

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, 50 lbs. 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.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, JUNE 2, 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.

THE RAPID TRANSIT EAST RIVER TUNNEL DEFECTS.

In accordance with a resolution of the Rapid Transit Board at its last meeting, when the Mayor suggested that there had been a lack of publicity in respect of the defects in the East River Rapid Transit tunnel, the chief engineer, Mr. George S. Rice, has presented a report which fully explains the conditions on this important piece of work.

It seems that there was no serious trouble in driving the tunnel and maintaining the correct grade, until the shield had passed below the water level of the East River, when water was encountered in considerable quantities, and the shield began to settle below the established grade. The settlement was immediately detected by the Rapid Transit engineers, reported to the chief, and by him was reported to the Board, and from that date to the present, the conditions in the tunnel have been regularly made known at successive Board meetings.

The cause of the trouble was the failure of the sub-contractor to maintain sufficient air pressure at the shield to keep out water, and so preserve the ground through which the shield was being driven in a proper condition to support the weight of the shield, amounting to about 50 tons. Instead of maintaining the pressure sufficiently high to keep the shield free of water, which might have been done by increasing the supply of air, or by the use of special devices intended to diminish the loss of air, the contractor preferred to keep down the excess of water in the shield by pumping.

In other words, instead of preventing the water from flowing into the shield, he preferred to let a certain amount of flow take place, and remove the water by running a suction hose to the bottom of the forward edge of the shield and pumping it out through the tunnel. Now, while this method was successful in keeping the water down, it had this unfortunate effect, that the water, flowing around the under sides of the shield toward the suction hose, washed along with it the underlying sand, causing a cavity beneath the shield. This produced the condition that the shield and a certain amount of the forward end of the tunnel were pressed down by the heavy load of sand and water above it, while there was no corresponding sand to support the overhanging structure from beneath. This brought a heavy vertical bending strain upon the forward end of the shield and tunnel lining, causing it to settle gradually even when it was not being advanced. The bending strain also cracked the plates, and resulted in those depressions in the line of the tunnel which must now be remedied.

It was realized that it would be possible to rectify these errors of grade subsequently while the rest of the tunnel was being constructed, and this reconstruction is now being carried out on a length of 1,800 feet in the north tube and 700 feet in the south tube. This reconstruction involves the lowering of the track or the replacing of plates in the bottom or top of the tube, according to the conditions. These repairs will be completed by the time the river headings are driven to a connection, which will probably occur during next November.

The Brooklyn tunnel is being driven through a glacial drift consisting of sand mixed with boulders, and some gravel. The public may be perfectly satisfied as to the permanent stability of the tunnel. The report states that the material which the engineers have encountered under the river is such that when the tunnel is completed, it can be absolutely relied upon to stay in place.

PRESENT CONDITIONS AT PANAMA.

The chairman of the Isthmian Canal Commission, at the close of his last report giving a summary of the work that has been done on the canal, states that the carrying through of this great work divides itself into two parts—first, that of thorough preparation; and second, that of actual construction; and he says

with great truth that the former is the more important and more difficult of the two. Like many of the colossal tasks involving the movement, sustenance and control of large bodies of men in climates to which they are unsuited and unaccustomed, this enterprise has suffered from a reversal of the proper order of procedure as stated above. In the desire to "make the dirt fly," actual construction was begun before adequate preparation had been made. Men from northern climes were sent into a fever-laden district, where there was no provision to adequately house and feed or employ them, to say nothing of the lack of those hygienic safeguards which are indispensable, if the white man from more temperate zones is to live and work in a tropical region.

The policy inaugurated by the chairman in the late summer of 1905 included the closing down of the work of excavation, except so far as it was necessary to put the cuts in condition for the installation of the maximum number of steam shovels that could be economically employed, and the direction of the energies of the force to that general work of preparation which should have antedated any serious attempt at construction. The work of preparation has included the creation of an effective working organization; the sanitation of the Isthmus; the provision of suitable quarters and food for employees; the construction of proper terminal, yard, and railway track facilities, and intermediate yards suitably disposed along the line of the canal for the handling of the vast quantities of supplies and material; the installation of a system of parallel working tracks laid through the cuts; and finally, the working out of all engineering problems and formulation of a comprehensive plan for carrying forward the work in each department.

The health conditions on the Isthmus are to-day most satisfactory. Although there are 23,000 employes on the payrolls, there are fewer patients in hospitals than for many months past, 450 beds being vacant. There has been no authentic case of yellow fever since last November. Mosquitoes are so scarce that many people sleep in unscreened houses. Indeed, Dr. Gorgas considers that he has the health situation so well in hand, that no epidemic can arise within the canal zone.

In regard to food and quarters for employes, we learn that the building department has not only provided ample quarters for the existing force, but has at the present time a sufficient reserve to accommodate 3,000 additional laborers. An interesting side light is thrown upon the character of the native laborers in the canal zone by the fact that although mess kitchens have been created at the different labor camps where wholesome and nourishing meals may be obtained at the cost of ten cents each, the laborers did not avail themselves of the privilege, except in small numbers. This was due, not to a desire to save, but to indulge in food unsuited to their physical needs, and to gratify their desire for drink and other indulgences. To meet this condition the chief engineer was authorized to insert in all future labor contracts a proviso, whereby the employe agrees to permit a fixed amount to be deducted from his daily wage, in consideration of which he is to receive three wholesome and nourishing meals per day. With regard to the food supply of American employes, we learn that modern refrigerator cars are now running on the Panama Railroad; that there is a cold-storage plant in operation at Colon, and that refrigerating plants have been installed on two of the steamers running between New York and Colon. A continuous line of refrigeration, therefore, exists between all points in the United States and the various districts within the canal zone. The first consignments of American meats and vegetables have been successfully distributed along the canal.

