As a matter of fact, the verification of identical properties in the serum of animals immune against snake poison was made almost at the same time by Calmette, Physalix, and Berthand, these experimenters arriving at the conclusion that it was possible to obtain a serum sufficiently active against snake poisoning by following a process analogous in the preparation of the animals which furnished the serum. Calmette makes the animals immune by injecting continually increasing doses of poison with continually decreasing doses of hypochlorite of calcium. Dr. Vital does not use hypochlorite nor any substance which neutralizes the effect of the poison, but commencing with infinitely small doses of the poison in a salt solution of 7 to 1,000 succeeds, in the course of a year, in rendering animals not only immune, but capable of receiving, at one time, doses of poison that would kill one hundred animals of equal weight. One of the illustrations shows a horse that has been made immune in this way and is now receiving 100 milligrammes a day.

While repeating the experiments of Calmette and while using his serum, Dr. Vital found it to be ineffective, much to his surprise, and on further experiment, made the important discovery that there are two classes of snake poison, the bothropic and the crotalic, the first belonging to the genus *lachesis* and the second to the genus *crotalus*. With these he made two types of serum, the antibothropic and the anticrotalic, each of which is effective only in bites of snakes of the same class as that which produced the serum. This important discovery explained, therefore, the ineffectiveness of the serum of Calmette which is taken from animals made immune by poison from snakes of India. In order to produce a serum of universal efficacy, Dr. Vital mixes equal parts of the other two serums and calls it anti-ophidic. The animals which furnish the serum receive injections of poison every other day in the manner shown by the illustration, and the extraction of the serum is made twice a month, 3,600 grammes of blood being drawn each time. The horses and mules, of which there are eighteen for pest and twelve for snake serum, are kept solely for this purpose and are not used otherwise. The serum is separated from the coagulum by a process invented by Dr. Vital, a process by which the quantity is much larger than in the ordinary processes of separation.

The efficiency of the serum has been proved repeatedly on animals in experiments, some of which the writer has witnessed. Side by side with a rabbit that died in forty-five seconds was another that received a mixture of a quantity of poison equal to that used in the first instance and the proper amount of serum. This rabbit showed no effects. One dove received enough poison to kill it in about an hour and another an equal amount, but soon after the proper amount of serum. The first died and the second lived. An infinite number of similar experiments have been made, always with results almost mathematical in their accuracy. Besides these experiments, Dr. Vital has now a history of persons bitten in which the serum has been successfully applied.

A great figure in the press world of Paris has passed away, according to the Westminster Gazette, in the person of M. Hippolyte Marinoni. He was the inventor of the printing presses which bear his name. As a lad, he was of a mechanical turn. His parents apprenticed him to an engineer in the Rue d'Assas. He brought out the first flat-bed four-cylinder printing machine, and later, in 1872, his celebrated rotary. Meanwhile he had become manager of the Petit Journal, of which the editor at that time was the distinguished publicist Emile de Girardin. The great success of the Petit Journal was due to the "Marinonis," which printed, folded, and cut the papers at the rate of forty thousand an hour. Then a color printing machine was invented by M. Marinoni and thus the well-known illustrated supplement of the Petit Journal became possible. M. Marinoni was of the thorough type of self-made man—a little rough externally, but with a heart of steel.

THE MOUNT PILATUS RAILWAY, SWITZERLAND.

BY EMILE GUARINI.

