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THE KINZUA VIADUCT.

We give an engraving of the largest railroad bridge in America, now being erected by the New York, Lake Erie. and Western Railroad. It is situated in the middle of McKean County, Pa., four miles from Alton, the present terminus of the Bradford branch of the Erie road, and crosses the Kinzua Creek at an elevation of 2,100 feet above the level of the sea.

For many years the valley of the Kinzua has been an obstacle to engineers in locating a road between Buffalo, N. Y., and Pittsburg, Pa. The banks on both sides form steep slopes, and are covered by a dense growth of heavy hemlock trees. The stream itself is small and shallow, but flows through a deep ravine from its source until it empties into the Allegheny River.

Various surveys have been made from time to time for the purpose of finding easy grades and good alignment, but with no definite results until two years ago, when it was proposed by Mr. O. W. Barnes, of New York, to cross the valley by an immense viaduct.

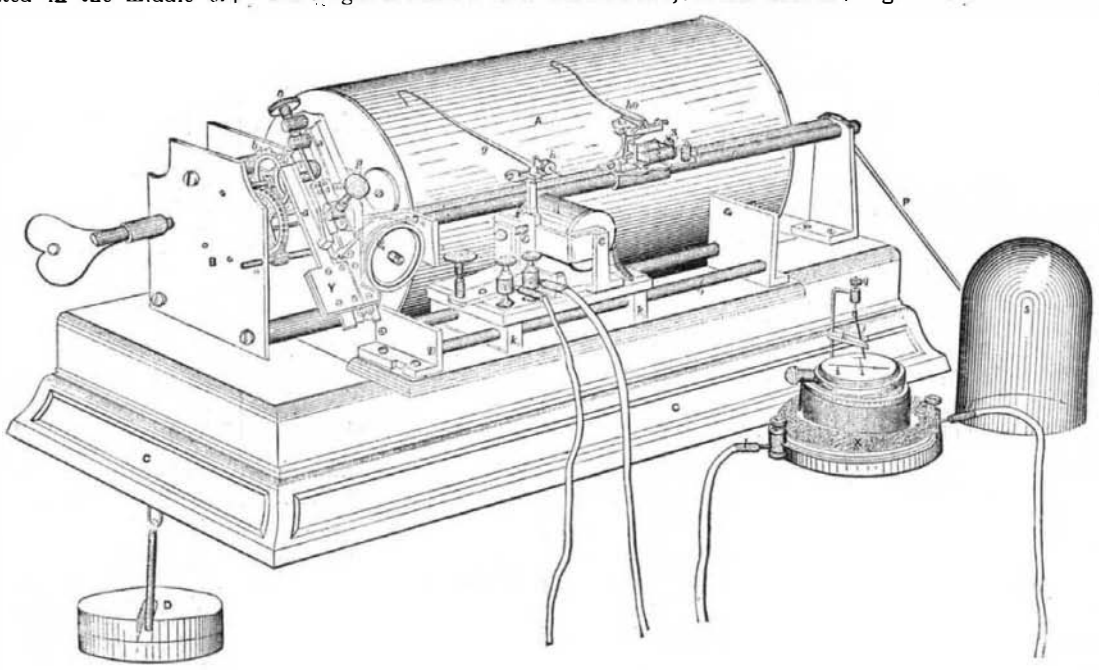


Fig. 1.—CHRONOGRAPH FOR ENGINEERING PURPOSES.—[See Page 291.]

Mr. Barnes, who at that time was Chief Engineer of the extension of the Bradford branch of the Erie, having received the approbation of the company to carry out his plans, selected a suitable place to span the ravine, and made the calculations for strains and windage, aided by his able and energetic assistant. Mr. Charles Pugsley.

