### THE RAILROAD ON MT. PILATUS.

If the Rigi railroad is worthy of being considered an extraordinary and wonderful piece of work, the latest undertaking of this kind—the building of the railroad on Mt. Pilatus—certainly ought to attract the attention of engineers and of the traveling public. This new road differs essentially from its older rivals in the construction of its roadbed, as well as of the rolling stock. The ruggedness and steepness of the mountain, together with its great height (6,882 feet, against 5,905 in the case of Rigi), offered much greater obstacles than the roads previously built, and required an entirely different system.

The restless spirit of man is always glad to set for itself some new task, and consequently men were found who, equipped with the necessary capital, were willing and able to carry out this tremendous undertaking. When a portion of the road had been completed, all fear in regard to strength and safety were removed, for it was thoroughly tested every day, the locomotives going as often as was necessary to that part of the road on which they were at work, carrying materials of all kinds, weighing from 20,000 to 22,000 pounds.

The southeastern side of the mountain was chosen for the road, which begins at Alpnach-Stad, between the Hotel Pilatus and the Eagle Hotel (1,448 feet above the level of the sea). From there it climbs in a northerly direction to the Aemsigenalp, then westward to the Mattalp (5,315 feet above the sea), and after much winding reaches the plateau of the Hotel Bellevue on Mt. Pilatus (6,811 feet above the sea).

The road is about 2¾ miles long, and the total height climbed from the shore of Alpnacht Bay to the Hotel Bellevue is 5,360 feet. The grade is from 18 to 48 per cent, which is scarcely exceeded by any rope road. In the middle of the line, at Alp Aemsigen, there is a switch. Seven thousand two hundred and sixty-seven feet of the entire road consists of straight stretches, curves, with radii of from 262 feet to 328 feet, constituting the remainder. The road includes a viaduct, three short tunnels and one long one. The width of the track is 2 feet 7 inches. The foundation consists of a wall covered with plates of granite and loose material, and on this the superstructure is firmly anchored.

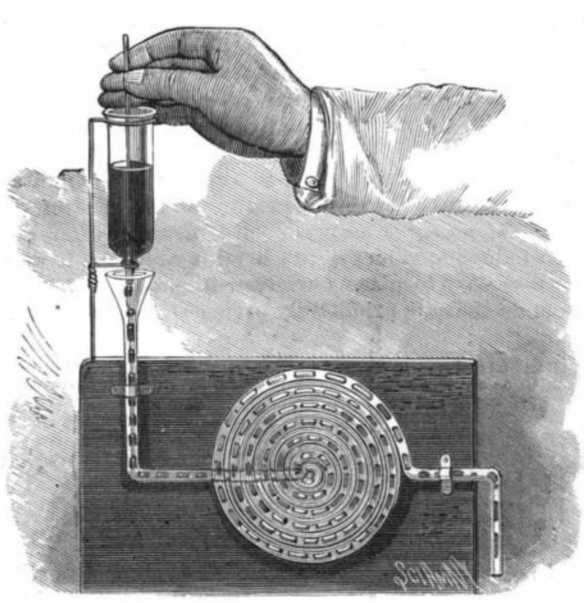
The toothed bar—which is placed midway between the rails and is somewhat higher than the latter—consists of soft steel, and is provided with a double row of vertical teeth, which are milled out of the bar. The cogged wheels on the cars, which engage the toothed bar, are arranged in pairs at the right and left of the same. The axles of these cog wheels are not horizontal with the level of the road, as in the Rigi system, but perpendicular to the same, this arrangement making it impossible for the cog wheels to become displaced.

The locomotive and cars form a train with two running axles and four cog wheels engaging the toothed bar. The boiler and engine are behind or below the cars, which latter accommodate thirty-two passengers. Brakes can be applied to all of the cog wheels, and besides this there are two clamps at the upper running axle which clutch the head of the rail, thus preventing the upsetting of the cars by the wind. The weight of the loaded cars is about 21,000 pounds, and one trip up or down can be made in about 80 minutes.

**The idea of the Pilatus road originated with Edward** Locher, of the firm of Locher & Co., in Zurich, under whose supervision and control the road has been built. The engine was invented by mechanical engineer Haas, and engineer Hensler, who has had much experience in the construction of railroads, undertook to act as the representative of Messrs. Locher.—*Illustrirte Zeitung.*

### NOVEL LANTERN SLIDE.

The engraving shows an inexpensive and very simple and effective device for exhibiting the action of the circulating fountain upon a screen. It consists of a glass tube of small diameter bent into the form of a volute, with the inner end of the tube extended laterally, and



CIRCULATING FOUNTAIN FOR PROJECTION.

then bent vertically and provided with a funnel at the upper extremity. The tube at the outer end of the spiral is bent outward radially, then downward at right angles. The tube thus bent is mounted on a board having a circular aperture a little larger than the spiral, so that the entire spiral may be strongly illuminated while the ends of the tube leading to and from the spiral are concealed by the board.

