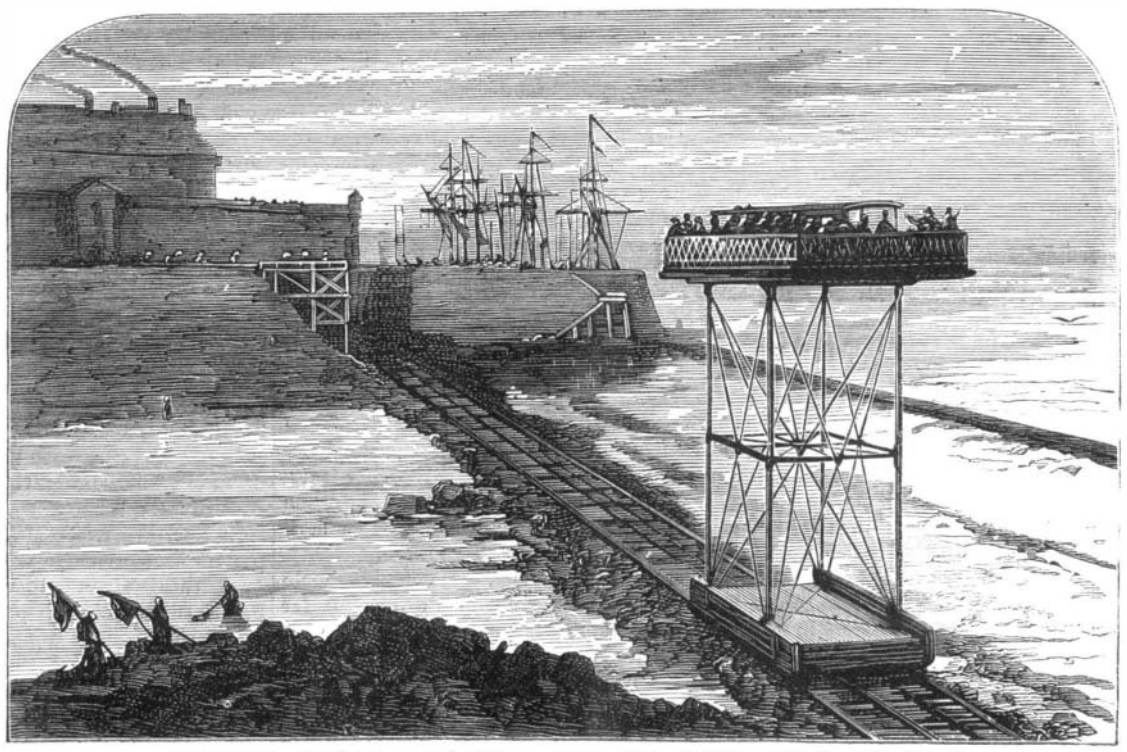
the stone is deposited at his feet, and, keeping hold of the rope with one hand, the diver grasps and tears off the sponges within reach, which he deposits in his net. He then, by a series of jerks to the rope, gives the signal to those above, and is drawn up.

ROLLING BRIDGE BETWEEN ST. SERVAN AND ST. MALO.

The towns of St. Servan and St. Malo, in France, are situated on either side of the river Ronce, or, more strictly, of the arm of the sea into which that river empties. The tide is here subject to great fluctuations, retreating so that the bed of the estuary may be crossed on foot, and again rising to a hight of several yards. The mode of crossing the stream, until the construction of the curious bridge represented in our engraving, consisted in taking a wide *détour* to a point where an ordinary bridge spanned the river, or else in using boats. To avoid such inconvenience as we have referred to, M. Leroyer, town surveyor of St. Malo and architect to St. Servan, designed and had constructed the bridge we illustrate. It consists of a platform supported on wheels, which run on rails laid on the bottom of the estuary. The platform is supplied with accommodation for horses and vehicles at either side, and two classes are provided for passengers, the fares being one and two cents respectively. The platform stands level with the quay at each side, so that nothing is more easy than access to it; and, as our illustrations (from *L'Illustration*) show, it is worked at all states of the tide with perfect safety. One of the engravings represents the bridge traveling on its ways at low tide, and the other, crossing the river when the water is high.



ROLLING BRIDGE AT ST. MALO, FRANCE, AT LOW TIDE.

The bridge appears to be exceedingly popular with the inhabitants of St. Malo and St. Servan. It is novel in design, and reflects no small credit on M. Leroyer.

THE DEGERFORS IRON WORKS, SWEDEN.