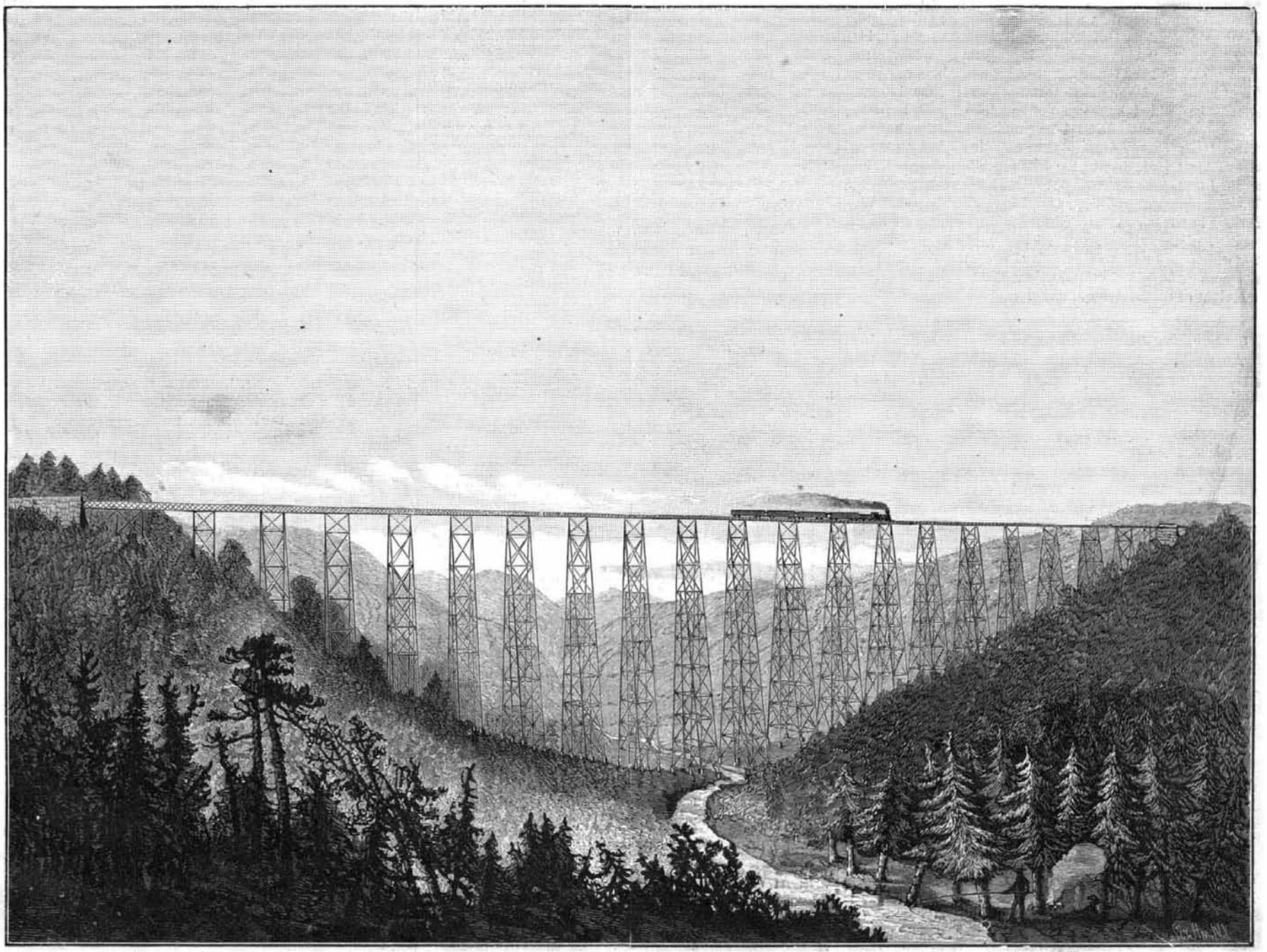
The length of this immense structure is 2,051 feet clear of the abutments, and the height is 301 feet from the bed of the stream to the base of rail. There are twenty spans 61 feet long, and one 62 feet long, alternating with the tower spans, which are 38½ feet each. The truss being 6 feet high and 10 feet wide, and continuous from one end to the other, is supported by columns 1 foot thick, which increase in length toward the middle of the bridge. They spread out with a batter of 2 inches to the foot, which gives a distance of 10·5 between the columns of the highest bents at the bottom. The two longest bents rest on two long piers with pedestals, built on either side of the stream, each containing about 500 yards of masonry.

All the other columns rest on separate piers containing from 20 to 125 yards of masonry.

Foundations for the most part are built on solid rock; only in a few piers near the bottom where timbers have been used. They average about 14 feet square on the bottom, and batter in to a coping of 4 feet square on top and 2 feet in thickness.

The iron shoes, to which the columns are fastened, are embedded in the copings, and each one is anchored to the pier by two large bolts passing down through to a manhole in one of the bottom courses, where they are made secure by an iron plate and nut. These bolts are put in to counteract the influence of the wind.

An excellent quality of sandstone has been found in the



KINZUA VIADUCT.—THE HIGHEST RAILWAY BRIDGE IN THE WORLD.—[From a Sketch by John Toomey, Assistant Con. Eng.]

immediate vicinity of the bridge, which proved quite beneficial to the contractor of masonry, Mr. John G. Noakes. Four million pounds of iron and 7,000 yards of masonry will be consumed in the construction of the viaduct. It will cost not far from $300,000.