Above the funnel is supported a reservoir with a fine ajutage, the reservoir being provided with a pointed wooden rod which extends down into tube at the lower end and forms a valve for regulating the flow of liquid.

The liquid employed is water to which has been added some coloring matter, such as aniline blue, red, or green. A few drops of aniline red ink answers for this purpose.

The flow of the liquid is started by loosening the valve, so that the water drops regularly into the funnel of the tube below. The drops should fall so as to include air spaces between them. The liquid, as it issues from the downwardly turned end of the spiral, is received in a cup, by which it may be returned to the reservoir to be used again.

When it is desired to accelerate the motion of the liquid in the tube, a short rubber pipe is connected with the downwardly turned end of the glass tube.

**The glass tube is about one-sixteenth inch internal** diameter, and the spiral is three and one-half inches in diameter.

When the fountain is in operation, the material of the spiral appears to revolve, but each convolution at a different rate of speed, owing to its increasing diameter. When projected with a good lantern and a strong light, it becomes a very interesting object.

G. M. H.

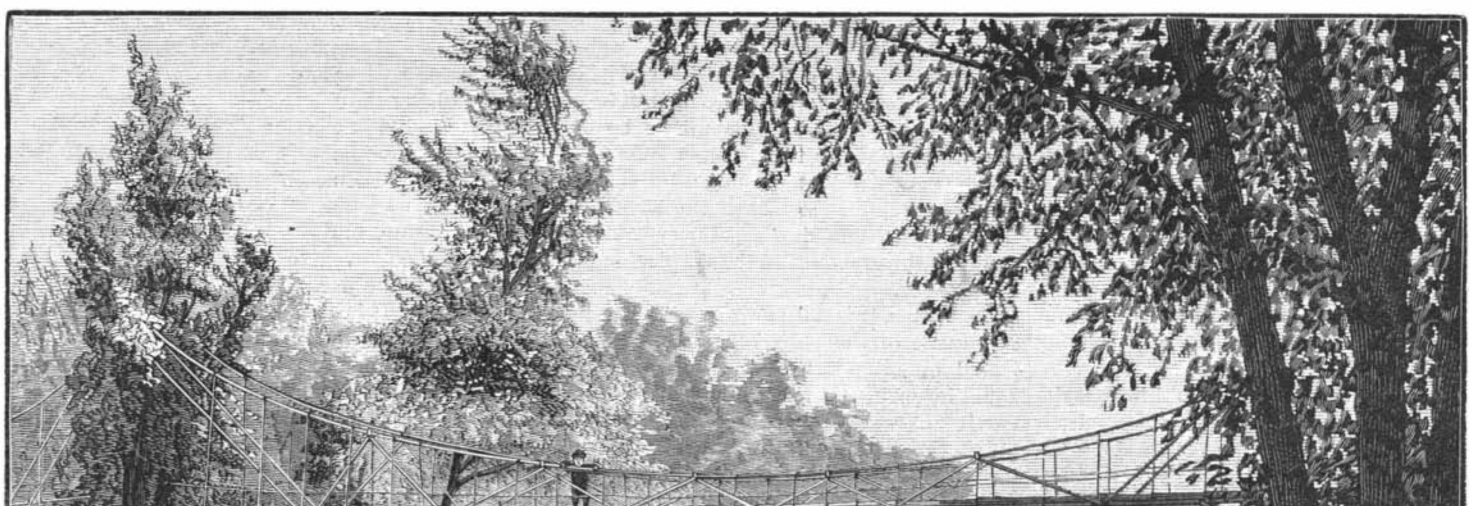
### SUSPENSION FOOT BRIDGE.

An instance of the practical work done by amateurs in mechanics is furnished by the suspension bridge which has been erected at Oak Park, Ill., and which we illustrate in the accompanying engraving. The bridge is very light, and is intended solely for the use of foot passengers, and it is suspended from a large double elm tree on one side of the river, while a tower has been erected as a pier on the other bank, which is a rather high bluff. The cables at this end, however, are carried to an oak tree, where they are anchored at the ground.

Mr. Leo G. Haase, who sent us the photograph, says in his letter that "the bridge was built by amateur mechanics, with no other knowledge of bridge building than that gained by observation and constant and thorough reading of the SCIENTIFIC AMERICAN. The builders were young men, just in their twenties."