There is a marked contrast between the relations of employer and employed in Sweden and the similar relations existing in England and the United States. In both English-speaking countries strikes and lockouts are rather the rule than the exception. Master and man are arrayed on opposite sides, each seeking to get the better of the other, and neither attempting in any very appreciable degree to lessen the existing antagonism. In Sweden, exactly the reverse is the case. The practice so earnestly advocated and followed in the past by the man most prominent in the development of the iron industry of the country, of regarding his workmen as living fellow beings, and not as mere machines from whom the utmost labor possible must at all hazards be ground for the least pay, holds in the great establishments of the present. The example of Samuel Owen was a grand one. In lieu of unions, draining upon the earnings of the industrions for the support of the lazy, flourish sick and benefit clubs and cooperative societies—while we read besides of yearly engagements, dwellings and land provided free for the workman by the employer, free fuel, free medical attendance and medicines, and free and compulsory schooling for his children. Again, the iron masters do not concern themselves with the buildings and plant of their ironworks only. They are intimately associated with every detail of the existence of the communities of which they are the leaders; they build dwellings and schools, even hospitals or infirmaries; they own and cultivate lands, and rear crops for the maintenance of their industrial allies, or enable them to do so; they possess, directly or indirectly, their own mines for ores; they own large tracts of forest land, and burn huge quantities of charcoal. Finally, they utilize the natural resources of their country by turning to full account all the water power available.

These considerations will lend additional interest to the following description of one of the greatest Swedish iron works, the "Degefors Aktie Bolag," for the details of which we are indebted to *Iron*:

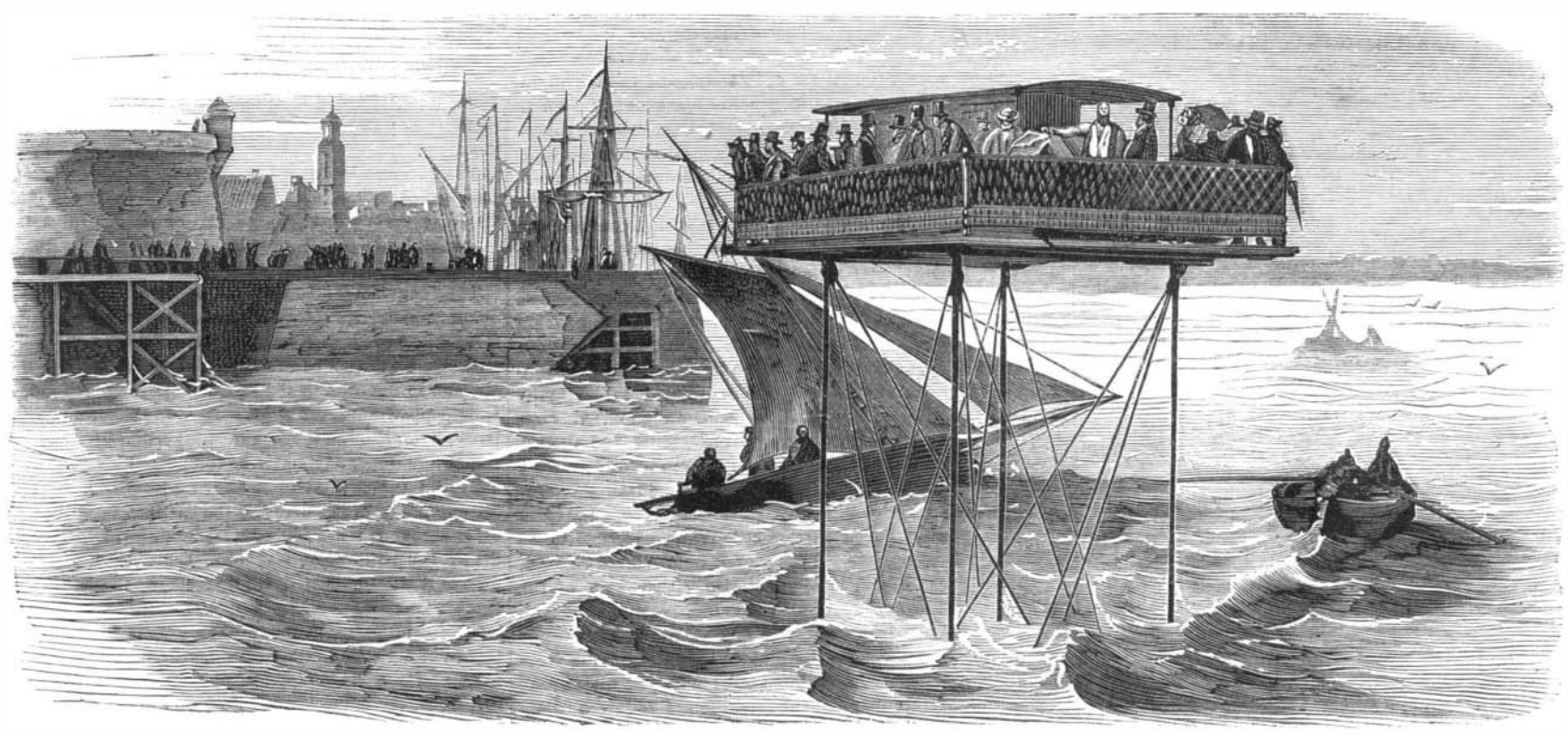
These works are most eligibly situated at the southern extremity of the Lake Möckeln, in the parish of Carlskoga, and province of Wermland. It is only of recent years that they have attained their present rank among Swedish industries. At the present time the works comprise, in addition to the residential premises, the following structures and plant: One blast furnace; one calcining furnace; seven Lancashire furnaces, which are constructed according to the patented system of Messrs. Lagerhjelm and Nanfelt, these having been found by experience to yield iron in greater quantities for the same period of time, and throughout more homogeneous in quality, than those of the usual form; two guide mills, worked by two large turbines, of 150 horse power each; one newly erected 18 inch rolling train for blooms and iron of large size, say up to 5 inch round, etc.; with all needful fitting and repairing shops. These are in operation, but they do not give the full measure of the future productive capacity of the works, for there are other important extensions which are now fast approaching completion. They comprise a complete set of cupolas, converters, and all the requisite plant for the manufacture of Bessemer steel; also another blast furnace and a calcining furnace; one 22 inch rolling train, for rolling boiler plates; one 22 inch rolling train for puddled bars; both these trains to be driven by a large turbine of 800 horse power; two shearing machines for plates and bars, to be worked by steam power; and a 4 tun steam hammer; with additional founderies and repairing shops, etc. Since the union of the two works, the upper and lower Degerfors, under one administration, both the waterfalls have been united, by the construction of a canal, giving a combined total fall of 25 feet, and producing a water power of 1,400 effective horse power, utilized in the operations of the works; this, however, is estimated to be only about one third of the total effective hydraulic power of the river Leth-elfven, which exceeds 5,000 horse power—a truly magnificent prime motor and basis for industrial operations.