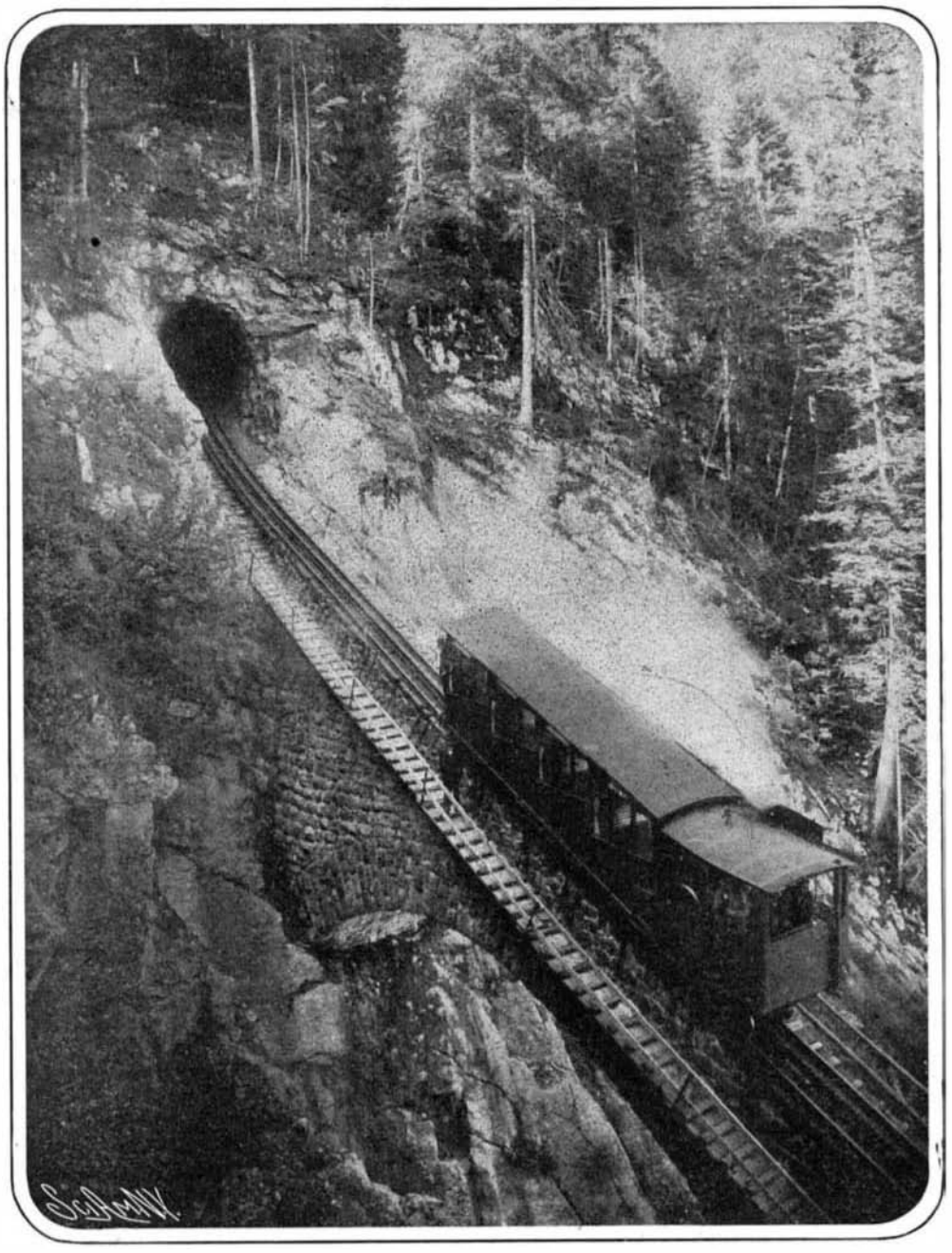
Notwithstanding that there are few assertions that can be made without fear of contradiction, there is one nevertheless that is undeniable and undenied, although the beautiful may be what pleases and its conception may consequently vary with taste, and that is that Switzerland is a beautiful and picturesque country. This is not the opinion of the Swiss alone, who are proud of their lakes and mountains, but of the tourists who come annually from all parts of the world to visit the country. Every one finds it beautiful because every one finds in it what pleases and interests him, and this includes the technical man, as well as the artist, the geologist, the botanist, the man of active life who comes to obtain rest, and the person of leisure who comes because it is the fashion.

