and children shall become common property; when all selfishness shall be done away, and each shall prefer to see his neighbor enjoy, rather than to enjoy the fruit of his labor himself, Mr. Macfie would find the principles he advocates precisely the thing.

To suppose, however, that in the existing state of human society men will consent to relinquish their rights to property in thought, or the results of their mental toil, and allow a distinction to be made between these rights, and those by which they hold the results of physical toil, is to suppose them on the average, to be as incapable of drawing a logical conclusion as Mr. Macfie himself; a state of general imbecility we are unprepared to admit. Of course everybody would be free if there were no laws of any kind. We should then have free trade, free stealing, free murder, free starvation, and a host of other freedoms which men have thought it wise to resign for another kind of freedom, *i. e.*, freedom to go and come unmolested, to accumulate wealth, and to improve their bodily and moral condition.

In Mr. Macfie's code carried out logically to its conclusion, A may plant and cultivate a hill of potatoes, which, as soon as he has dug them, all the other letters of the alphabet may seize and appropriate, provided there is enough to go around. True, A is compensated for his loss by the right to invade the onion patch of any other letter, and devour turnips wherever he finds them growing. Thus we get back to the old original savage game of grab. It will not take long for B to find out that he is stronger than A or C; nor long for A and C to find that their chances for either potatoes, onions, or turnips, are small and slim when B is around.

No man would get pay for anything he might do, but would live, if he lived at all, by stealing, unless, as we said above, each would work for all, and uniform distribution were secured, a thing which even the early Christians found difficult, as we learn from "Acts," the widows were neglected in the daily distribution.

We believe in neither Mr. Macfie nor his logic, and the logic of the *Spectator* is little better when it says:

"One of the most serious considerations with regard to the Patent Laws is that they are already being removed in other countries, and that the competition to which our manufacturers will thus be exposed must embarrass them in their business, while reducing the value of patented inventions. Mr. Macfie gives us a message from Count Bismarck to the North German Parliament, recommending the total abolition of patents throughout the new Confederation. The Second Chamber in the Netherlands passed a similar resolution by 49 ayes to 8 noes. It has already been found in some remarkable instances that countries restricted by patents cannot hold their own against others in which manufacture is unimpeded. M. Chevalier tells us that France cannot export Bessemer steel to Prussia, and that the French makers of velvet suffer in like manner from Prussian competition. The history of the aniline dyes discovered by Professor Hofman, but patented by others, teaches the same lesson. French manufacturers who had to pay £40 a kilogramme for what cost only £12 out of France, flocked by shoals from their own country and set up new factories in Switzerland and Belgium. The danger to every trade which is weighted by patent restrictions becomes the more formidable as those restrictions are removed in other States."

Let England adopt a wise protective system, and the policy of other European nations in regard to patents need not trouble her.

Uses of Mica.

Recently scales of mica have been used for spectacles and in optical instruments. The chief use in this country is in connection with stoves, and it is now quite an article of commerce, especially in New England. Many furnace doors are now supplied with small holes closed with mica, which serve as windows to enable the engineer to see the state of the fire without letting in a blast of cold air by opening the door. Many varieties of mica abound in curious markings, which have attracted the attention of microscopists as affording some clue to the true origin of this stone. Mica is one of the constituents of granite, and contains potash, and sometimes lithia and other alkalis. Stove dealers are the chief consumers of this article.]

PATENT RIGHTS IN CONGRESS.

Our readers will probably recollect—as we noticed it at the time—that President Grant's first veto was that of a bill to extend the patent of Rollin White, the inventor of the Smith & Wesson revolver. We have never had a doubt that the veto was a righteous one.

In the House of Representatives on Wednesday, June 22, the bill was reconsidered, General Butler supporting its passage over the veto of the President; whereupon Mr. Farnsworth accused General Butler of having received \$2,000 for his support of the measure. General Butler retorted that the charge was false, malicious, and infamous, and stated that the \$2,000 received by him were counsel fees, received in a case tried before the Supreme Court, the brief in which cost him four weeks' work. He considered the money honestly earned, and doubtless so will the public.

