THE NEWARK WATER WORKS.

The water supply of the city of Newark, N. J., has for some time been unsatisfactory It is derived from the Passaic River, below the cities of Paterson and Passaic, so that the water is far from pure. Hitherto her consumption has amounted to an average of 15,000,000 gallons a day, but recently on one day it rose to 24,000,000 gallons.

The East Jersey Water Company is now rapidly constructing a new water plant designed to supply the city of Newark with water from a distant portion of the Passaic water shed. The water works consist of two storage reservoirs, communicating by natural water courses with an intake reservoir. The latter connects with a steel pipe four feet in diameter, which runs as nearly in a straight line as the inequalities of the country will permit to the present Belleville reservoir, and also to a high service reservoir situated on South Orange Avenue, in the city of Newark.

The bird's eye view illustrates the general scope of the work. The right hand reservoir, termed Oak Ridge reservoir, is situated on the main stream of the Pequannock River. It is formed by an earthwork dam with concrete core. The structure is over 40 ft. high and about 800 ft. long. To the left is seen Clinton reservoir, situated on a branch of the Pequannock River, and formed by a dam of the same general height and construction as above, but about 1,200 ft. long. The dams are fitted with gate houses and connect by natural water courses with the lower reservoir, termed the Macopin intake.

The intake is formed by a masonry dam, 25 ft. high, with a main portion about 250 ft. long, from which a spur 32 ft. high and about 150 ft. long runs into the side hill. These dams are all established upon the solid rock, granite underlying the entire region. The earth dams have spill ways at their sides ; the masonry dam permits the waste to go directly over its crest. These three reservoirs and the natural outflow of other portions of the total drainage area of the Pequannock River constitute the water supply. One of the interesting features of this water supply is the fact that the two main reservoirs are about five miles back from the intake, Clinton reservoir being 300 ft. and Oak Ridge reservoir 200 ft. above it. The water, therefore, in passing over this five miles and down several cataracts, becomes thoroughly aerated before it reaches the Macopin intake.

The ground underneath the reservoirs having been thoroughly cleared from soil, stumps and trees, the construction of the dams was proceeded with. The earthwork of the upper two was deposited in six inch layers, thoroughly wet and rolled. The operation of construction of one of the earthwork dams is shown in the cut. The Macopin intake, built of masonry entirely, is 585 ft. above tide water ; its gate house is provided with four main valves. One set can be used in an emergency to empty ; it the other set connects with the conduit.

The conduit consists of a 4 foot pipe about 25 miles long. It is made of riveted steel, with the longitudinal joints double riveted and the circular joints single riveted only. Its thickness varies from one-quarter to five-sixteenths and three-eighths inch, according to the head of water which it has to sustain. It is made at a special shop at Paterson, N. J., by the contractors, McKee & Millson. The extreme range of temperature to which it is possible to be subjected is 45° Fah., while the probable variation is not over half this amount. The pipe is so designed that changes of length caused by variations of temperature can be safely borne by the elasticity of the whole structure. Starting from the intake, the pipe runs along the Pequannock River valley, thence to Pompton Notch, in Pompton Mountains, thence in an almost straight line to what is known as the Great Notch, in the Orange Mountains, thence it turns a little to the right, as shown in the picture, and runs direct to Newark. In its course it runs up and down hill, forming many true and inverted siphons, but never rising above a hydraulic gradient of 2 : 1000. It crosses the Pompton and Passaic Rivers on steel truss bridges with stone piers. It is carried under the Pequannock and Second Rivers. Three times it goes under the Morris Canal.

The general terms of the contract entered into between the East Jersey Water Company and the city of Newark are as follows :

The works are to have a capacity of 50,000,000 gallons daily. Upon completion the city of Newark is to pay $4,000,000. For this it is to have the privilege of drawing 27½ million gallons daily up to the year 1900. Until this period the company can draw all the water not used by the city of Newark. In 1900, Newark is to get possession of the entire water supply and is to pay the company an additional sum of $2,000,000, the East Jersey Water Company operating and maintaining the works until 1900. Before that time the company will have to build other works to supply its customers, meantime supplied from the Newark conduit.