Among the innumerable sites that are annually visited by the tourists who travel in Switzerland, Lucerne, that classical resort of foreigners, is, with its lake and remarkable surroundings, assuredly the most picturesque. But, just as one cannot claim to have seen Switzerland without having made the ascent of some one or other of its mountains, just so he cannot say that he has seen Lucerne unless he has ascended Pilatus, which, of all the mountains of Switzerland, is the most celebrated by the writings of which it has been the object, by the splendid panorama there unfolded to view, by the sea of fog that is sometimes seen forming there, by the magnificent spectacle presented to the spectator when he is on the top of the mountain, by the terrible legend of the damnation of Pontius Pilate, and, finally, by its meteorological legend, which has it that when clouds occupy the summit it is a sign of fine weather, and, when they are situated half way up, it is a sign of rain, a fact expressed in the country by the following archaic stanza:

"Quand Pilate a son chapeau,
Dans le pays il fait beau;
Mais quand il ceint son epé,
Gare l'ondée."

Formerly, when the ascent of Pilatus was made (an event that for centuries could not take place without a special permit for fear that the visitor might disturb the soul of Pilate and let loose a scourge upon the country, but in reality because certain lakes had for a long time been the refuge of a pagan cult), it was made by following a steep footpath that started from Alpnach-Staad and ended at the summit. It is this footpath that the Mount Pilatus railway follows for quite a long distance. But, while the modest footpath accomodates itself to all the capricious meanderings of the slope, the railway goes straight to the top, boldly crossing narrow passes and ravines, and traversing walls of rock that seem to bar its passage.

When the tourist leaves his conveyance at Alpnach-Staad, he finds himself at the lower station of the rack railway that runs to the summit. He is then at about 1,450 feet above the level of the sea. The car is there, inclined upon the track, the gradient of which is already 36 per cent. The locomotive and the car form a single vehicle. The car is divided into four compartments, placed one above another, and each accommodating 8 passengers. Its lower part is occupied by a water tank having a capacity of 100 gallons. The axles are arranged in such a way that curves of very small radius may be taken despite the distance apart of the axles, viz., 20 feet. Four pairs of cog wheels, two in front and two behind, serve for the propulsion, running, and braking of the vehicle. Rings that embrace the head of the rails prevent the car from being blown from the track in a gale or from running off because of ice or snow that may exist upon the roadbed. The boiler, which is of the tubular type, is 6 feet in length, has a heating surface of 225 square feet, and employs a working pressure of 12 atmospheres. It is placed at right angles with the axis of the track, in order to prevent the various gradients from producing fluctuations in the level of the water. The average gradient is 38.1 per cent; the minimum, 19.2 per cent; and the maximum 48 per cent. The engine cylinders are 8.75 inches in diameter, and the piston stroke is 12 inches. The normal speed of the trip is a little over three feet a second. The dead weight is 9.6 tons, and the load with 32 passengers, 2.4 tons. The locomotive is of about 70 horse-power. The braking arrangement has naturally been very carefully looked after. It consists of a compressed-air brake, an automatic brake, and two friction brakes. The suspension of the vehicle is assured by a system of four pairs of elliptic springs combined with spiral ones. The play of the car is prevented by safety stops, so that the vibrations are no greater than they are in an ordinary well-suspended train.



The Car on its Journey Through Wolfort Gorge.

Such, then, is the singular, but powerful engine, constructed by the Winterthour locomotive works of Switzerland, that daily traverses the 5,400 feet which separate the Alpnach-Staad station from that of Pilatus-Kulm, which is at an altitude of 6,800 feet. This altitude is reached by means of a track of 15,150 feet in length, constructed by MM. Lacher and Guyer-Freuber, of Zurich. From the edge of the lake to the top of the mountain, the substructure consists of solid masonry covered with large granite flagstones. The track itself, which is all of iron and steel, is solidly riveted, once in every three feet, to the underlying masonry. The bed for the rack is placed between the two rails, which it slightly exceeds in height. Attached to each side of it is a steel rack with which engage horizontally, on the right and left, the four cog wheels of the vehicle. Numerous bridges had to be constructed under most difficult conditions, and yet, in spite of that, the Pilatus railway, its rolling stock, stations, and shops, cost but $380,000 and took but four hundred days to finish. The track in the first place traverses plains bestrewed with wooden buildings, and then reaches the gorge of Wolfort, at an elevation of 2,950 feet, which it crosses by means of a bridge constructed with surprising boldness. This bridge, which is entirely of dressed stone, is within the radius of 260 feet uniformly adopted for the curves of the track. Its span is 75 feet. The railway afterward enters Wolfort tunnel, 145 feet in length, and then climbs the Risleten, the gradient of which is 48 per cent. In order to cross this critical place, it became necessary to employ a number of hurdles and piles, and to construct subterranean vaults, as well as huge sustaining walls. Continuing the ascent, the tourist reaches a wild region intersected by the two Spycher tunnels, 167 and 318 feet in length. Upon leaving the upper tunnel after a magnificent view of