The finished products of the works for the last year of operations, 1873, amounted to 5,000 tuns; but of this total quantity about 2,000 tuns were rolled for and on behalf of other ironworks, as yet unprovided with rolling mills of their own. Of the remaining 3 000 tuns the bulk was converted principally into nail rods and wire rods, a small quantity being rolled into bars of various sizes, some also being used up for axles, piston rods, etc. It is confidently anticipated that, owing to the increased facilities offered as regards the transport of ore and raw materials, the proportionate make of iron will largely increase during this and subsequent years.

There are 156 skilled hands constantly employed at the iron works; these men are mostly married, and live, rent free, in convenient and substantial cottaged wellings, provided for them by the proprietors. None of the women of the families are employed at the works, but several boys are provided with constant employment; these, however, are engaged in work for a limited period only, their attendance at school daily, for a specified time, being compulsory, until they have attained the age of sixteen years. In addition to the foregoing, about 200 daily laborers are regularly employed at Degerfors; and about the same number of hands are engaged in the pursuits of charcoal burning and the work connected therewith, and in agricultural occupations, on the proprietors' estate at Lassona.

All the male and female adults of the little community can read and write, without exception; all the children, except as above named, are kept at school until they are fifteen or sixteen years of age, when they are examined and confirmed by the vicar of the parish. Thereafter they are freed from compulsory school attendance. The school buildings are provided by the company, and maintained by them under the management of two teachers.

All the men employed at the works in any capacity are engaged by the year; but they are paid in various ways, according to the nature and conditions of the work, some of them, for example, such as the rollers and all assistants employed at the rolls, blast furnace men, and those employed at the charcoal burning furnaces, are paid at specified rates per tun, by agreement; others, such as shinglers, weighing machine men, and the like, are paid by the day, and earn from 50 cents to 75 cents and $1 per day of 10½ hours. The piece work men work in shifts or turns of eight hours, and may earn from 75 cents to $2 per day, according to circum-



ROLLING BRIDGE AT ST. MALO, FRANCE, AT HIGH TIDE.