The bridge extends over the river Displaines, with a span of 125 feet in the clear. The distance from the tree pier to the concrete anchorage is 75 feet clear, and the distance on the other bank between the tower and the tree anchor is 50 feet. The total length, therefore, is over 225 feet. It weighs but 2,750 pounds, and has been tested by placing fifteen men thereon. There are four five-eighths inch cables, but only two carry the load, the other two forming an auxiliary support in case of accident to the main cables.

The passenger way is narrow, the floor being about 3 or 4 feet wide, and passing directly between the two trunks of the tree through which the cables are passed. The height of the floor at the tree is about 10 feet. The flooring is built of planks 1 inch by 6 inches, laid 1 inch apart, on account of snow, on longitudinal stringers, 2 inches by 4 inches. These are supported by 1 inch gas pipe, hammered flat at the ends. One-half inch pipes are used at the middle of the bridge. The bottom ends are bolted to the stringers, and upper ends are provided with small wooden blocks clamped by two three-eighths inch bolts, and a space being left in the blocks for the passage of the cables. The bridge was built in the winter time, in order that a scaffolding could be erected on the ice on the river to facilitate the construction. The bridge is considered quite a curiosity, and many thousands cross it every year.



A CURIOUS SUSPENSION BRIDGE NEAR CHICAGO, ILL.

### Brown Reins or Saddle Leather.

Unstained leather may be colored a fine chestnut brown by treating it daily for a week or more with a solution of pine and alder barks. The bark is leached with rain water, using, by bulk, ten times as much water as ground bark, returning the water to the leach until all the coloring matter is extracted from the bark. The leather is then laid into the water, and allowed to remain until wet, then hung up to dry. By repeating **the process three or four times, a fine color is secured.**

### An Insect Destroyer of Boots and Shoes.

In the last report of the Commissioner of Agriculture, Professor C. V. Riley states that the beetle known to science as *Dermestes vulpinus*, and, in its larval state, to tanners as the "dry hide worm," came under his observation in 1884, for the first time, as a destroyer of boots and shoes. The insect was first noticed in the establishment of a wholesale manufacturer in St. Louis, in the spring of 1884, when a lot of boots and shoes which had been shipped to some Southern town were returned condemned as "wormy." This led to an examination of the stock in store, and the proprietor found, to his astonishment, that there was justice in the complaints of his customer, and that several boxes of heavy boots and shoes which had been packed for some time were literally swarming with the insect in all stages of development. This was the first time that he had ever known of the existence of such a pest.

About the same time, the insects were found in numerous leather houses throughout the same city, and invaded the manufactories. In the summer of 1885, public attention was called to the pest by various oral and exaggerated accounts of the "grub" that worked unseen in the soles of shoes, reducing them to mere shells, which crushed into fragments when subjected to the pressure of the foot in wearing.

Another case of the destructive action of this same beetle was brought to Professor Riley's attention at about the same time by Mr. F. Eisenstein, of A. Eisenstein's Sons, of Savannah, Ga., whose firm had instituted a lawsuit against the Boston & Savannah Steamship Company, by reason of damages done by the insect to boots while in transit from Savannah to Boston.

In the St. Louis cases, none of the dealers was able to trace the introduction of the insect from any particular warehouse or tannery, but learned from tanners that it was quite common in old hides.

In the warehouses and manufactories the insect still retained its partiality for undressed leathers, and an examination at once shows that the soles and heels of boots and shoes are more liable to injury than the uppers. It seems probable that the comparative immunity of the uppers is due to the oily dressing used in the finishing processes. They do not, however, entirely escape, for they are occasionally found bored by the larva or roughened and eroded by the beetle.

The work of the larvæ, both young and full grown, consists in boring smooth, round channels in every direction through the leather, preferring, as above stated, the soles and heels. A favorite place for entering the shoe is in the angle between the sole and heel, or in the crevice between the upper and the sole, a crack of some kind seeming to be necessary to enable them to get sufficient purchase to begin boring.

The principal occupation of the adult beetle is the propagation of the species, yet it also is a leather destroyer, gnawing and scoring the surface of the boot or shoe, but not burrowing bodily into its substance.

Professor Riley states that when the insect has already made an entrance into cases of boots and shoes, it will not be a difficult matter to destroy it by a proper use of bisulphide of carbon. Of course, it would be preferable to overhaul the contents of each box thoroughly, and to treat the boots in which the insect is found with benzine or some other efficacious insecticide; but, where this cannot be done without too great expense, it will probably suffice to open each case and place an open saucer of the bisulphide on top of the contents. The liquid will volatilize, and the vapor will sink down through the mass, if the box be tight, and will kill the insects in their burrows.

