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, JANUARY 20, 1906.

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.

PIPE GALLERIES IN THE NEW SUBWAY.

Now that rapid transit subways in this city have acquired all the prestige which comes from twelve months of remarkably successful operation, it is to be hoped that the Rapid Transit Commission will be emboldened to take an unyielding stand on the important question of the construction of pipe galleries. It is a most regrettable fact that the present subways have been built without any pipe galleries, and that the various gas and water mains lie spread out over the roof of the Subway, under conditions which will mean the ripping up of the streets whenever a break occurs, or a new system of pipes has to be laid down. In justice to the Rapid Transit engineers, it should be stated that originally they drew up complete plans for pipe galleries extending on each side of the Subway. The Rapid Transit Commission, moreover, approved of these plans, and was anxious to have them carried out. That they were not built was due to interference from the department which is responsible for the major part of the street mains. The grounds of this interference were apparently of the most trivial and unreasonable character; and there is no doubt that had the Rapid Transit Commission carried the question into the courts, they could have secured the necessary legal indorsement for the construction of the galleries. At that time, however, the Subway scheme was opposed by many powerful interests, and the Commission decided that rather than run the risk of legal delays, it would be better to forego the pipe-gallery plans for the time being, and push the Subway itself through to completion.

To-day, however, the Rapid Transit proposition in New York city needs no such delicate handling. It has established itself as one of the most attractive ventures for the investment of capital. It is safe to say that the very interests which did their utmost to kill the Rapid Transit scheme when it was advocated on the high grounds of public utility, are now falling over each other to secure Rapid Transit franchises, because of their proved commercial value. It is not likely that there will be any opposition to the construction of pipe galleries as a part of future extensions of the Subway. The objections that were raised against them originally were altogether trivial, and were strongly suspected of being prompted more by political considerations than they were by considerations of a constructional or operative character. The only plausible objection on technical grounds was that offered by the gas companies, namely, that the presence of electric mains and gas mains in the same galleries might, under certain conceivable conditions, lead to serious explosions. We consider this danger to be exceedingly remote. The gas mains would be so placed in the galleries that every part of them would be open to daily inspection; and it would be possible to detect a leak long before sufficient gas could accumulate to form explosive mixtures with the air. A further safeguard would be afforded by utilizing the system of ventilation, which should be installed as part of all future subways, to effect a continual renewal of air in the galleries.

WE SHOULD USE THE METRIC SYSTEM.

It is gratifying to note that the agitation for the introduction of the metric system of measurement is growing in strength, and seems not unlikely to be pushed to a successful issue. Judging the question from the purely practical standpoint, and in a broad-minded spirit, there is everything to be said in favor of, and nothing against, this most rational and convenient system. It is really surprising that a nation which is as eminently practical as we are, and which has proved by over a century of use that as a system of coinage and for all monetary transactions, the metrical is ideally perfect, should for so many generations have been content to subject its arts and industries to the burdensome inconvenience of the old system of measurement.

At the same time, it would be a mistake for the advocates of the metric system to shut their eyes to the fact that its introduction could not be brought about without incurring in some quarters a certain amount of inconvenience and some pecuniary loss. To those whose hostility is based upon the fact that their interest would, for the time being, be temporarily affected, the argument should be presented on the high ground, that great improvements of a broad and sweeping character have usually been attended with a certain amount of inconvenience to the small minority. This minority must take such comfort as it can from the reflection that its temporary loss or inconvenience is absolutely insignificant compared with the vast national benefit that would be conferred, not merely in the present hour, but for all time. The question of the relative merits of the decimal and duodecimal systems has been well threshed out, and we believe there is practically a universal agreement that, except for the minor and temporary drawbacks attending its introduction, there is everything to be said in favor of the more modern and rational method.

ALTERNATIVE SCHEMES FOR THE PANAMA CANAL.

The average citizen of the United States may well be excused if the subject of the Panama Canal appears to him to be just now something of a Chinese puzzle. What with reports of committees and advisory boards, plans for high-level canals and plans for low-level canals, plans for canals with locks and plans for canals without, to say nothing of the 500-foot "Straits of Panama," it is certainly difficult for the average work-aday citizen to distinguish fact from fiction, and find in the flood of printer's ink with which the subject has been deluged a few solid verities, on which he may plant his feet and say, "This at least I know to be true."

Broadly speaking, there are, at the present writing, three leading proposals for the construction of a canal across the Isthmus, and with these three we propose to deal in separate articles in the SCIENTIFIC AMERICAN. The first is that proposed by the former Chief Engineer of the Panama Canal when it was under French control, Mr. Bunau-Varilla. It contemplates the early completion of a high-level canal, and its subsequent widening and deepening after it has been opened to navigation. The second proposal is that of a leading American hydraulic engineer, Mr. Lindon W. Bates, who proposes the formation of a large fresh-water lake at each end of the canal, and the creation of a central lake by means of a dam at Bohio; the surface of this lake to constitute the summit level, which would be cut through the Culebra divide at an elevation of about 60 feet, the level of the two terminal lakes being held at about 30 feet. The third proposal is that which it is understood has been agreed upon by the International Advisory Board of Engineers, and which recommends the immediate construction of a sea-level canal provided with a tidal lock near its Pacific terminus.