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stances. The wages are paid fortnightly. In estimating their position, it must be borne in mind, as before stated, that, over and above their wages, all the hands employed at the works are provided with houses and fuel free, and have medical attendance, with medicines, also free; their children are freely educated at the schools of the works, and for themselves a sick club has been established and maintained at the works.

These facts, in reference to the Degerfors Iron Works and their administration, are sufficient by their simple enumeration to prove the value of the enlightened policy on which they have been established and are maintained: comment thereon would be superogatory.

Correspondence.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

I have read with some interest the several articles in the recent issues of your journal by Mr. Joshua Rose. Practical information, such as he seeks to impart, is of great value to the artizan, and especially to the young mechanic or apprentice. He has entered upon a field which, if well cultivated, must be productive of great good. In that part of article No. 4 which relates to the above subject, he, like almost all who have written upon it, overlooks some of the most important points in the problem.

The following, taken principally from a series of lectures delivered by me to the classes in engineering, while Instructor at the Naval Academy at Annapolis in 1868, will elucidate the points I refer to, and will, I think, add to the interest with which your readers must have perused Mr. Rose's articles:

"It is safe to say that a cutting tool cannot be too hard for any purpose whatever, so long as the edge will not crumble or break up; in other words, to make any cutting tool the most efficient, it should be made as hard as it can be made to perform its work without fracture. With many forms used for cutting metal, the solid angle required for the cutting edge is so great as to give sufficient strength, without resorting to what is known as drawing the temper. In a large majority of cases, however, the latter operation must be resorted to in some degree. The difference in the degree of hardness to be obtained simply by the different temperatures at which the tool has been originally dipped has been experimentally proved to be very slight, and results only in varying the strength or tenacity of the metal. That is to say: A tool dipped at a high temperature, as at nearly a white heat, will be more brittle and possess less strength than if dipped at a low red heat, but will not be truly harder to any sensible degree. A tool, then, dipped at a high temperature will require to be drawn more—that is, reheated to a higher temperature—than one dipped at a lower heat, in order that it shall withstand the required strains without fracture of the edge; and it will be, in consequence, really softer, when ready for use, than the low dipped tool."

In some experiments conducted by the writer, a short bar of good tool steel was so heated that in its length it had every gradation of temperature, from a white heat at one end to that which could be borne by the hand at the other, and in this condition it was immersed in its entire length. It was found that, by the most careful manipulation, small cutting tools, made by grinding from small pieces broken from the highly heated end, could not be made to scratch or mark, in the slightest degree, any piece taken nearer to the cold end, except beyond the very decided line, which will always be found in such a case, beyond which no sensible hardening had taken place. If, therefore, a tool be dipped at the lowest temperature at which it will harden at all, it will be harder when ready for use than if dipped at any higher temperature, if required to be drawn in temper at all.

It is, however, in the final operation of drawing the temper that Mr. Rose makes his greatest oversights. To give simply the certain color to which a certain tool must be drawn is to give the least of what is actually required to be known or observed. It is well known that the color produced upon the polished surfaces of steel or other metals, as their temperature is elevated, is due to the formation of a film of oxide, and the variations from the light yellow to the blue, as on steel or iron, is the effect of the increasing thickness of the film. For the formation of this film two things are necessary, oxygen and elevation of temperature; while to lower the temperature of or partially soften a tool, elevation to a certain temperature, and that alone, is required. The film of oxide is taken as a convenient high grade thermometer simply; and if the very necessary precaution is takes to observe and take into account all the conditions, it serves as a very good one indeed: but to take account of the color of the film alone is to throw out terms of the problem which will render the results of no value. The element of time and the greater or less facility for access of the oxygen of the air to the polished surface are as important to be observed and taken into account as the color produced. For instance, a tool in reheating may be raised to the temperature at which a yellow color begins to form; and if simply maintained at that temperature, it will in time assume the full blue color, and its assumption of that color without further elevation of temperature is a question of time only; while really the blue would, without taking into account the time of its formation, be taken to measure a much higher temperature. A piece of polished steel, once raised to the temperature at which oxidation is in visible progress, will continue to oxidize without further heating until the film has become thick enough to assume the blue color. Of course it takes a much longer time than when produced by the aid of continually increasing temperature. Again, the temper of tools is very often drawn over a coal or charcoal fire, in a muffle open at one or both ends, or, as Mr. Rose advises in the case of dies, by laying them upon a piece of heated iron, turning them over often to insure an equal distribution of the heat. But in either of these processes the perfect operation of our color thermometer is interfered with by the partial exclusion of the air, and consequently of the oxygen from the surface upon which the color is to appear. Over a fire of any kind the air is constantly and very much diluted with the products of combustion, and the same may be said of the muffle, while the piece lying upon the hot iron has the surface in contact with the iron in some measure excluded from the air. If the formation of the film is thus retarded, it will easily be understood that a tool so treated will be softer, when the required color is obtained, than was intended, unless this condition be taken into account. To temper an ordinary cold chisel, for instance: in the initial dipping, it may in one case be immersed a sufficient depth and length of time to require the lapse of but a few seconds for the heat to be conducted from the body of the chisel so as to bring the edge to the wished-for blue, while in another case it may have been cooled so that two or three minutes would be required. In the latter case the operative, tired of waiting for the color to appear at the edge of the chisel, will endeavor to hasten it by holding it over the clear coals; but he is surprised to find how strongly the color comes, and finally wonders, when he comes to use the chisel, how it could possibly have become so soft with such a perfect color arrived at. If he is patient and allows the color to form without the assistance of the fire, he then wonders how it can be so hard with the prescribed blue upon it, to a shade. And this is an everyday experience in shops: an unprofitable experience, wherein proper information disseminated through so widely circulated a medium as your valuable journal—read as it is now-a-days in almost every workshop in the country—will go far to save.

