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THE FONTAINE LOCOMOTIVE.

In the SCIENTIFIC AMERICAN of October 8 there was given a large engraving of No. 1 of the new type of locomotive engine designed by Mr. Eugene Fontaine, with a brief account of its peculiarities. In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found a corresponding illustration of the Fontaine locomotive, No. 3, recently completed, with critical estimates of the value of the improvements introduced by the inventor. There is given also a sufficiently full statement of the behavior of these engines to enable the reader to form an idea of the reasonableness of the high expectation which the friends of the new plan of locomotive construction entertain with regard to the advantages it involves. The SUPPLEMENT paper referred to, it is proper to say here, is by Mr. John Orton, Mechanical Superintendent of the Canada Southern Railway, under whose direction engine No. 1 has been running for several months. The high professional standing of Mr. Orton gives weight to the judgment which he expresses—a judgment based on a critical study of the theory of the inventor as well as the practical behavior of the engine.

From the evidence thus furnished it seems to be abundantly established that the Fontaine locomotive marks a long stride forward in the direction of speed and economy in railway service. If it is not, as its friends confidently believe, the most important improvement made for many years in the construction of locomotive engines, it is still one that cannot fail to give a notable impetus to the advancement of railway engineering and to the social and commercial changes incident to increased facilities for rapid transit.

The distinctive mechanical features of the new engine have been sufficiently dwelt upon in the articles already mentioned. It is enough in this place to say that, by a bold and ingenious change in the manner of applying the power through auxiliary drivers, a large increase of speed is obtained with a given size of driving wheel without increasing the number of piston strokes or the amount of fuel consumed. Or, the speed of the train being constant, the improved method of applying the power and the more complete development of the working force of the steam enable the engine to haul a much heavier load than is possible with the engines in common use. Theoretically the advantage gained is nearly eighty per cent in speed or traction above the best performance of engines of the same size, built in the prevailing style—a practical gain of 30 per cent is deemed well within the bounds of demonstration.

The dimensions of engine No. 2, designed for freight service but not yet built, are given in the SUPPLEMENT.

The new engine (No. 3) has not yet been tested for speed. No. 1 has developed a speed approaching seventy miles an hour over long distances. In May last it drew a light special train from Amherstburg to St. Thomas, on the Canada Southern Road, a distance of one hundred and eleven miles, in ninety-eight minutes. The run from Amherstburg to Buffalo, two hundred and thirty-five miles, was made in two hundred and thirty-five minutes, including stops for coal and water. The expectation is that No. 3 will make ninety miles an hour, in which case it will be placed on the road between Jersey City and Philadelphia.

The influence upon commercial and social life certain to flow from an improvement like this—which greatly cheapens the cost of power for hauling freight and passengers—it is impossible to estimate. Social and commercial activity increases not in simple but in compound ratio with each step in the mastery of time and space, and in every instance hitherto the results of such improvements have surpassed expectation.

For ages men have envied the ability of birds to cleave the air at a speed approaching a hundred miles an hour, and it has been thought that nothing short of a flying machine would ever enable men to achieve a transit so rapid. It seems incredible that the problem should be solved without leaving the ground, yet not so incredible, nor half as improbable, as a speed of fifty miles an hour seemed to engineers fifty years ago.

There are few existing railways, it is true, on which it would be possible or prudent to drive a train at anything like the speed expected of the Fontaine locomotives, owing to the instability of the road-beds and the sharpness of the curves. But the improvement of established roads is being rapidly carried out, wherever the service requires it, and we may be sure that any degree of excellence which the future may demand will be promptly supplied.

But aside from any consideration of increased speed, the new locomotive (if experience shall confirm the promise held out by the performance of the engines now on trial), will materially increase the economy of railway service. There are already something like a hundred thousand miles of railroad in this country, employing not far from twenty thousand engines. All our great locomotive works are burdened with orders, some having contracts which will require two or three years of constant work to fill. Obviously an improvement which will add thirty per cent. to the efficiency of the locomotive, the running expense being the same, has the capacity of adding millions to the value and vastly to the capacity of our railway systems.

No Award in the Cattle Car Competition.

At the meeting of the American Humane Association in Boston, October 19, President Brown announced that there was no award by the judges of the \$5,000 prize offered last year for an improved cattle car. Seven hundred designs and models had been submitted to the committee, but no one of

them so complied with the conditions as to win the prize. Evidently the owners of good cattle car patents hold them at a higher figure than \$5,000.