THE MOUNT PILATUS RAILWAY.

the lake Quatre Cantons and the Righi, the traveler leaves the forest region and reaches Aemsigenalp at an altitude of 4,590 feet, a charming place provided with an inn and a small wooden structure containing two pumps of small size, but great power, which furnish drinking water to the two hotels situated at about 2,300 feet higher up in a rocky and arid region. The train, after taking a supply of water for the second time, traverses one of the most pleasing regions of Mount Pilatus, and then reaches the huge and fantastic blocks of the Mattalp, whence the view embraces a magnificent panorama of the Matterhorn, the enormous mass of the Esel, and the ridge that connects these summits. The railway then reaches the region of bare rock, describes a curve toward a point of the southeast ridge, and then climbs the wild escarpment of the wall of the Esel. It is difficult to imagine a bolder direction line. At an altitude of about 6,230 feet, four tunnels of 144, 180, 148, and 36 feet here and there pierce the colossal mountain sides. Between the two upper tunnels, there unfolds the panorama of the Bernese Alps. The railway then begins its last climb up a 48 per cent grade, and reaches the Pilatus-Kulm station at about 6,800 feet altitude. The mountain falls perpendicularly upon the charming country of Lucerne, beyond which we discover a vast extent of hills and valleys strewed with blue lakes, cities, and villages, and numerous rivers which, between the low eminences, shine like threads of silver. There are two hotels to receive the tourist, who, from their terraces, obtains a magnificent view over the lake of Quatre Cantons, which appears in such splendor that one does not know what to admire the most, the dark azure of its waters, or the variety of the sinuosities that they form. In order to complete the attraction of Mount Pilatus, the railway company has undertaken the construction of the road which is the most singular in Europe, and that is the Tomlishorn road running from one of the hotels to the peak of the Tomlishorn along the most abrupt of the walls of rock, and ending at a platform whence may be enjoyed a scene such as Switzerland alone is capable of presenting.

But here we are far from the railway, about which we have not much further to say, however, unless it be to speak of the intrepidity of the Italian laborers, who, sometimes suspended by ropes along perpendicular walls of several hundred feet in height, were employed in the construction of the railway, and, finally, to give the number of the travelers furnished by the last annual statistics and which amounted to a total of 44,231, 520 of whom were Americans and 12,011 English. The success of the road is easily explained. The traveler who is not very familiar with mountainous countries and with ascents finds himself here carried gently and without fatigue to the summit of one of the most celebrated mountains of Switzerland, and preserves a deep impression and lasting remembrance of the spectacle that unfolded under his eyes and of the gigantic work that permitted him to see it and that attests both the genius of man and of nature.

THE MERCURY VAPOR LAMP FOR PHOTOGRAPHIC WORK.

(*Continued from page 108.*)

the illustration, Fig. 2, shows the frame lowered to the floor and being used as a printing lamp. Mr. Pratt states that he has made sittings at night with this equipment in the astonishing space of one second. The prints are made with the same light in from 2½ to 10 seconds, according to the density of the negative, and the light only barely heats the negative, but not enough to damage it in the least. These lamps are constructed of glass tubes having metal sealing-in wires at each end. These wires lead the current to the electrodes, one of which is of mercury, and the tubes are exhausted to a high degree by means of a vacuum pump and sealed off, preventing any escape of the vapor which fills the tube.

It is claimed that these mercury vapor lamps produce the most efficient electric light known, the current consumption being about 0.4 watts per spherical candle and, under favorable circumstances, it is stated as low as 0.3 watts per candle-power. Three ordinary 32-candle-power incandescent lamps required as much current as a mercury vapor lamp of 750 candle-power and the efficiency is therefore more than seven times that of the incandescent lamp and about double that of the arc lamp.