The Joint Committee on Retrenchment lately directed to investigate settlements by the Navy Department of contracts made by Isherwood, Chief of the Bureau of Steam Engineering under the last administration, for steam machinery, held a meeting on the evening of the 22d June. No witnesses were examined, but the Hon. William E. Chandler was present by invitation, and in reply to a question he stated that he knew nothing personally of the settlements, but acted as the counsel of Henry W. Gardiner and others, in their efforts to defeat an extension of the Corliss patent and in the preparation of papers placed before the House Appropriation Committee, to defray an appropriation to pay Corliss' certificate, given by G. W. King, the present head of the Steam Engineering Bureau, in settlement of contracts with the Corliss Steam Engine Company, of Providence, R. I. This Company had contracts unfinished when the present administration came into power. A settlement was made, by which engines began were left unfinished, the Department agreeing to pay some \$250,000.

USES OF FLUOR SPAR.

In an article on fluor spar as a flux, Vol. XXII., page 288, we stated that in the manufacture of iron, "the proper proportion is about 50 pounds to 100 pounds pig iron, or 40 pounds to 100 pounds spiegel iron." In both of these cases for 100 pounds read 100 *centners*—this makes the proper proportion 50 pounds fluor spar to 11,000 pounds pig iron, or 40 pounds to 11,000 pounds spiegel iron.

FLUOR SPAR IN GLASS MANUFACTURE.

E. Richters, in Waldenburg, Germany, states that the substitution of fluor spar for lime in the manufacture of glass allows of a great reduction in the amount of glauher salt, and greatly promotes the melting of the frit.

As the result of numerous experiments conducted on a large scale, he found that with the same consumption of fuel and similar length of time, the amount of glauher salt required could be diminished one half by substituting fluor spar which had previously been pulverized and calcined for the lime usually employed.

In countries where fluor spar can be had in abundance, its introduction into glass manufacture would appear to offer many important advantages. The following are the proportions taken:

	With fluor spar.	With lime.
Sand.....	115-44 lbs.	116-40 lbs.
Fluor spar.....	27-60 "	15-55 "
Glauber salts.....	4-90 "	8-00 "
Manganese.....	4-00 "	3-00 "
Charcoal.....	2-00 "	2-00 "
Glass frit.....	299-00 "	248-00 "

A Warning to Thieves.

The *Journal of Commerce* notices with astonishment that bank officers, who pay such large sums for safety vaults, burglar-proof locks, steel-lined chests, and all the other very proper protections against robbery, neglect to add one of Holmes' Electric Alarms. With this, well arranged, a gong might be set ringing on the first opening of the door or window of a banking house, making sufficient noise to waken a whole village. Mr. E. Holmes, whose office is at No. 7 Murray street, showed us recently a large gong that he had arranged especially for bank alarms. Some banks in this city are protected in this manner. It is well worth the attention of those interested, and we write solely for their benefit from our own knowledge and experience, without any solicitation from the owners of that invention.

A New Use for Oxygen.

We are informed by M. Widemann, who is connected with the works of the New York Oxygen Gas Company, that the use of oxygen in renewing and increasing the flow of oil in petroleum wells, has been so successful that a regular trade has sprung up in oxygen gas for this purpose. The gas is injected into the wells through tubes, and mingling with the hydrocarbon vapors, forms an explosive mixture which, when ignited, completely opens seams which have become clogged, and thus renews the flow.

COMPRESSED FISH OFFAL FOR MANURE.—In a recent article upon the uses of codfish the compressed offal was spoken highly of as a manure. Mr. W. F. Rickard, F. C. S., formerly of London, writes us from Leviathan Mine, Cal., that he is the inventor of the process therein described as French. He further writes that the compressed offal does not decompose by exposure to the air. Samples which had been lying about his London office four years have been found perfectly hard and sweet, proving thereby that the article may be exposed in bulk without the cost of packages.

COCKROACHES can be destroyed by using smooth-glazed china bowls, partially filled with molasses and water. Set the bowls against something by which the insects can get in; they will not be able to get out.

PATENT OFFICE AFFAIRS.

The business of the Patent Office is now in a flourishing condition, and the present is a favorable time to enter applications. Inventors will find the SCIENTIFIC AMERICAN PATENT AGENCY ready to attend to the prosecution of claims with the greatest dispatch. By reference to our register, we find that we have made upwards of twenty-four thousand preliminary examinations into the novelty of alleged new inventions. This great experience, together with the fact that a large proportion of all the business with the Patent Office, for the past twenty years, has been conducted through this Agency, suggests to inventors the surest and best means to secure their rights.

We give opinions free, and all we require is a rough sketch and description of the invention.

Inventions patented through this Agency receive notice in the SCIENTIFIC AMERICAN.

