THE MALLECO VIADUCT, CHILIAN STATE RAILWAY, COLLIPULLI, CHILI.

Our illustrations are from photographs for which and for the following particulars we are indebted to Mr. Henry Blake, of Collipulli. The viaduct crosses a ravine and the Malleco River at Collipulli, in the southern part of Chili, 38° S. latitude, 72° 50′ E. of Greenwich. It is of steel, built by the Schneider Steel Company, at Creusot, France, and has the following dimensions:

Total length, 347 meters, 50 centimeters, divided into five spans of 69 meters 50 centimeters each.

Height of steel pier	No. 1,	43 meters,	70	centimeters.
" " " "	No. 2,	67 "	70	"
" " " "	No. 3,	75 "	70	"
" " " "	No. 4,	43 "	70	"
" " girders,		7 "	45	"

Total weight, 1,550 tons.
Total height from river 93 meters and 70 centimeters.

The metallic piers are bolted down on solid masonry built with best Portland cement and granite rock, piers Nos. 1 and 4 having a base of 15 meters and 98 centimeters by 12 meters and 40 centimeters.

Pier No. 2 has a base of 21 meters, 98 centimeters by 15 meters and 50 centimeters.

Pier No. 3 has a base of 21 meters and 60 centimeters by 15 meters and 50 centimeters.

They are built on the bed rock of the slope.

Height of rock piers No. 1 and No. 4, 14 meters and 90 centimeters.

Height of rock piers No. 2 and No. 3, 15 meters and 90 centimeters.

One of our views shows the solid stone arches at the north end. These arches as well as the piers are built up from the bed of rock. The metallic piers were first built, and the girder built on the north side of the ravine and launched forward on rollers moved by large ratchets, as you will see by photograph No. 1.

The great difficulty of this undertaking was the extreme steepness of the banks of the ravine, which caused a great deal of lost time in getting material to its place, there not being a bit of level ground within 2,000 feet of the bridge location.

This viaduct was projected and planned by the deceased engineer of Chilian Railways, Mr. Aurelio V. Lastarria, and carried out and finished by the present engineer, Mr. Eduard Vigneaux, a most indefatigable and enthusiastic engineer of the Chilian government.

Sand Transportation by Rivers.

James C. Graham, in a recent number of the *Amer. Jour. of Science*, says: There has recently come under my observation a case of the transportation of siliceous sand upon the surface of the water, due to capillary floating.

It is well known that a needle can be placed gently upon the water so as to float, the force of capillary attraction producing a surface tension so as to prevent its sinking. This same principle was being used in removing sand from a bar jutting out from an island in the Connecticut River.

The erosion was being carried on from the side of the bar against which the current did not strike. It took place by gentle ripple waves splashing up against the sand bar (which was at an angle of about 150° to the surface of the water) and upon the retiring of each wave a little float of sand would be on the water. At first these were about the size of a silver quarter of a dollar, but by the union of a number, some floats would be formed of about six inches square. These blotches were so numerous as to be very noticeable in rowing up the river, and could be traced for half a mile or more below the bank, though this bank from which the sand came was but a few yards long.

If one of the blotches was disturbed by touching or the too violent action of the waves, it would immediately separate, the particles at once falling to the river bottom. This shows that coarse sand *can be* floated away by a current of far less velocity than 0·4545 mile per hour.

It shows a method of removing sand from the lower side of a forming bar which has got above high water mark.

It indicates a possible explanation of the coarser particles of sand occasionally found in otherwise very fine deposits.

Car Coupler Law of New York.

The following is the existing State law of New York concerning car couplers, passed in 1889:

"All persons and corporations operating any line or lines of railway by steam power in this State shall, after the first day of November, one thousand and eight hundred and ninety-two, equip all of their own engines and freight cars run and used in freight trains, or other trains in this State, with . . . automatic self-couplers; and it shall be unlawful after that date to run or operate in this State any freight cars belonging to such persons or corporations without having the same equipped with the appliance above mentioned. Provided, that it shall be lawful, in case of accident or other emergency, to temporarily dispense with the use of such appliances."