As the vapor is inclosed under a vacuum there is no consumption of the light-giving element and, therefore, this type of lamp requires no trimming.

The mercury vapor lamp produces a light which is seemingly pure white, but is entirely lacking in red rays or nearly so, thus making it entirely unsuitable where the accurate determination of color values is necessary. The mercury vapor lamp operates with absolute steadiness and without noise and is said to be the most desirable form of light for factories, machine shops, and work-rooms of architects and draftsmen, as well as for all classes of photographic work.

The light of this lamp is composed to a very large extent of chemically active or actinic rays and is, therefore, a perfect substitute for daylight for all sorts of photographic processes. By the use of this lamp the studio for portrait photography may be located in any part of a building and the operator is entirely independent of weather conditions. The photographer can devote his attention entirely to the artistic arrangement of lights and shadows, as the time of exposure is constant at all times. The same equipment for the mercury-lamp skylight can be utilized for printing of all kinds with great satisfaction. The mercury lamp is of such shape that it is particularly well adapted for mechanical blue-printing with glass cylinders and revolving drums being, it is claimed, many times more efficient than the focusing arc lamp, while for photo-engraving work lamps of this type consuming eight amperes are said to do the work more quickly than arc lamps taking three times this amount of current.

Correspondence.

Ground Corn.

To the Editor of the SCIENTIFIC AMERICAN:

I beg leave to take exception to the statement made in the SCIENTIFIC AMERICAN of to-day by Mr. A. W. Dennis, that corn ground by steam will heat, whereas, if ground by water power, it will not. I know, from several years' experience as a practical miller, that *damp* grain ground by water power will heat if left in large bulk or even in as small a receptacle as a flour barrel, and that large bins full of meal from *dry* corn are safe even if ground by steam.

Worcester, Mass., July 30, 1904. W. H. DELONG.

Corn Grinding.

To the Editor of the SCIENTIFIC AMERICAN:

I noticed, in reading the article of Albert W. Dennis, on page 78 of the July 30 number of the SCIENTIFIC AMERICAN, the statement that corn ground in a grist mill that is run by steam will generate so much heat within itself, or acquire the heat in some way from the machinery, that it will burn and spoil if left in large bulk after being ground, but that corn ground in a mill operated by water will not heat itself or be affected in this way.

Mr. Dennis has been misinformed. The facts are these: Corn ground on a stone operated by water will heat and spoil just as quickly as a mill operated by steam power, and meal ground under the same conditions by water or steam will heat, if piled up, until after the grinding heat is out, then it is not safe to leave a very large amount piled up longer than a few days at a time. Meal ground on a dull stone will heat quicker than meal ground on a sharp stone. The kind of power does not make any difference with the heating of the meal, as any miller can tell him.

Macedon, N. Y., August 2, 1904. EDWIN YOUNGS.

Pressmen and Electricity.

To the Editor of the SCIENTIFIC AMERICAN:

I have read the article of Mr. A. W. Dennis, of Salem, Mass., on "Are Pressmen Affected by Electricity from a Belt?" and was much interested. I would be very glad to give him my experience and observations.

The kind of electricity spoken of is static or frictional and is the same as lightning. It is generated by the friction of two unlike non-conducting substances. Its cause in this case is the friction of the belts and pulleys, and it exists as a charge on the surface of the belt.

By consulting a standard work on electro-therapeutics, we find that static electricity is used much in treating nervous affections and that it requires care and skill to apply it so that the effects will not be injurious. There is no doubt that this treatment is beneficial to the nervous system when it is applied correctly, with reference to quality and quantity. The charge from a belt is irregular and varies constantly and we find that electricity applied in this manner injures the nervous forces. A person when subjected to the influence of a current or series of discharges for any length of time becomes numb and his breathing and pulse slow down considerably, even if the current is so mild as to cause no annoyance.

Once I had an opportunity to remedy a case of this kind in an electrical plant. The main shaft was driven by two wide belts and anyone passing near them invariably received a severe shock, which was a constant inconvenience. This discharge may be effectively prevented by running wires from any water or gas pipes in the building and fastening the ends near the belt, or they may be allowed to touch the belt. This allows a path for the discharge and proves an effective remedy.