The work is in charge of Clemens Herschel, M. Am. Soc. C. E., also M. Inst. C. E., who is engineer and superintendent for the company.

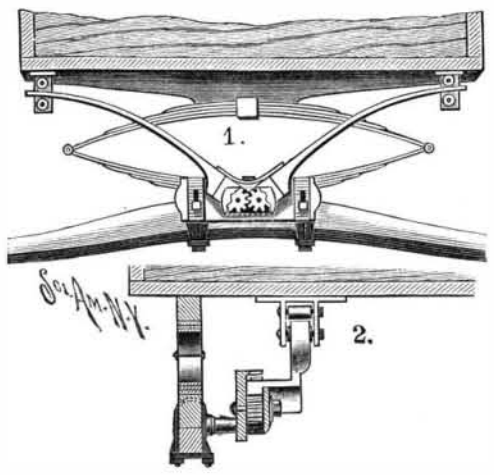
As illustrating some of the modern uses of the long distance telephone, it is interesting to observe how the office in New York, as well as the residence of the superintendent, is in constant telephonic communication with different parts of the works. Telephones being necessary for the operation of the works after completion, they have been established for use during construction at the reservoirs, and a special instrument called the "Perambulator" is kept moving in advance of the pipe laying.

One of the cuts, showing the work upon the conduit at Stone House Brook, near Butler, illustrates the general character of the pipe laying. This part of the operation is done by the contractors, T. A. & R. G. Gillespie, of Pittsburg, Pa. The reservoirs and dams are constructed by the company under Mr. Herschel's direct superintendence. The thoroughness in the work is exemplified in the case of Clinton dam, where 28 feet of drift was cleared away to reach the rock upon which to found the dam. At this depth several large pot holes were found in the ledge, showing that at some remote period the rock had been exposed to the action of some heavy cataract.

The work is progressing with great rapidity, nearly a mile of the conduit is laid every week, and more than one-half is now under ground.

A SPRING EQUALIZER FOR VEHICLES.

The illustration represents an improvement designed to prevent the tilting of a vehicle, by distributing the weight to bear evenly upon the springs, thereby also contributing to their endurance and preventing the twisting of the king bolt. It has been patented by Mr. Marshal T. Foster, of Piedmont, Kansas. Fig. 1 is a broken-away front view showing the application of the equalizer, Fig. 2 being a vertical longitudinal section. The springs are supported on the axle in the usual way, and to the axle clips, which are vertically slotted,



FOSTER'S SPRING EQUALIZER.

a back plate is attached by means of bolts extending through each clip, a sleeve or washer being inserted between the clip and plate to hold the latter and the equalizer arms it supports a sufficient distance back beneath the wagon body.

The slots in the clips allow for the vertical adjustment of the bolts, and the plate is also slotted to allow for further adjustment in adapting the equalizer arms to the vehicle. The plate is also corrugated on one side, and the bolt carries a washer with similar corrugations, so that when the bolt is tightened in place, the plate cannot be moved. The equalizer arms are laterally bent, and are pivoted at their lower widened ends between the plate and a smaller rear plate, the two plates being connected by bolts which serve as pivots for the arms. The inner extremities of the arms are semicircular in shape, and have interlocking cogs, so that when one is moved the other also will be moved, the outer ends of the arms, as shown in Fig. 1, extending between rollers, preferably of rubber, pivoted in brackets attached to the bottom of the wagon body. Mounted on a lug on the center of the plate to which the arms are pivoted is a spring adapted to press against the arms to take up any lost motion. This device may be employed with any kind of vehicle, the depressing of one of the equalizer arms by placing extra weight on one side of the vehicle causing the opposite arm to be also depressed, by means of the interlocking cogs, and thus keeping the vehicle body level and even at all times.

"Staff" for World's Fair Buildings.

Thirty thousand tons, or two thousand carloads, of "staff" will be used in the construction of the main buildings of the Columbian Exposition. It has been decided that all of the buildings will be faced with this material. Staff was invented in France about 1876, and first used in the buildings of the Paris Exposition in 1878 It is composed chiefly of powdered gypsum, the other constituents being alumina, glycerine and dextrine. These are mixed with water without heat, and cast in moulds in any desired shape and allowed to harden.