Another preparatory work which is nearing completion is the creation along the line of the canal of proper yard and track facilities for receiving and distributing the vast amounts of supplies needed for the canal, and to provide for the disposal of the millions of cubic yards of excavated material, as it is brought out from the cuts. The large terminal yard at Cristobal is nearly completed, as are the machine and erecting shops, coaling stations, turntable, etc., while the receiving and forwarding yards at Bas Obispo and Pedro Miguel, on each side of the Culebra cut, which will receive the dirt trains as they come down from the levels of Culebra cut, are well under way. Several miles of the double-tracking of the Panama Railroad main line have been completed, and the grading for more of it is well advanced.

The great Culebra cut has been put in shape for the approaching wet season, with a view to the installation of the largest possible number of steam shovels. All the barriers left across the cut by the French have been removed; tracks have been laid and ballasted on each level of the cut, and a well-ballasted, double-track line has been built through the bottom of the canal prism. The chief engineer believes that by July or August he will have forty steam shovels installed and will be removing about 1,000,000 cubic yards per month. The actual cost of excavation during March was 53½ cents a cubic yard.

Finally, and by no means least important, is the announcement by the chairman of the Canal Commission that law and order continue to be maintained to a degree that would be remarkable under any conditions, and is especially so when the character of the population of the zone is considered; for its vast army of 23,000 employes has been gathered from all parts of the world. Under the administration of the Canal Zone Governor, the police force is so vigilant and so efficient that good order is steadily maintained, serious crime is almost unknown, and arrests are mainly for petty offenses and violations of the sanitary laws.

As matters now stand there is an urgent call from the Isthmus for an early decision as to the type of canal to be built, the preparatory work having reached the stage at which, if a plan of construction be not quickly decided upon, a large part of the engineering and constructive force must remain idle.

RECENT EXPERIMENTS IN THE PRESERVATION OF MEAT.

In a report by the Italian Minister of Agriculture on the subject of refrigerating in Italy, Mancini gives some interesting results obtained by the Craveri process for preserving meat, a process which was much discussed some months ago, but of which a more definite idea can now be formed, since a series of experiments has been conducted under the direction of a number of university professors.

The Craveri method would seem to have solved the problem hitherto unsolved—of preserving meat in a form fit to be eaten, by means of chemical treatment. Excluding for hygienic reasons ordinary antiseptics, and recognizing as insufficient for practical purposes the usual method of salting, Craveri resorts to injections into the veins of slaughtered animals, from which the blood has been drained, of a solution of 100 parts of water, 25 of kitchen salt, and 4 of acetic acid; in other words, of a solution of a mixture of substances such as are found normally in our bodies, and which form part of our nourishment. The solution is injected to the amount of one-tenth of the weight of the living animal. Prof. Brusafarro, of Turin, experimented upon two animals, a sheep and a calf; the two carcasses were hung in a subterranean room for 75 days, at a temperature of 16 deg. C. (about 61 deg. F.). After this time they were skinned, dressed, and cut up. The heart, brains, liver, and intestines seemed somewhat macerated, but were normal in appearance. The fat beneath the skin was perfectly preserved, the flesh appearing bright red in color, moist, and giving out an agreeable, slightly acid odor. In no part was there any trace of putrefaction, even incipient. This meat boiled produced an excellent broth, resembling in every particular that obtained from fresh meat. Roasted it was tender, and even tasted better than ordinary meat, was digestible and nutritious. As a result of these and other experiments, Prof. Brusafarro declares it as his opinion that the Craveri method promises great advantages over others. The other professors engaged in the experiments came to exactly the same conclusions. Submitted to a bacteriological examination, the meat proved to be free from bacteria; in the long period of preservation given, the beginning of dissolution was noticed in the visceral and muscular tissues, but without the production of any toxic principle whatever.

DENATURED ALCOHOL FREED FROM TAXATION.

On May 24 the Senate passed by a unanimous vote the bill which provides for the freeing from taxation after January 1, 1907, of denatured alcohol used for industrial purposes. The bill had previously been passed by the House, where it was opposed chiefly by the manufacturers of wood alcohol. This substance is to be used as an adulterant, however, to make the alcohol unfit for drinking. According to the provisions of the new law, the adulterating or denaturing of the alcohol is to be done in the various factories under the supervision of an internal revenue officer.

By removing the tax from industrial alcohol our government has effectually put a stop to the domination of the oil trust over the use of liquid fuel for light, heat, and power. In Germany and France devices for using denatured alcohol for these purposes have already been perfected and placed in actual use, and their adoption in this country will no doubt come quickly as soon as industrial alcohol is on the market. As this fuel can be produced from many vegetable products that have heretofore gone to waste, and that, too, at a considerably lower price than is obtained for gasoline and kerosene to-day, there need never be any fear of lack of fuel, even should the coal measures all become exhausted and the supply of natural oil cease.

The new fuel, besides being cleaner and less volatile, will, when used in suitably designed internal-combustion motors, develop about as much power per gallon as will the old, while for light and heat it is far superior. Its introduction will create a new market for the farmers of our country, while they will benefit directly from it also by using it themselves for the production of light and power.