With reference to steam and water ground corn meal, it is my impression that the difference in quality depends upon the speed in each case, which necessarily governs the friction. The machinery of a steam mill runs so fast that more heat is generated in the grain, which "kills" the grain, as millers say. On the other hand a water-driven mill operates at a lower speed and the quantity of heat generated is less. It all depends upon the speed.

Danbury, N. C. J. FRANK MARTIN.

Electricity and Lathe Work.

To the Editor of the SCIENTIFIC AMERICAN:

In reply to the interesting letter from Mr. Albert W. Dennis, published in a recent number of the SCIENTIFIC AMERICAN, I take the liberty of imparting the following bit of information:

While engaged in the manufacture of certain staple articles, about eight years ago, I had occasion to do considerable lathe work. The lathe upon which I worked had a twisted belt which was always strangely charged with static electricity, so much so in fact, that tufts of dust would cling to the leather. The belt would readily suck the oil from a spoon and wire-draw it into hair-like strings which would encircle the belt. Before this experience I had been a sufferer to a marked degree from nervousness or excessive nerve tension, but soon after I began my lathe work I felt a change for the better, though, I must admit, accompanied by a slight falling off in muscular vim. During the past year I found that after using a large Holtz static generator, with which to carry on experiments, considerable ozone was liberated. The gas would fill the room in a short time, so that my health became powerfully affected, causing pains in the thorax, and general distress, which fresh air seemed to relieve. If there are frequent discharges from Mr. Dennis' belts it is quite probable that a man working near them would in time become affected. More ventilation would be needed in the press-room, or else the press itself should be grounded. While the presence of an excess of ozone in the air, owing to its superiority to oxygen, may cause undue nervous tension and a subsequent reaction, I believe that a nervous system of ordinary tone would in time become affected and finally succumb, because of a continued form of electro-catalytic action on the highly sensitive animal tissue. ALBERT F. SHORE.

Brooklyn, N. Y., July 30, 1904.

Mosquito Extermination Again.

To the Editor of the SCIENTIFIC AMERICAN:

In a letter published in your correspondence column recently I find the following:

"No doubt if the malarial mosquito could be exterminated there would be an end to the propagation of malaria through this means, but it is not claimed, I understand, that the mosquito can, of itself, propagate the disease. It must first have had access to an infected person."

The mosquito theory as outlined above is an unproved hypothesis. It is true that the plague of mosquitoes was minimized by kerosene distribution in their breeding places, at Havana, and that yellow fever did not appear that season. But neither did it visit Santiago, Cuba, where the mosquitoes ran riot as usual. In Italy, when the "mosquito theory" started, the malarial insect was found abundantly, but no malaria existed, or *vice versa*. But, granting that there is some foundation for the theory of infection, it is evident that the insect procures its poison from the water where it was born, principally wet regions and shallow wells. If a microscopic quantity of poison from mosquito bites can produce malarial fever what must the ravage be when the polluted water is used, in large quantities, for drinking purposes?

In my opinion there is no such thing as malaria (bad air), in any habitable place. It is malaqua, not malaria, that causes the fever. I have known men and women to dwell in swamp regions, traditionally unhealthy, and maintain superb health simply by drinking pure artesian water and avoiding shallow well water. The Roman fever, in Italy, has practically vanished from the Eternal City since the establishment of new water supplies. Still blows the air of the Campagna upon Rome, but it brings no fever on its wings.

Killing, exterminating mosquitoes is a desirable thing for human comfort, but if every mosquito on earth were slain, the "malarial" (so-called) fever would continue as long as people drank polluted water and contaminated milk.

The "malarial" superstition dies hard, but it has not the potency it once possessed. Once the human mind generally understands that malaqua and not malaria is the enemy, the mosquito plays a very small fiddle in this problem. JAMES R. RANDALL.

Augusta, Ga., August 1, 1904.

About 8,400,000 gallons of water are evaporated daily from the salt ponds in Utah when the pumps are operated ten hours a day during June and July. In August the salt harvest begins, and the yield is at the rate of 150 tons per inch per acre. Utah produces annually nearly 60,000 tons of salt.