The natural color is a murky white, but other colors are produced by external washes, rather than by additional ingredients. To prevent brittleness the material is cast around a coarse cloth, bagging or oakum. The casts are shallow, and about half an inch thick. They may be in any form—in imitation of cut stone, rock-faced stone, mouldings, or the most delicate designs. For the lower portions of the walls the material is mixed with cement, which makes it hard. The material is impervious to water.

Alleged Deceptions in German Steel Works.

A correspondent writes as follows to the London *Iron and Steel Trades Journal:* The great lawsuit now proceeding at Essen, Germany, in the matter of income tax defraudations, said to have been practiced for years by the directors and the principal employes of this, the greatest German steel-making establishment, has suddenly taken a most startling turn.

Mr. Wm. Baare, the director-general of the Bochum Union, and one of the greatest industrial princes of Germany, holding the highest official and honorary position, has, in conjunction with others connected with these steel works, been accused of having for many years systematically and purposely defrauded the national, as well as the municipal, revenues by manipulating their income tax estimates in such a way as to avoid paying taxes on almost nine-tenths of their incomes.

The Bochum Steel Works supply most German and a vast number of foreign and colonial railway administrations and companies with steel rails, sleepers, axles, etc., steel requisites for railways and railway carriages, etc., and have always been looked upon as A1 in every respect.

But now the director-general and the board of directors of these great works are accused of having systematically and purposely practiced, at all events connived at the practice of, the most audacious frauds possible for manufacturers and contractors.

The accuser further says that "the Bochum Steel Works, in order to be able to get rid of their inferior steel manufactures, practiced another fraud, namely, substituted for the rails, axles, etc., which had been chosen by the official examiner for being tested for their tensile strength, similar rails, axles, etc., which they had specially made from the very finest 'testing' steel that could be manufactured. The officially stamped rails, axles, etc., were surreptitiously removed, viz., replaced by rails, axles, etc., of much superior material, which had meanwhile been stamped with the fraudulent stamps of the Bochum Works." The tests were made, and invariably proved highly satisfactory.

The accuser produced at once in substantiation of his accusation a quantity of stamps, of which in all some 57 were in use during the last 16 years; moreover, he produced orders to and receipts from the maker of such stamps ; he also gave a number of railway accidents, etc., which he alleges have been caused by breakdowns in consequence of the fraudulent practices of the Bochum Union. The public prosecutor at once stepped in and entered a separate action for wholesale commercial forgeries and defraudations alleged against Mr. Baare, his co-directors, and the Bochum Union.

Pile Driving by Jets.

Mr. Edward Hurst Brown gave a description before the Engineering Club, of Philadelphia, of the application of a water jet to the driving of piles for the boardwalk at Atlantic City, N. J.

The water was brought from the city water supply in a 2 inch pipe, extending along the line of the work. To the end of this pipe (which was extended as the work progressed) was attached a 30 foot length of rubber fire hose terminating in an ordinary brass nozzle about 4 feet long, with an opening of 1¼ inches.

The piles were swung into position by a rough but light tripod, provided with block and fall, and steadied in place by the foreman, while one of the men held the nozzle of the hose vertically and close to the foot of the pile. Under the action of the jet, the pile was lowered into position almost as fast as the men could pay out the rope, the nozzle following it down.

To drive a pile from 6 to 10 feet into the compact beach sand required only from 30 seconds to 1 minute from the time the water was turned on the foot of the pile until the pile was finally fixed in position, the hose withdrawn, and the tripod removed.

The instant the hose was withdrawn, the sand packed at once around the pile, holding it, apparently at least, as firmly as if driven by a ram in the usual way. Should a pile be driven too far, it is easily raised while the jet is on.

The jet process has been successfully used in other parts of New Jersey, in some places through coarse gravel with stones 8 to 10 inches in diameter, but in such cases, of course, the sinking is less rapid than in the beach sand.

When a city water supply is not at hand, a steam force pump is used.

In sinking pipe wells the pipe itself may be used for the jet, but the separate nozzle appears to be preferable.