The first type of canal, to which its author has given the high-sounding title "Straits of Panama," forms the subject of illustration and description in the present issue. In an early succeeding issue we shall give an illustrated description of the Lindon W. Bates lake-and-lock project; to be followed in due course by a third article on the proposal of the President's Advisory Board, the full report of which will be available at an early date.

In presenting the Bunau-Varilla and Bates proposals we offer no words of criticism one way or the other, and this for the reason that both plans will be the subject of comment in the forthcoming report of the Advisory Board to the President of the United States. The high position held by Mr. Bunau-Varilla during the operations of the French company and the wide experience and well-deserved reputation of Mr. Bates in operations involving the excavation and removal of material in works of the general character of the Panama Canal, demand for both of these engineers a thoughtful hearing. Although the plans of Bunau-Varilla for digging out 600 million cubic yards of material, and dumping it all into an artificial lake that is 200 feet above tide level, are calculated at the first hearing to stagger the conservative mind of the average engineer, it must be remembered that its author has a wider acquaintance with the actual conditions of work on the Isthmus than any living engineer.

ELECTRO-TECHNICAL INDUSTRIES.

The complete revolutionizing of many old industries, and the creation of entirely new ones, by electricity in the last half dozen years represent some of the most marvelous achievements of the present century. In no line of scientific and experimental work are the uncertain opportunities for magnificent possibilities so brilliant as in the practical laboratory of the electrical engineer and chemist. Electricity supplied in large and cheap current permits the experimenters to make tests in the fusing of metals, which a dozen years ago could not be performed except at enormous cost in time and money.

Electro-metallurgy has given a tremendous impetus to the manufacture and refining of many common articles of commerce, and owing to the cheapening of their manufacture, the demand for them has enormously increased. Thus in the production of aluminium the price has been so reduced in the last few years that it is employed in many new industries. The most noticeable field of usefulness is the substitution of aluminium transmission wires for copper in the electrical industries. The new transmission lines are of stranded aluminium, and they carry heavy voltage over great distances. The longest transmission line in the world, from Electra to San Francisco, a distance of 154 miles, is composed of stranded aluminium wire, and also the Colgate to Oakland line, a distance of 144 miles. The demand for aluminium is so great, that all the electrical manufacturing companies engaged in its production are extending their plants to increase the output. There are to-day upward of 70,000 electrical horse-power used in the manufacturing of aluminium in this country and Europe. Four plants are located in this country and they have available for the manufacture of aluminium upward of 24,000 horse-power, and the total output of the American plants varies from 15,000 tons upward a year. With the development of the Niagara power the extension of these aluminium manufacturing companies is being rapidly pushed, and the total capacity of the plants is likely to double within a year or two.

In copper refining electricity has achieved results no less notable than in the production of aluminium. There are upward of thirty-two electrolytic copper refineries in operation to-day, and considerably over half the world's output of copper is refined in these plants. The annual output of electrolytic copper is estimated at nearly 320,000 tons a year. In spite of the cheapening of the refining of copper by electricity, the price has steadily advanced in recent years. The employment of electricity for the extraction of copper from low-grade ores has also developed a good deal, and in this new development it may be possible to materially increase the world's annual supply. In Canada the electrical extraction has been quite successful with ores containing only from 2 to 4 per cent copper. An experimental company of French operators have more recently located a plant in Chili to handle the low-grade native ores of that country by means of an electric furnace process of concentration. The recovery and refining of scrap copper has also assumed considerable proportions in this country. By means of the electrolytic process, old copper bottoms, boilers, tubing, nails, sheet clippings, and type-shells can be utilized in a remarkable way. Scrap copper of this nature commands from 12 to 13 cents a pound, and is only a trifle less than casting copper. The scrap copper is thus recovered at little cost, and used over again in the industries. Old copper wire commands a premium to-day at prices ranging from a cent to half a cent less than that of the best casting copper.

The manufacture of artificial graphite with the electric furnace has assumed considerable importance, and to-day upward of 3,000 horse-power is used in supplying the electric furnaces with heat for this purpose. The output of artificial graphite at Niagara Falls last year was over three million pounds. The method of production is covered by patents, but the process consists of converting a large mass of coke or carbon into graphite by means of the electric furnace. At a certain temperature all carbides decompose, and the carbon separates in the form of graphite, but by the process now used only a small amount of iron or silicon is required for the purpose. The flourishing nature of this industry has led to further extensive experiments with the electric furnace in the treatment of carbides.

The use of the electric furnace in the iron and steel industry has promised for several years great transformation of smelting, but the actual reduction or iron ore for steel making by means of the electric furnace has not yet attained a large commercial success. A number of such furnaces have been in operation in different parts of the country, and new improvements are constantly being made to simplify the process. In certain parts of the world where electric current is very cheap and abundant, iron ore plentiful, and coal scarce and high priced, the electric furnace may displace the ordinary blast furnace for the production of pig iron. Or what may be nearer the truth, the use of the electric furnace in certain regions near great hydraulic works may build up electric smelting where it would be impossible to succeed with coal as a fuel.

In the specialized field of making high-class steels and steel alloys from scrap, the electric furnace has a more promising outlook, and quite remarkable achieve-