CASUALTIES IN BLASTING.

The introduction of the new blasting powders, especially those of which nitro glycerine is the basis, has given rise to many novel questions upon the responsibility for accidents. The workmen employed in engineering, quarrying, or mining operations, often disregard proper precautions simply because they do not know the nature and dangers of the explosives furnished for their use. This ignorance on the part of laborers, although natural and unavoidable, is the cause of many disasters. Gunpowder, formerly the only blasting agent used, has become quite well known to the common people. For more than a century the Fourth of July has been practically devoted to instructing the boys of the land that fire and gunpowder must absolutely be kept separate unless an explosion be desired. Thousands of casualties have re-enforced the lesson upon the minds of grown men in all the walks of life. What fact is better known than this, even among persons the least instructed? Quite otherwise as to the modern blasting powders. They have been so recently invented, are of so many kinds, and are in use under so many names, that no one should expect ordinary laborers to be fully acquainted with them all. Again, gunpowder can be fired only by an actual spark; if such a thing be possible as that it should be exploded by a blow, this could only occur under extraordinary circumstances, enabling the blow to heat the powder to the point of ignition. But, as all readers know, nitro-glycerine and its compounds, as well as some other agents somewhat used in blasting, may be exploded by concussion merely—the ordinary stroke of a hammer, the dropping of the can upon a floor or rock; and this concussion is believed to operate not at all by raising the temperature of the substance to the point where it will ignite, but, in some way not very well understood, by the change it introduces in the relation or position of the chemical constituents. The average laborer, though trained to recognize gunpowder and to guard it most carefully from every form of fire, does not equally know the blasting powders, either by sight or by their multitudinous names; nor does he realize that careless handling, an unlucky rub or stroke, may be to them what the spark is to the powder.

What once happened on a Boston railroad is a good illustration. Some one having work in hand involving blasting wrote to manufacturers of dualin for a quantity of that explosive, and to another manufacturer for a number of the exploders or detonators commonly used in firing it. It is a peculiarity of nitro-glycerine (also of gun cotton) that if a small quantity lying loose be touched with a match it will burn quietly; but if a blow be given to it an explosion will follow; and if the suddenness and violence of this blow be made as great as possible, which may conveniently be done by exploding some one of the fulminates in contact with the nitro-glycerine, the explosive power of the latter is raised to the maximum. Hence the use of exploders in connection with dualin. In the Boston accident the manufacturers of the dualin sent it, in cases plainly labeled, to the railroad depot to be carried to the customer. The manufacturer of the exploders sent those to the same depot; they also were labeled. Unfortunately both parcels reached the depot at the same time. Now this occurred ten or twelve years ago, when dualin was a novelty. The train hands saw the labels; but what did they know of the character of "dualin," the use of "exploders," or the peculiar danger of packing them together? And what did they do but put the two parcels side by side in the same freight car! The natural jolting of the car upon the journey fired the explosives and great mischief was done. Evidently such disasters are attributable not to carelessness in a strict sense, but to ignorance inseparable from the introduction of a novel and dangerous agent.

Recent books of court reports contain several cases illustrating the duties of those who furnish these powerful agents to untaught workmen. It is worth an employer's while to know that his obtaining leave from the public authorities to have a dangerous piece of blasting done does not diminish his responsibility for any disastrous consequences. There are rules of law limiting the right to keep explosives in store; and cities usually have somewhat stringent ordinances on the subject. When the Delaware, Lackawanna and Western Railroad Company constructed its tunnel through Bergen Hill it sought and obtained, in addition to the general authority given by the legislature in its charter, a specific license from Jersey City, in which the eastern end of the tunnel lay, to store the explosives needful in blasting. Under this twofold permission from the State and city their contractor built a magazine in which he deposited blasting powders. These exploded, damaging the adjoining houses. On behalf of the contractor it was shown that the magazine was built and the explosives kept in a most careful manner; no precaution was omitted. And he claimed that as he got leave to keep the explosives in stock, and kept them carefully, he was not liable for damages. The court said, in effect, that the keeping of nitro-glycerine or other explosive substances in large quantities in the vicinity of buildings is, generally speaking, unlawful; in New Jersey it is a misdemeanor. Getting permission to keep it simply relieves the person from this prohibition. It does not exempt him from damages if his dangerous goods explode. Whoever for his own profit stores these things in a city, must not only get leave, but also bear the entire risk.

Quite like this is a late New York decision relative to gunpowder kept in a fireworks factory.