Work was commenced last August, and will be finished next August, about the same time that the grading will be done. It will be 60 feet higher than Niagara Suspension Bridge, 170 feet higher than the great bridge across the Ohio at Cincinnati, 189 feet above High Bridge, 170 feet higher than the East River Bridge, and 45 feet higher than Portage Railroad Bridge over the Genesee River.

The officials connected with the road are: O. Chanute, chief engineer; Chas. Pugsley, P. A. eng.; C. H. Keefer, div. eng. in charge of viaduct; Wm. Seaman, resident engineer; and C. E. Ball, inspector of masonry; Barnes & McFadden, contractors. The iron for the bridge is furnished by the Phœnixville Bridge Company, and erected by R. A. Simmons.

Heating by Sunshine.

Professor E. S. Morse, of the Essex Institute, has devised an ingenious arrangement for utilizing the heat in the sun's rays in warming our houses. His invention consists of a surface of blackened slate under glass fixed to the sunny side or sides of a house, with vents in the walls so arranged that the cold air of a room is let out at the bottom of the slate, and forced in again at the top by the ascending heated column between the slate and the glass. The out-door air can be admitted, also, if desirable. The thing is so simple and apparently self-evident that one only wonders that it has not always been in use. Its entire practicalness is demonstrated in the heating of the professor's study in his cottage at Salem. The value of the improvement for daily warming buildings like churches and schoolhouses, which, when allowed to get cold between using, consume immense quantities of heat before they are fairly warmed again, is evident. Of course some other means of heating must be available when the sun does not shine. But in the colder regions, say in the far Northwest, the sun shines a greater part of the time, and hence the saving of artificial heat would be very large if the sun heat could be "turned on" for eight or ten hours out of the twenty-four.

Giffard.

Mr. Henri Giffard, inventor of the injector, is dead. He was born in Paris, on February 8, 1825, and he was thus but a little over 57 years of age at the time of his death. In 1841 he became engaged in the works' offices of the Paris-Saint Germain Railway, and shortly after he commenced the study of ballooning, a study to which he subsequently devoted a great part of his life. In 1851 he published his work entitled "Application de la Vapeur à la Navigation Aerienne,' and the following year he made his first ascent in a balloon of elongated form, which it was intended should be guided by steam power. The result, however, was not a success. In 1854 he published another book entitled "Du Travail depense pour obtenir un Point d'Appui dans l'Air," while during the Paris Exhibition of 1867, and again in 1878, he established captive balloons at Paris, the latter, which was of enormous size, having been fully described in our pages. Mr. Giffard is best known by his invention of the injector, which he brought out in 1859, and for which he in that year received from the Academie des Sciences their prize for mechanics. In 1863 he was created a Knight of the Legion of Honor.

Some of the Beneficial Effects of Electric Lighting.

An English writer, after describing the baneful effects of gas lamps upon the healthfulness of living rooms, goes on to notice some of the mischief done to books, wares, furniture, and the like. The evil effects of the heat of gas jets is augmented, he says, by the large amount of water produced by the gas flame.

Sixty burners will produce on the lowest computation two gallons of water per hour; hence in a November evening many large shops filled with delicate goods will have a nine-gallon caskful of water thrown into their atmosphere in the form of steam, to condense on any cool surface, as we often see it trickling down the windows in winter. But worse remains behind. The sulphur, always present in gas in larger or smaller proportion according to the character of the coal employed, burns into sulphurous vapor, which passes in the air to the state of oil of vitriol. The eminent chemist, Dr. Prout, exposed water in a drawing room in which gas was burnt, and found that it absorbed sufficient of these vitriolic emanations to redden blue litmus and show the presence of free sulphuric acid. The fumes from gas will indeed, in the long run, discolor every sort of fabric, rust metals, rot gutta percha, and reduce leather (as in the binding of books) to "a scarcely coherent powder with a strongly acid taste." After referring to the evidence of the librarians of the Atheneum Club, London Institution, etc., as to the rotting of the bindings of books kept in rooms lighted by gas, the writer says: "Drapers know to their cost how the edges of pieces of dyed fabrics become faded and rotten when kept long on the upper shelves of gas-lighted shops; no plant will grow in a room where gas is burning, and cut flowers quickly wither; while those who work long and habitually in gas-lighted rooms become blanched and sickly. From all these manifold evils electricity will deliver us."

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NEW YORK, SATURDAY, MAY 13, 1882.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 332,

For the Week ending May 13, 1882.

Price 10 cents. For sale by all newsdealers.

THE LIBYAN DESERT.