Correspondence.

A Whistling Well.

To the Editor of the Scientific American:

I have a six inch bored well in my door yard, 135 feet deep, with eight feet of water. Over a year ago I noticed that at times a strong current of air came out of the openings around the pump stock, and by observation find it to be an excellent barometer, as it blows from six to twenty hours preceding a storm. I have placed a brass whistle in the space, which at times can be heard a quarter of a mile. The harder and longer it blows, the more intense will the coming storm be. A peculiarity of it is the fact that, after the storm, it takes back the wind. It is not gas, as it has no smell. An immense volume of air passes out during one of its protracted blows. The air comes up through the water. When well is open, one can hear it bubbling.

It is called hereabouts "the whistling well." There are a few other wells within a mile or so of here that act in unison with it, but their owners have not as yet put whistles in them. The noise at times becomes so monotonous that we are compelled to plug it up. Can you give a scientific solution of the phenomenon?

To all who have as yet visited it, the source is a profound mystery. R. L. SMITH.

Winona, Logan County, Kan., December 15, 1890.

Ingrowing Toe Nails.

To the Editor of the Scientific American:

I have noticed in several of the late issues of your valued paper some methods of treatment of ingrowing toe nails. As I have had a number of cases to come under my notice in dispensary practice, probably the course of treatment that we pursued may be of interest to some of your readers. In all cases, and even in severe forms of ingrowing toe nails, where one would be disposed to think that the only procedure would be to remove a portion of the offending nail, together with the matrix or bed of the nail, we resorted to the simple method of packing the ingrowing portion of the nail with cotton. After the nail has been well packed, a few drops of the tincture of chloride of iron are allowed to soak into the cotton. The iron acts as an astringent, hardening the usually very tender and sensitive granulations; it also deadens pain to a great extent, and by its stimulating action causes healthy tissue to form rapidly. The packing is repeated three times weekly; and at the end of one or two weeks the use of the iron may be discontinued. The nail, however, is to be well packed with cotton until the ingrowing portion has grown out and is able to be properly trimmed. In trimming the nails one should be careful to cut them straight across and not to carry the scissors deep down into the corners of the nail, as so many are apt to do.

I have seen some of the worst cases of ingrowing toe nail cured by following the above plan of treatment.

CHARLES B. WILLIAMS,
Resident Physician, Pennsylvania Hospital, Phila.
Philadelphia, Dec. 17, 1890.

Improved Lamps Greatly Needed.

To the Editor of the Scientific American:

The Boston *Herald* publishes another lamp casualty, which occurred at Newark, N. Y., on the 19th December last, by which a woman and child were burnt to death.

The alarming frequency of such disasters imperatively demands some radical improvement in the present method of burning oil.

It is with the view of furthering this object that I wish to bring before your readers the results of experiments which I have recently made, in order to ascertain, as nearly as possible, the cause of similar accidents, commonly known as "lamp explosions."

From investigation I find that it has long been the aim of lamp manufacturers to keep the main body of the oil in the fount, or reservoir, as cool as possible, and there is no doubt that, by highly ingenious methods of construction, they have fully succeeded in attaining their object. There are, indeed some lamps, of the more expensive patterns, in which I find the increment in the temperature of the main body of the oil scarcely noticeable, after several hours' burning, yet I find these lamps as dangerous as the cheaper kind, for the simple reason that the space inside the fount, not occupied by oil, is quickly filled with explosive vapor, which is generated in the wick tube by the heat of the flame which rests thereon.

This device attains a high temperature after the lamp has been burning but a few minutes, and consequently an explosive vapor is rapidly generated therein, which descends into the fount containing the oil. There it collects, ready to catch fire, and explode, although the oil beneath is perfectly cool.

This action can readily be proved by a comparatively simple experiment. Take a wick about four inches wide, moderately saturate it with kerosene oil, place it between two plates of common window glass, ignite the top of the wick, and to prevent smoke, have as little as possible of the wick above the wick tube. Then hold the device over a hot stove or other heated surface. Soon a vapor, generated in the tube on which the flame rests, may be observed descending and issuing from the lower end of the tube. This vapor is highly explosive, and may instantly flash into flame.