The courts are holding that whoever, as employer, is conducting blasting operations owes to his workmen the legal duty of providing safe materials and apparatus, and of instructing the men adequately in the perils involved and the precautions proper. He must tell the men what they are using and how it should be used. This is common sense; it is likewise law. It is well illustrated by a California decision rendered last year in a suit against a quartz mining company. The company in its first blasting operations used gunpowder; but afterward the management adopted Excelsior powder in its place. Yet the workmen continued the practice of tamping the charge with an iron bar. One day there was a premature explosion, and the workman was badly hurt. He sued the company for damages, complaining that Excelsior powder was too dangerous to be used in mines; and that at least a wooden bar ought to be furnished for tamping, and special instructions given, neither of which things had been done. The court told the jury that the proprietors of such works have a right to introduce a more effective powder, though it be more dangerous, provided it is one which experiments and judicious tests have shown to be ordinarily suitable for blasting. But they are bound to furnish any apparatus needful for using the new powder safely; if the cause of the disaster was that a wooden bar was needful and was not supplied, the company was liable for the workman's hurts. And they are bound to give the men judicious explanations and instructions, according to the novelty of the agent; hence if the disaster was fairly attributable to the neglect of the foreman to tell the hands of the change in the powder and the danger of using an iron bar, the company was liable. Upon the other hand workmen who accept employment in blasting take the risk which is inseparable from the business. Even if the risk is increased by introducing a more dangerous powder, the workman, by continuing his service after he has been fairly informed of the change and the danger, agrees, as the law views the matter, to take the additional risks. He is even considered as agreeing to take the risk of any carelessness on the part of his fellow workmen. He is also debarred from claiming damages if he was negligent; thus if this complainant knew from any source that it was imprudent to tamp with an iron bar he ought to have declined to do so.

A similar decision was rendered in New Jersey, last November, in favor of a miner in the employ of the Oxford Iron Company. The president and general superintendent introduced giant powder as a substitute for gunpowder, without giving the men information of the change and the new precautions they would need to use; and an explosion occurred which blinded a workman for life. The court said that he ought to have damages. By hiring himself to the company for duty in blasting he took the risks necessary in that dangerous business, including risk that his fellow workmen might be careless. But he did not agree that a novel and highly dangerous explosive might be substituted without warning to him. The company was bound, when introducing the giant powder in its work, to make known to the men its properties and the right mode of using it. To furnish such an article for a laborer's use without giving him the information, is gross negligence on the part of an employer; and whether the employer or company knows the danger and omits to disclose it, or furnishes the article without knowledge of the danger, makes no difference. The president represented the company in introducing the new powder; and as he clearly neglected the duty of instructing the men, the company must pay damages.

OYSTER NOTES.

One hundred and fifty years ago there were four thousand oyster women in Paris, who pursued their business with much zeal and dexterity.

The "green" oyster, so much prized in France, will not sell in our markets. The "greening" of oysters is extensively carried on at Marennes, on the banks of the river Seudre; and this particular branch of oyster industry extends for leagues along the river, and is also sanctioned by free grants from the State. The peculiar color and taste are said to be imparted by the vegetable substances which grow in the beds where the oysters are cultivated.

A resident of London, England, claims that that city spends over \$25,000,000 a year for oysters, and that more than twice the number of these bivalves would be used if they could be obtained at as reasonable prices as in America. The genuine Whitstable oyster fetches about seventy-five or eighty cents a dozen. Oyster culture in England is yet in its infancy. Large numbers of oysters are now carried to England from this country. The most popular size for eating is in a shell about as large as a dollar. They are packed in barrels very closely and kept right side up during the voyage. Quite a trade is now springing up in carrying "seed" oysters to Europe.

Car loads of oysters are shipped to California from New York every few days. The "native" oyster of that western coast is obtained in the Gulf of California, and is small and of coppery taste. There is as wide a contrast between the California bivalve and the Eastern as between a crab-apple and a Rhode Island greening. Something of a supply is being obtained on the Oregon or Washington Territory coast. These are better than the more southern.

The seaboard of Georgia, South Carolina, and Texas abound in oysters. In some places they have grown up into reefs extending for twenty miles along the coast. Much of

this oyster wealth may yet become available for Northern markets. Various river mouths and estuaries along the Connecticut and New York shores would be most excellent oyster farms, if some means could be provided to keep the deposits of mud from covering and smothering the young oysters. The time may be near when enterprising men will seek to clear off these ruinous deposits as they now drain marshes and fill up swamps and pools. The recent law of Connecticut creating a State Commission to sell the deep water ground of the Sound, has served to inspire great activity in securing farms in the sea. Many thousands of dollars have already been realized for grounds appropriated.