A closer study of the geological structure of the Libyan Desert is likely to change the views previously entertained regarding its origin. Prof. Zittel, in a lecture delivered in Munich, said that the scientific expeditions to that region, undertaken by Rohlfs, Zittel, Ascherson, and Jordan, have yielded a paying harvest in geology at least. We learn that this region, the geology of which was so little understood, as well as the so-called Arabian Desert, which lies between the Nile and the coast of the Red Sea, and which is inseparable from the Libyan Desert so far as the stratifications are concerned, is not, as has been generally supposed, the remains of a sea that has recently disappeared. On the contrary, it consists of formations that belong to the cretaceous and lower tertiary, formations long anterior to the geological present. The rocks of the cretaceous, which prevails, are principally sandstones, variegated marl, calcareous marl, and limestone; the cretaceous fauna was found to be extraordinarily richly represented, as rarely happens elsewhere, such as oysters, ammonites, sea urchins, etc. In the oldest tertiary the nummulites formed deposits, so called because the petrifactions which they held were considered by the common people to be petrified coins. There are shells of foraminifera from the size of a pea to that of a dollar, and elsewhere in the lowest layers of the tertiary they appear in immense masses. The soil of the desert is covered with them for miles.

With the exception that in the middle tertiary the sea pressed inward on the north in two comparatively unimportant depressions, every trace of any later sea is wanting.

The whole Sahara as well as the Libyan seems to belong, for the greater part, to the chalk formation, and while the older *stratified* rocks are wanting eruptive rocks appear, forming mountain chains.

Hence there can be no talk of the sea having covered the Sahara in the recent past, for if this were the case there would be later stratified rocks on top of the cretaceous with fossils resembling the marine fauna of the present time. Then, too, the surface of the desert is not of such a shape as to indicate that it has been the bottom of the sea; but, on the contrary, the torn, ragged, fissured chasms of the desert mountains, the deep cut valleys, indicate the erosive action of flowing waters which, perhaps, in the oldest historic times still lent luxuriant fertility to the region now so sterile. This sterile character of the Sahara is to be attributed entirely to the unfavorable meteorological conditions, to the almost total lack of rain. The soil itself is well adapted to the production of a rich vegetation.

The quantity of salt present in the collections of water rendering many of the oases uninhabitable, depends upon the rock salt, which, with gypsum, is very abundant in the chalk marl as well as elsewhere. The ascending thermal waters, which make a paradise in the midst of the cheerless desert, according to Zittel's investigations, are not, as was formerly supposed, referable to the Nile, but have their origin in the rainy zones of Central Africa, whence they are led northward on impenetrable strata that have an inclination in that direction.

The sand of the desert is from the "Nubian sandstone," which belongs to the cretaceous formation and extends along the left bank of the Nile through the tenth degree of longitude. It has been transported hence by ancient water courses, aided by the wind.

The National Academy of Sciences.

The announcement that Mr. J. H. Cushing would read a paper "On the Mythology of the Zunis" drew an exceptionally large attendance upon the meeting of the Academy, April 20. The six Zuni chiefs were present, and were introduced to the audience by Mr. Cushing at the opening of his address. After giving an account of the intricate system of priesthood among the Zunis, Mr. Cushing gave an enumeration of the Zuni gods, who are divided into six great classes. Interesting among the hero gods is the great priest of all religious orders save one. He is supposed to have appeared among the ancestors of the Zunis, so poor and ill clad as to have been ridiculed by mankind. He it was who taught the fathers of the Zunis their architecture and their arts; their agriculture and their system of worship by flames and painted sticks; but, driven to desperation by the ingratitude of his children, he vanished beneath the world, never to return to the abodes of men; yet he still sits in the city of the sun, ever listening to the prayers of his ungrateful children.

The address was followed with many interesting illustrations of a poetical character of this strange people. The other papers for the day were as follows: "On the Polarization of the Light of the Moon," by A. W. Wright; "On the Results of the Incandescent Lamp Tests at the Paris Exhibition," by G. F. Barker; "On the Formation of Metalliferous Vein Formation at Sulphur Bank, California," by Professor Joseph LeConte; "On a Form of Standard Barometer," by A. W. Wright, and "On a Marsupial Genus from the Eocene," by Professor E. D. Cope. On the last day one new member was elected—Prof. Ira Remsen, of Baltimore.

ANOTHER ELECTRIC RAILWAY.—The second electric railway constructed by Messrs. Siemens and Halske in Berlin was formally opened, April 29. It runs from Lichterfelde, a suburban station on the Berlin-Anhalt Railway, to the Military Academy, about one and a half English miles.