As the natural home of the insect is in hides, it devolves upon transportation companies that carry both made-up leather goods and hides to exercise some degree of care and cleanliness, as they are otherwise liable to lay themselves open to damages payable to the owners of the more expensive goods.

### The Mirage of Sound.

Mr. H. Fizeau has just presented a very interesting note to the French Academy of Sciences, on the mirage of sound. The attention of this learned physicist was attracted to this subject by the recent collisions between ships which presented the greatest guarantees of security, and were provided especially with the powerful sonorous apparatus now generally in use, such as sirens, steam whistles, etc.

Under the influence of variations in temperature, the propagation of sonorous waves may give rise to a sort of *mirage of sound*, entirely analogous to the well known phenomena of light, and which results from a more rapid propagation in the less dense strata.

If, then, we suppose that, under certain circumstances, the sea is hotter at its surface than the neighboring strata of air, the latter in fair weather must, in the vicinity of the warmer water, take on an arrangement of strata of decreasing temperature, in measure as their distances increase up to a certain height above the level of the water. This is what is oftenest observed at sea during the night, and frequently during the day in foggy weather.

Under these circumstances, which are precisely those under which the greatest use is made of acoustic signals, the sonorous rays designed to propagate themselves horizontally in the strata of air in the vicinity of the sea necessarily undergo, through the effect of the inequalities in the temperature under consideration, unequal velocities—those nearest the surface of the water getting ahead of those that traverse the strata situated above. Now, as the direction of the rays is always given by a line at right angles with the common tangential plane of the waves, it will be seen that this direction must be successively inflected from below upward, so long as the propagation continues in a direction near a horizontal one.

This inflection of the sonorous waves, which is not very sensible in the vicinity of the sound's origin, increases greatly with the distance, and at some hundreds of yards may produce considerable of an effect, even with slight variations in temperature in the superposed strata of air.

If we suppose that the temperature of the strata of air decreases with the height, at the rate of one-tenth of a degree only per yard, a calculation gives the following values as the heights at which it would be necessary to place ourselves, in order to hear the sounds that are primitively propagated in the normal direction:

| Horizontal distances starting from the origin of the sonorous waves. | Vertical heights of the sonorous waves above their primitive horizontal direction. |
|---|---|
| 328 feet | 0·36 inch. |
| 3,280 " | 3 feet. |
| 8,200 " | 18·78 " |
| 16,400 " | 75·14 " |
| 24,600 " | 168·9 " |
| 32,800 " | 300·5 " |

In certain cases, for example during foggy weather, fair nights, and a calm sea warmer than the neighboring strata of air, we would obtain still greater differences than these, resulting from the above hypothesis, and it would be necessary to double or treble the vertical heights if the decrease in the temperature of the air happened to reach two-tenths or three-tenths of a degree per ten feet of height.

The means to be employed for correcting the effects of this accidental deviation in sonorous signals, and to obtain the greatest range possible in all weather, are obvious. Since we have to fear an inflection of the sounds in the direction of a curve whose concavity is turned upward, it must be advantageous to place the starting point of the sounds on one side and their point of arrival on the other, at a sufficient height above the lower strata of air to allow the sounds to follow their path in a straight line freely, without getting out of the space wherein they can be heard.

In conclusion, Mr. Fizeau expresses the hope that special experiments may soon be made, on the open sea and near the coast, under circumstances proper for utilizing practically what is formulated in the above theory.—*La Nature.*

### Use of Electric Light in Telemetry.

Up to the present time, the idea of using the electric light as a measurer of distance has not been entertained. Nevertheless, at night this might be of the greatest advantage, and by the process suggested to us by M. Edme Genglaire, not only could a ship provided with producers and reflectors of the electric light discover the enemy stationed at greater or less distances, but at the same time it could in the simplest manner determine its distance.

To do this, it is only necessary to establish in the bow and stern of the ship reflectors, whence can be projected on all points of the horizon luminous rays of equal intensity. If now from each of the two reflectors two luminous rays are caused to converge upon the same point, the distance from which to the ship is to be determined, a triangle will be furnished for solution whose base (the distance separating the two reflectors) and two adjacent angles are known.

To facilitate the measurement of these angles, the support of each reflector carries a needle, perpendicular to it and which moves over a graduated circle. With regard to the distance to be determined, the two luminous rays can be regarded as the sides of an isosceles triangle whose base is the space between the reflectors, and this consideration will yet be of the greatest use to us.