The production of oysters has more than doubled in quantity in and about New York Harbor, Staten Island, and Perth Amboy during the past five years. It is believed if the mud could be kept out of New York Harbor it would make one of the finest oyster beds in the world.

The natural oyster beds on the east side of Staten Island are the places whence much of the "seed" for all the various famous kinds of oysters about New York is obtained.

It is believed by some that every evil has its antidote. Every pest, sooner or later, can be met by something that will subdue or check it. The potato bug ravaged a few years, and then Paris green came into use, so that they are no longer feared. He would be a benefactor indeed who should discover some cheap and efficient means of stopping the ravages of "stars" and "drills" on oyster beds. Every oyster cultivator says: "Tell us, if possible, how to fight these pests." Here is a field for a scientific scholar. So far it seems to be understood that stars find their homes and breeding places among rocks and reefs. They move out from these upon oyster beds. It has been discovered that dead "stars" are a good means of enriching land. They are capital things to put on the garden. They ruin oyster beds, but enrich vegetable beds. Professor Verrill, of Yale College, says the "star" takes the small oysters into his stomach whole, shell and all; but the larger ones he kills before eating. He does this by surrounding the oyster with the lobes and folds of his enormous saccular stomach. The gastric juice from it is infused into the shell and kills the oyster, so that the bivalve opens and is soon consumed by the rapacious "five finger." The only way yet discovered to destroy this enemy is to dredge them off the beds and throw them on the land.

Science has demonstrated that oysters can be so managed that their spawning seasons can be regulated, and thus good oysters be had and eaten every week in the year. This is arranged in the Connecticut waters by planting them in different depths of water. This secures variety in temperature. The greater the heat the earlier the oysters will spawn. Therefore by moving them into shoal water in a sheltered place where the sun will warm the water easily the spawning season will be over in early summer. Those in the deeper and colder water will, of course, feel the heat later, and therefore spawn later. Thus one portion of the oyster supply can be always ready for use.

STEAM BOILER NOTES.

The boiler of J. J. Cornish's saw mill, near Richmondville, ten miles northwest of Port Sanilac, Mich., exploded at 4 o'clock P.M., October 6, instantly killing Fred. H. Diehm, who was acting as engineer. The top piece of the south end blew out, striking Diehm, who was standing directly in front, knocking him about ten feet, breaking his neck, bruising his face, and scalding his body above the waist. The owner of this mill made a statement which runs thus: "About half an hour before the disaster I went to see to the boiler and engine, and found them working all right. I told Diehm he must put on the injector about ten minutes, but don't know whether he did or not. Just before the explosion he stopped to oil up and I did some oiling around the saw. Diehm said to me, 'Are you ready?' I said, 'Just about.' He said, 'Hurry up.' I said, 'All right; go ahead,' and looked up. I put my hand on the saw lever, ready for work, and saw him go to the globe valve to turn on the steam. The steam gauge was facing me, and, as I looked up, I glanced at the gauge and saw that it registered sixty-five pounds only. Before the engine had started I saw dust and steam and flying brick, and then heard a deafening report. I knew at once that the boiler had exploded, and ran to where Diehm stood; did not find him, and looked around, but did not see him nor hear him. I thought he was killed. Ten or fifteen feet away to the south, and directly in front of the boiler, the body lay on its face. I never saw him move. I was hit with pieces of brick, but not injured at all. The boiler was stationary, set with brick, and was bought second hand of Bruno Gunt last spring. When bought it tested 200 pounds, which it stood all right." The mill had been burned and rebuilt sometime previous to the explosion, and when ready to start the boiler "was tested again the same as at first and stood test all right except around the dome where a number of pin holes appeared. As only sixty or seventy pounds of steam was needed it was thought to be safe. The boiler sets north and south, fronting south. The explosion took the top half of the front out, lifted it clean off the arch and threw it about twenty rods up a hill. It struck on end and turned completely over."

The boiler in Thomas Grady's shoddy dye works at Clifton Heights, Delaware County, Pa., exploded, October 10, instantly killing the engineer, Robert McClure, and wounding several other persons. James Maguire had his collar bone broken, and was sent to the Pennsylvania Hospital.