MODELS.—In order to apply for a patent the law requires that a model shall be furnished, not over a foot in any of its dimensions, neatly and substantially made. Send the model by express, prepaid, addressed to Munn & Co., 37 Park Row, New York, together with a description of the operation and merits of the invention.

CAVEATS.—Whenever an inventor is engaged in working out a new improvement, and is fearful that some other party may anticipate him in applying for a patent, it is desirable, under such circumstances, to file a caveat, which is good for one year, and, during that time, will operate to prevent the issue of a patent to other parties for the same invention. The nature of a caveat is fully explained in our pamphlet, which we mail free of charge.

EUROPEAN PATENTS.—Probably three-fourths of all the patents taken by American citizens in Europe have been secured through the SCIENTIFIC AMERICAN PATENT AGENCY. Inventors should be careful to put their cases in the hands of responsible agents, as in England, for example, the first introducer can take the patent, and the rightful inventor has no remedy. We have recently issued a new edition of our Synopsis of European Patent Laws.

All communications and inquiries addressed to Munn & Co., respecting patent business, are considered as strictly confidential.

THE REPORT OF COL. W. A. ROEBLING, CHIEF ENGINEER OF THE N. Y. BRIDGE CO.

The Superintendent and the Chief Engineer of the N. Y. Bridge Company, who have in charge the erection of the great suspension bridge over the East River between New York and Brooklyn, have made their reports. That of the Superintendent, Mr. W. C. Kingsley, pertaining chiefly to the financial matters, we shall pass without special notice. That of Col. Roebling, however, is so interesting and instructive, and the work is of such importance, that we make room for nearly the whole of his report, omitting only some introductory matter.

SURVEYS.

The general line, known as the Park route, had before been determined, but no actual line had ever been located upon the ground, the bridge line having been simply traced upon the largest and best maps procurable of both cities.

WORK WAS COMMENCED

In June, 1869. One single air line run through over the tops of the houses from the City Hall, in New York, to St. Ann's church, in Brooklyn, at once showed a discrepancy of more than fifteen feet between it and the line laid down on the maps. Several center lines were run on trial, each a little further to the east on the Brooklyn side and more to the west on the Chatham street, New York side, until one was found that was satisfactory.

In the location of bridges some attention is paid to the difficulties likely to be encountered in getting foundations for piers, in making approaches, etc., but here such consideration had to be ignored, and the towers and anchorages placed wherever the exigencies of the case brought them. The charter fixed the terminus on the Brooklyn side in the square on the corner of Sands and Fulton streets, etc., and on the New York side it was desirable to bring it as nearly as possible to the corner of Nassau and Chatham streets. The foundations of the Brooklyn tower threatened to encroach upon one of the main slips of the Fulton Ferry unless kept far enough to the east, but by doing so the New York tower unavoidably occupied one of the slips of the Roosevelt street ferry. Any further movement to the east would bring the approach over Prospect street to a point where no head room was left between the grade of the street and the bridge crossing it. The same was true in regard to North William street.

Other difficulties summed up showed that no change from a straight line was admissible. The center timbering established a minute and detailed survey. Since then the Brooklyn foundation has been placed in its proper position on this line, and any change is impossible.

In August, 1869, I was appointed Chief Engineer. At the first meeting of the Board of Directors, in September, 1869, the Executive Committee were empowered to proceed with the foundation of the Brooklyn Tower, and to complete the same up to high-water mark. Mr. Horatio Allen was appointed Consulting Engineer, and Mr. Wm. C. Kingsley, General Superintendent. To Messrs. Webb and Bell the contract to build the caisson was given.

THE BROOKLYN FOUNDATION.

In the meantime a boring made in 1867 showed gneiss rock at a depth of 96 feet below high water. The strata penetrated consisted in the first place of surface filling through alternate layers of hard pan and boulders of trap embedded in sand and clay. Below 50 and 60 feet depth the material was so compact that the bore hole stood without tubing for weeks. No necessity existed, therefore, for going down to rock; a depth of about 50 feet would suffice. But the great desideratum to be attained was a uniform character of the soil over the whole space of the foundation whatever the depth might be. It is well known that the drift formation of Long Island presents a great variety of strata in comparatively short diagonal distances. Within a hundred or two feet on either side of this foundation, there is no bottom so to speak, and piles are driven a great depth into mud; whereas in the center of our foundation the depth of water was only a few feet