It is obvious that the action, above described, is quite independent of the temperature of the oil in the fount, which may be, for the sake of experiment, as low as 32° Fah., or the freezing point of water!

I hope that my suggestions may lead to improvement in the present defective method of using oil.

PROFESSOR.

Smokeless Powder.

From the following interesting report of Krupp even laymen can form a judgment as to the high value of the smokeless powder. The report reads as follows:

Much as has been written so far about the effects of the new powder, no side has touched upon the composition of its chemical component parts. A much wished for light is thrown on this composition for the first time by the trial shooting report of Krupp. We have taken from it, says *Kuhlow*, the following, which is of general interest. For all new kinds of powder nitrited cotton forms the basis. If cotton is treated with nitric acid and sulphuric acid, then, according to the strength of the acid and the methods employed, three kinds of nitrated cotton arise:

	Trinitro-Cellulose.	Binitro-Cellulose.	Mononitro-Cellulose.	Cellulose.
Carbon	24·24	28·57	31·80	44·45
Hydrogen	2·36	3·18	4·34	6·17
Oxygen	59·26	57·14	54·10	49·38
Nitrogen	14·14	11·11	6·76	....
	100·00	100·00	100·00	100·00

So far it has not always been possible for one to prepare with certainty the one or the other combination of nitrogen mentioned above. On the contrary, the different combinations are always found to be mixed. If trinitro-cellulose preponderates, the product is called gun cotton; if binitro-cellulose preponderates, we get collodion wool. Gun cotton is only soluble in acetone, collodion wool only in spirit of wine and nitro-glycerine. This latter property has been utilized by Herr Alfred Nobel, the inventor of the dynamite, to manufacture a new powder for guns and cannons. The gun powder proposed by Nobel is made of equal parts of collodion wool and nitro-glycerine. The preparation is made in the following manner: At a temperature of +6–8° C. one part of collodion wool is put into 6–8 parts of nitro-glycerine. The whole is taken into a place which can be made void of air, so that the nitro-glycerine can come into the closet contact with the wool, then the nitro-glycerine substance is—as far as it is necessary for the intended mixing proportion—pressed out under a press or in a centrifugal pump. The cake which is gained by this flinging out or pressing is broken into pieces, exposed to a temperature of 60–90° C., in which the nitro-glycerine dissolves the collodion wool. Then the mass is rolled, under the same high temperature, into thin plates. These thin plates are pressed into thicker ones under a roller. The product thus gained must be perfectly homogeneous and evenly translucent in all parts. The thickness of the plates depends on the largeness of the required powder. The powder is used in the form of dice or in that of plates. To secure the stability of this powder one may add to the glycerine at the beginning half per cent diphenylamine. So much about the old manufacture.

The new chemical formula would be:

$$10C_3H_5(ONO_2)+9C_6H_7O_2OH(ONO_2)_2$$

with a molecular weight of 4,538. The decomposed products would therefore be:

$$58CO + 26CO_3 + 61H_2O + 48N$$

and all gaseous. The powder can be styled therefore smokeless, because the small amount of ash which the wool contains remains unnoticed. The products of combustion become visible by the steam getting condensed, when leaving the inside of the gun, and the nitrogen entering into a chemical combination with the oxygen of the air. What we see, during the firing, is therefore not powder smoke but powder steam, which disappears quickly if the charge is small. The powder has a density of 1·6, its color is yellowish, it feels to the touch like elastic and can be easily cut with a knife; it is not sensitive to moisture, and less sensitive to changes of temperature than the old powder; to warmth it is rather more so. That it is not advisable to keep powder at a temperature of more than 50° C. experiences with the black powder have shown. All the statements made here have been laid down by Krupp after a number of the minutest trials, and they are all indubitably true. We may only add that this firm had used for one year and a quarter smokeless powder for all calibers.

THE Royal edition of the *N. W. Architect* is an elegant production. It is embellished with a number of superior photographic prints of new buildings of beautiful architectural design.