The other wounded were taken to their homes. The mill was partially wrecked by the violence of the explosion, and, taking fire from the coals scattered from the furnace, was totally destroyed.

The Hamilton, Ont., *Times* has the following in relation to the thrashing machine boiler that exploded September 23, and killed Andrew Lloyd and wounded a young woman and two men besides Lloyd. "Mr. Robb, chief engineer of the Canadian Steam Users' Insurance Association, who was commissioned by the Ontario Government to examine the remains of the boiler which burst with fatal results at Thurlow, has completed his inspection, and has prepared his report. After making close examination, he reports that the boiler was evidently well kept, that it was clean, and that there are no signs that the water was allowed to run low. This is a strong point in favor of the engineer. 'The boiler burst,' he says, 'from inherent weakness, being made of poor material.' It was not provided with a first class safety valve, and the valve it has should in justice be called a danger valve."

The boiler at Major's flour mill, Colville, Ontario, exploded at an early hour on the morning of October 11, wrecking the engine house and saw mill, and seriously scalding William and Headley Major, sons of the proprietor, and William Bickell, miller. About 6 A.M., a fire was started under the boilers, one of which was a tubular and the other a flue, and it was left unguarded while the hands were at breakfast. After breakfast the three men named above went into the engine house, and were standing close to the flue boiler when the tubular one exploded. The cause is not definitely known. The steam gauge, just previous to the explosion, registered 56 pounds. No boiler of ordinary strength, that is, retaining a proper margin over the working pressure, has ever been known to explode at 56 pounds per square inch; but a great many have done so at pressures not greater than that, which showed defects of such extent as to excite surprise in the minds of observers that the boiler had sustained even so much as its common load. On the other hand steam gauges do not always tell the truth; they are not only often from 10 to 50 pounds slow, but they are often cut off entirely by obstruction of mud or sediment in the pipe that communicates with the boiler. Again, they sometimes stop at a regular point above which the pointer cannot go from obstructions in the quadrant gear. In short no reliance can be placed on a boiler that is not sound and has not a perfectly reliable and well kept safety valve.

American Success at the Electric Exhibition.

In advance of the official publication of the awards at the International Exhibition of Electricity, the Paris correspondent of the *Herald* cables, October 20, the names of the successful exhibitors from this country.

As a mark of the highest distinction, diplomas of honor have been awarded to the United States Signal Office, the Smithsonian Institution, the United States Patent Office, and Messrs. Edison and Graham Bell.

Gold medals are awarded to the Anglo-American and Brush Electric Light Companies, the United States Electric Lighting Company, Elisha Gray, and Tainter.

Silver medals to Bailey & Puskas, Connolly Brothers & MacTighe, Dolbear, Eccard, Electric Purifier Company, Hubbard Pond Indicator Company, Western Electric Manufacturing Company, Weston Electric Light Company, and the Electro-Dynamic Company.

Bronze medals to Messrs. Chavet, Cumming, and Dion, the Hoosac Tunnel Company, Trinitro-Glycerine Works, Partz, Photo-Relievo Company, White House, Mills and Williams.

If the relatively small number of American exhibitors be considered it will be seen that they have carried off a very large number of prizes. The awards have been made for the *ensemble* of each exhibitor's contribution, not for any single invention exhibited, except, of course, where there was only one.

Ozone at the Electrical Exhibition.

The editor of *Les Mondes* has had a call from Dr. Tommasi, the distinguished Florentine chemist, who came to propose an idea to him that is worth publishing.

The Palace of Industry is at present a place where there is in circulation, especially during the evening, an immense quantity of electricity. Now, under the special and entirely exceptional conditions presented by this vast closed space saturated with electricity, it may be that the atmosphere undergoes peculiar modifications; for example, there may be a production of a certain amount of ozone. It would be extremely interesting, then, to put up an apparatus for collecting the ozone from the air, and which should work continuously at the exhibition. Such an apparatus was proposed by Dr. Tommasi at London seven years ago. The moment seems to us opportune to perform these curious experiments. Dr. Tommasi is all ready to undertake them, but he needs for this the concurrence of some of our learned professors and the kind co-operation of the commissariat of the Electrical Exhibition. We trust that neither will be lacking. Should these experiments take place we will inform our readers of the results obtained.—*Chronique Industrielle*.

MAGIC MIRRORS.—The magic mirrors, which have been a good deal discussed of late, are all of metal. M. Laurent has succeeded in making them of glass, which is sufficiently elastic for the purpose.