In drawing the temper of such a tool, the operative should be taught to be as careful as possible to dip it about far enough, and a sufficient length of time to require a moderate time only to bring the proper color: not too quick, as that would defeat his object by causing the gradation of softness from the cutting edge upward, which must necessarily be the result in this method, to be very sudden, and will leave an extremely small fraction of the chisel's length sufficiently hard for his purpose. If, however, he has misjudged in his dipping and he finds the color coming too slowly, let him be sure, in whatever means he takes to hasten it, not to interfere with the free circulation of the air around it. If the color comes slowly, but not sufficiently so as to require additional heat, he must still take into consideration the time it really occupies, and produce a deeper color if the time is unusually long; while, if very quickly brought, the color should not be allowed to arrive at so deep a point before the final cooling. An intelligent observation of all these points must be had in order that correct results may be arrived at.

JOHN T. HAWKINS.

62 Cannon street, New York city.

Raiding Ants.

To the Editor of the Scientific American:

I never, in reading the natural history of insects, came across a description of the ant which I designate as the "raiding ant" (I know no other or a better name); I do not know whether this little guerilla is known to naturalists; at any rate I have never met with an account of it anywhere. It is one of the most daring of all the ant tribe, but its honesty and humanity cannot be boasted of. It is about half an inch in length, of a dark brown color; in shape and in movement, it closely resembles the common large black ant, known in nearly all the Western States, and called the "black colony ant"; but the raiding ant differs from all others in his warlike disposition toward his neighbors. He is a merciless murderer and robber.

I have seen these ants in Northwestern Arkansas, but never in any other country. They are the most notorious marauders in all the insect world. They send out spies; and on a favorable report being received by the authorities, an expedition is set on foot, for the capture of a neighboring colony, and carrying off their store and their young as booty. On one occasion, I discovered a large force of these diminutive marauders on the march. There seemed to be many hnndreds, all moving rapidly in the same direction, every one keeping in his place with the greatest exactness, and all very close together, in fact so close that the ground could scarcely be seen in the middle of the column. The column was near twenty feet in length and about ten inches wide. In front of the main body moved three or four who seemed to be leaders of the troop, never falling back to the main column, except to give orders, as it were. On either side of the column moved about twelve or fifteen others, who kept continually about one foot away from and a little in advance of the main column. I supposed that they were removing from one locality to another for the purpose of taking up their abode in a new or more advantageous position. I followed them for about two hundred yards, when they all came to a halt, at the command of one of the leaders. The halt was only for a moment. Those who had moved on either side of the column did not stop as the others did, but moved rapidly around a stone, about six inches in diameter, when they turned their heads toward the place whence they had come, and stopped. This seemed to be a signal, for the main column instantly rushed toward the stone, on one side of which was plainly to be seen the opening of an ant colony. These maurauders surrounded the stone on all sides, and rushed into the hole as fast as they could gain admittance, till all were in, except about fifty, who seemed inclined to stand aloof from taking any part in this wholesale murder and robbery; but it was not long before they proved themselves full brothers, for soon a poor, frightened fugitive came rushing from his home, and ran a short distance and took refuge under a friendly leaf. He had been seen by two of these fellows outside, who watched him to his hiding place; and then with all the fierceness of savages, they rushed upon him and literally dragged him from under the leaf and killed him almost instantly. Several others came moving from the hole, having escaped death inside, to meet it surely outside.