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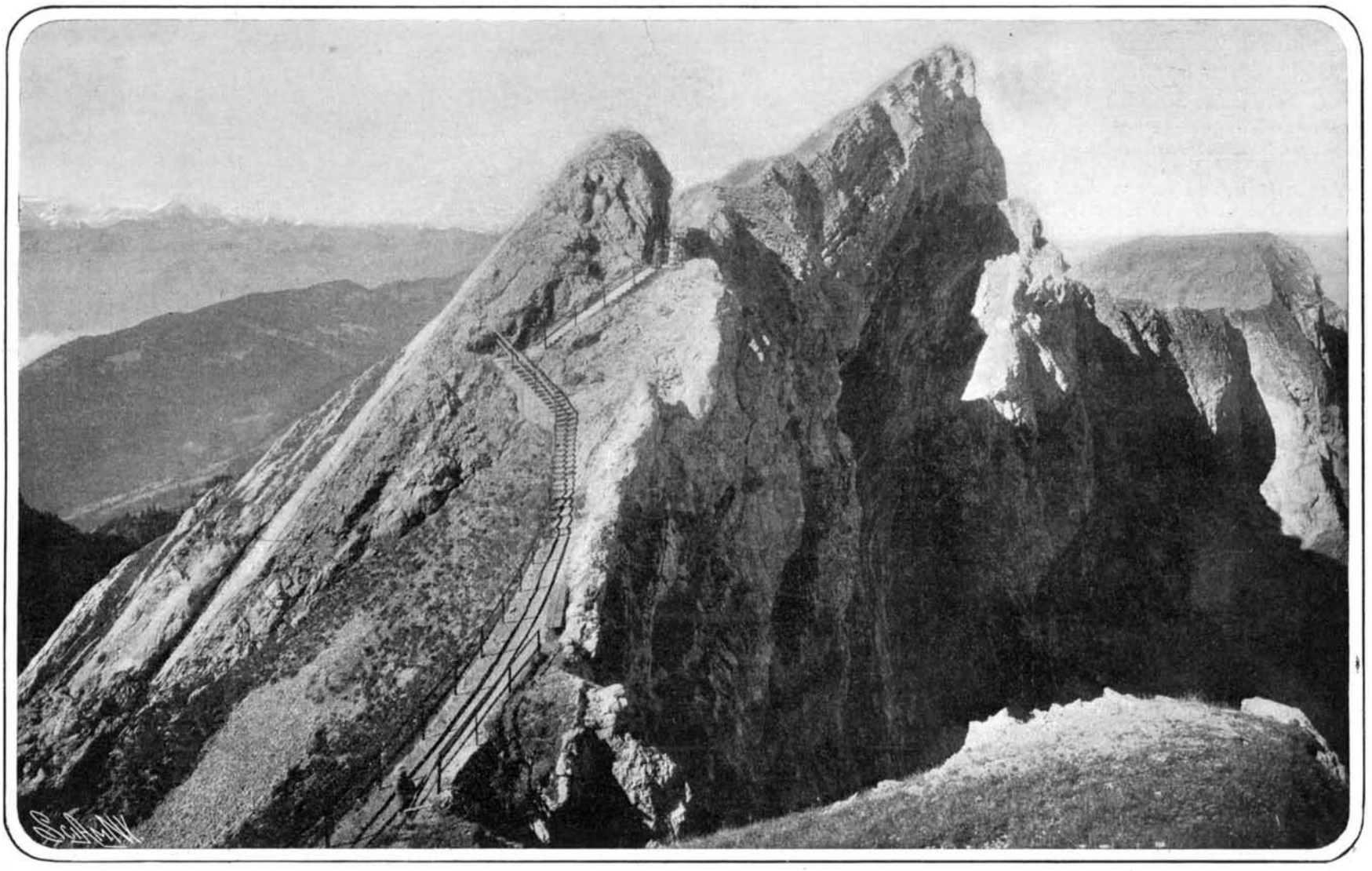
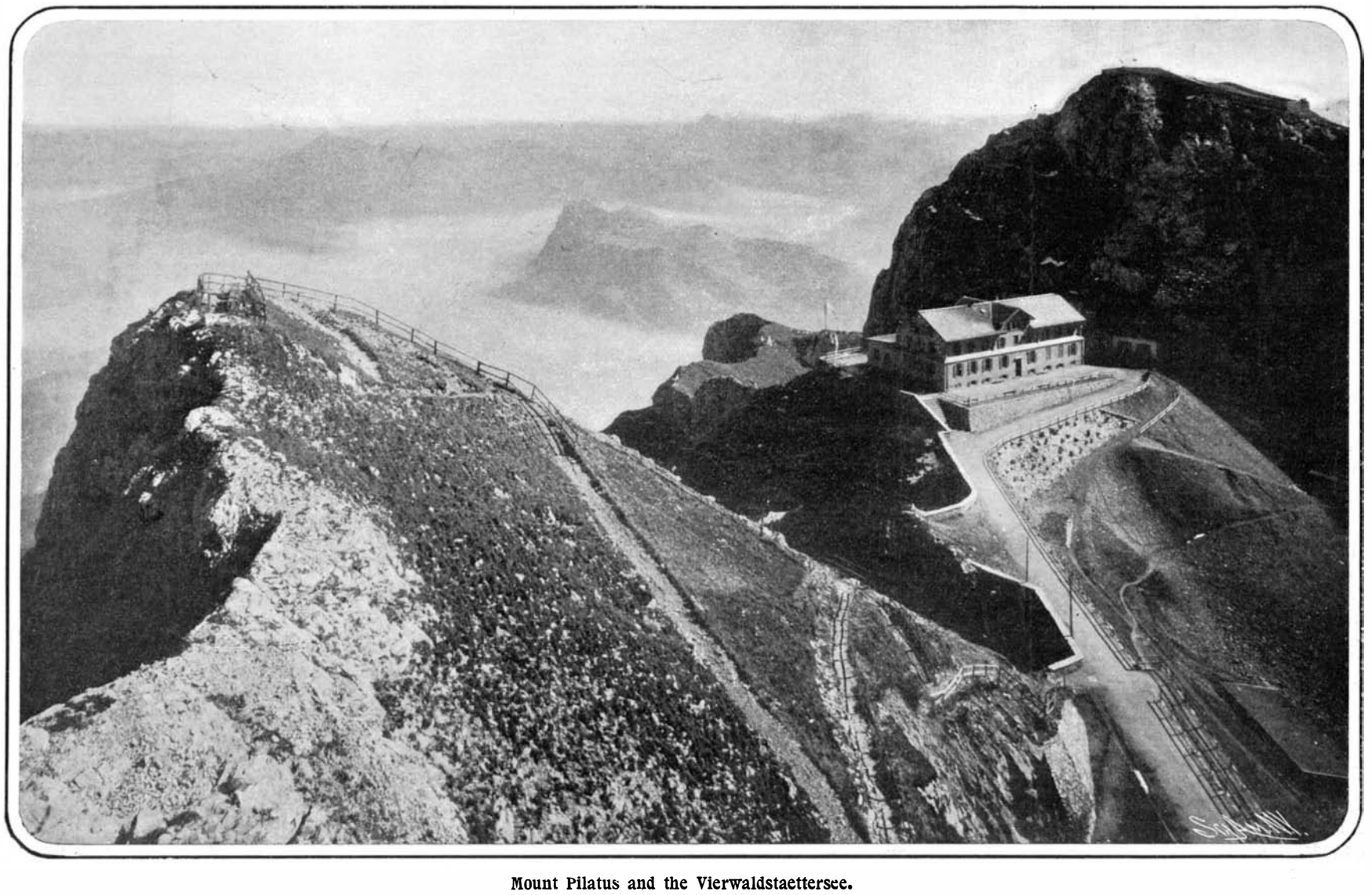


The Tomlishorn, 6,996 Feet High—A Noble Peak in the Alps.



Mount Pilatus and the Vierwaldstaettersee.

THE MOUNT PILATUS RAILWAY, SWITZERLAND.—[See page 110.]