The two luminous rays being equal in length, the angles at the base are equal, and their sum subtracted from 180° gives the angle at the apex; and it may be assumed that, the distance from base to apex increasing with the sum of the angles at the base, a table will be arranged containing, opposite to each value of the sum of these angles just spoken of, the corresponding distance from the base to the desired point. The two luminous rays grow larger as they increase in length, and it is only with difficulty that the point seen will be brought into the central axis of both converging rays. It is only by a succession of trials that this question can be determined, and great precision as yet cannot be looked for. Following out the above course of reasoning, a ray of light should be projected upon the desired point, so that it shall be well lighted by the central luminous area. The angle of the reflector required for this result is to be calculated, it is multiplied by two, and the table constructed as a preliminary will show opposite the doubled angular value the desired distance.

This process will be of the greatest utility on account of its ease of execution, on occasions when great exactness is not required and where quickness is of importance. On the other hand, the table can be determined experimentally.—*Electricité.*

### Harness Collars.

Custom has much to do with the styles of harness used and the manner of mountings. This is shown in the use of the collar. A man who would use a breast collar upon a coupe or coach harness would become a laughing stock for all his neighbors, while to use a round coach collar upon a trotting horse would bespeak a lack of taste and judgment.

This adopting of a fixed style for any one kind is due in part to the study of the requirements of the case by men who have interested themselves in improving the horse. The trotting horse, in order to give full action to his shoulders, works best in a breast collar when driven single, as the only strain put upon the shoulders is the draught. But if driven double, the pole and yoke must be supported, and the bearing down upon the neck requires more support and a better distribution of the strain than can be given by the breast collar, so a light round collar is preferred. The making of the latter collar is a branch of business that requires much skill if the work is to be well done. A ring around the neck is not what is wanted. The collar must be more than a ring. It must be made to fit the horse's neck. It should set snugly, but not bind at any point. If too narrow in the neck it chokes the horse, and if too wide it falls too far back and interferes with the freedom of the shoulders and produces permanent injury. It was long argued that a soft cushion was wanted, and that the galls on horses were due to the bad character of the collars. This theory seems to have been abandoned by the most intelligent horsemen, who now demand a collar that is solid, smooth, and firm, and one that fits the neck, and in order to maintain the latter quality the hames are fitted to the collar instead of being allowed to draw the collar out of shape, as they will if not bent to fit.

It is not always possible for the owner of a horse to have his neck properly fitted, owing to the distance from the collar manufacturer, but he may give such directions as will produce a well fitted collar. There is no fixed rule that can be relied upon, owing to the difference and size of horses' necks. But an old rule is to measure the height of a horse and add 5 inches to the number of hands for the size of the collar. Thus a horse 15 hands high would require a 20 inch collar. It is claimed by some that this rule works well, and can be relied upon except in the case of heavy draught horses or ponies. In the absence of a collar rule, this guide is better than none, but we think a better result can be obtained by resting the short arm of a carpenter's square upon the horse's neck where the collar rests, and allowing the lower end to rest upon the bearing line of the shoulder, and indicating the length by the long arm of the square. In addition to this, the collar maker should know the character of the neck, whether full or thin at three points, top, at shoulder, and midway between these two points. For weight of collar, give the circumference of the body at the shoulder.

It is claimed by some collar makers that there is no rule which can be followed, and they live up to their theory by making all collars over a single shaped block, but the success of a few men who have made collar making a study falsifies all such claims. There are men in the business who obtain from 20 to 25 per cent more for their collars than their neighbors do, simply because of the collars fitting the horse's neck properly, and if one man can fit from stock a variety of horses, we can see no reason why another should not do the same thing.—*Harness.*

### Platinizing Glass.

In the gallery of the *Conservatoire des Arts et Metiers* is preserved a frame of glass covered with a thin layer of platinum, which exhibits this remarkable property. Used as a reflector, the image of an object appears in it as in a mirror; used as if transparent, it acts like common glass, and objects can be seen through it. This invention, to-day abandoned, dates back more than twenty years. It is due to Dodé. The following is the process given by this chemist. It consists in intimately mixing platinic chloride with essence of lavender, A, and on the other hand in preparing a flux consisting of essence of lavender, borate and oxide of lead, B. A and B are mixed. When the paste is quite homogeneous, it is spread by a fine brush over one side of the glass. When dry, it is baked in a muffle at a low red. The volatile matters, including chlorine, are driven off, and the metal is left, mixed with the flux, to which it communicates a gray color. These objects, quite difficult to prepare, have hitherto been little appreciated. This might offer an interesting field for work.—*La Nature.*