Very few who came from the hole escaped being killed. Soon these raiders began to emerge from the hole, each one carrying something in his mouth, generally the larvæ belonging to the colony they had murdered and robbed. They instantly set out on the march for their own home, not halting until they had reached their own abode, distant about three hundred yards. They seemed kind to the members of their own tribe, carrying back their killed and wounded (four or five), but none of the dead or wounded of their enemies. After pursuing the raiders home, I returned to to the stone and turned it up, and found numbers of dead and wounded, and but few left to tell the dreadful story.

I have seen several of these raiding parties in Northwestern Arkansas, but never elsewhere.

Mount Vernon, Mo. J. S. D.

The Fireless Locomotive Accident.

To the Editor of the Scientific American:

I regret that a paper so ably conducted as the SCIENTIFIC AMERICAN should have given space to such a tissue of misstatements as those over the signature of Edwin Baker, 24 Atlantic avenue, Brooklyn, in your issue of July 4, page 5 entitled "Explosion of the Fireless Locomotive."

He asserts that, "on May 22, a large party of editors and reporters were invited to attend the trial trip," which is simply an untruth. He says that "none of the reporters present published an account in any paper." There were no reporters present, and it required a man like Mr. Baker, who could draw on his imagination *ad libitum*, to make such misstatements as he has done.

The facts were these: The small half inch glass tube attaches outside the stationary boiler to indicate the water line, cracked; and some steam escaped from the glass until the valves could be closed. This was the extent of the calamity so dreadfully described by Mr. Edwin Baker. Instead of the fireless locomotive having exploded, as alleged by him, she left within a few minutes, without a speck of injury, for Canarsie Bay, and returned after making seven miles of a satisfactory trip.

It is a fact that the fireless locomotive was not injured in the least, and that she performs her accustomed trips from East New York to Canarsie Bay. It is a pity that your valuable scientific paper should have become the medium of publishing all over the world the misstatements of Baker, thus aiding him in his well known spite against the fireless locomotive, which he has indulged in for the past eighteen months. Is it asking too much that you make the necessary correction by showing that the cracking of a glass water gage on a stationary boiler was a very different thing from the explosion of the fireless locomotive, as alleged by him?

East New York. JOHN M. GIBSON,
Superintendent Fireless Engine Company.

New Remedy for Hay Fever.

Dr. Horace Dobell, Senior Physician to the Royal Hospital for Diseases of the Chest, London, has suggested a contrivance and a prescription, by the combined use of which immense comfort may be given to many sufferers from hay fever and sneezing.

The prescription is as follows: Chloral hydrate and camphor (of each) 16 grains, carbolic acid 20 grains, pure morphia 12 grains, oleic acid (enough to dissolve the morphia) 20 grains, castor oil (the clearest and finest) 7 drachms. Rub well together to make a lotion.

The contrivance is for the efficient application of the above remedy, and consists of a miniature bottle, contained in a little boxwood case so that it can be carried easily in the pocket. To the lid of the box is attached the cork of the bottle, and to the cork, in the same fashion as the spoon of a cayenne pepper cruet, is fixed a little club shaped rod of polished ivory, long enough to reach to the bottom of the bottle, and also to the upper extremity of the nostril. The little bottle is kept half full of the lotion above prescribed, and the little rod immersed in it. Directly the patient feels the tickle or other signal of a coming sneeze, he uncorks his bottle, withdraws the ivory club, wet with the oleaginous lotion, and pushes it up the nostril till it reaches the seat of the sneeze signal; there it should be gently pressed so as to apply the lotion to the part. After this the club is withdrawn and returned to its little bottle of fluid, where it becomes at once charged for a fresh application. As often as the sneeze threatens, the operation should be repeated. Very often one application will keep off a threatened fit of sneezing altogether, even though its first effect may be to excite a sneeze.

PROFESSOR KING and two companions recently made a balloon voyage, from Buffalo to Salem, in the southern part of New Jersey. The route was roundabout, the balloonists passing over parts of the States of New York, Pennsylvania, Delaware, Maryland, and New Jersey. Starting at 6 P. M., July 4, the final landing was made the next morning at 7. Distance 400 miles. Time 11 hours.

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