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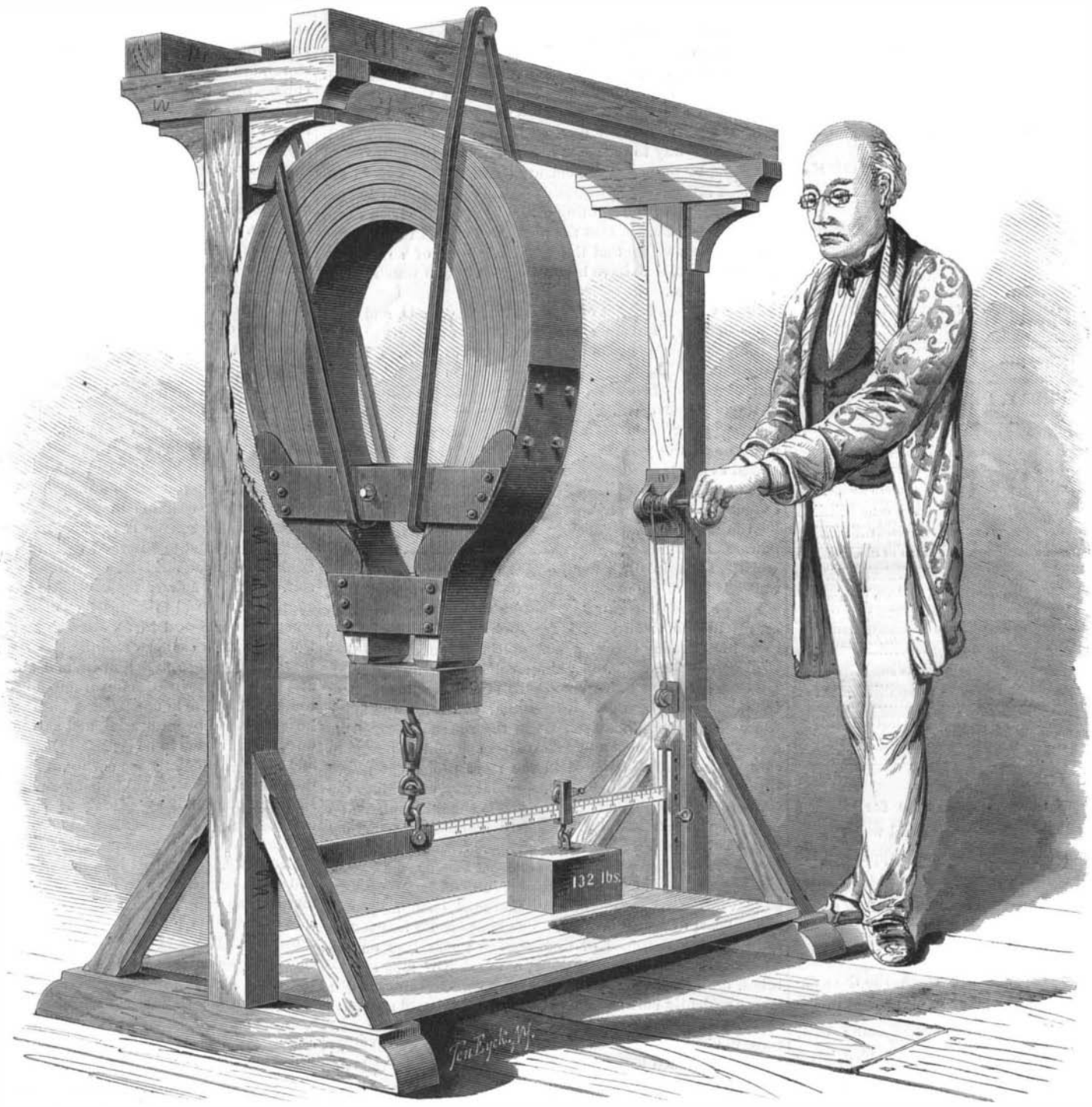
THE JAMIN MAGNET.

It is a well known fact that a compound magnet, formed of a number of plates or layers, each of which is separately magnetized, is possessed of a greater portative force, that is to say, will carry a heavier load than a simple homogeneous magnet of equal weight. Generally, however, it has been heretofore considered that this portative force is, as compared with the weight of the magnet, quite small, and Hacker has established a formula showing that the load carried is equal to a constant (depending upon the method of magnetization) multiplied by the cube root of the square of such weight. Thus, to illustrate, while a magnet weighing one pound will exercise a portative force of ten pounds, a second one, similarly magnetized, weighing eight pounds, will, according to the formula, only lift forty pounds.

Up to the present time the manufacture of magnets has been principally pursued at the city of Haarlem, in Holland, and to the Dutch workshops it has been customary for scientific men of all countries to repair, when powerful apparatus of this description became needed. In spite of the brilliant researches of Coulomb, of Biot, and others, but little has been definitely determined regarding the laws governing the construction of magnets, and notably in reference to their dimensions in order to attain a given power. The manufacture has been, in fact, more a matter of experience and individual skill than of established rule. For some time past, however, investigations have been in progress at the French Academy of Sciences, and M. Jamin has succeeded in not only providing magnets of most extraordinary powers, but also in deducing laws for their construction and for determination of their capabilities, thus adding data of the highest importance in elucidation of a department of physics regarding which, it may be safely stated, we know less than of any other branch.



THE JAMIN MAGNET.

Before entering upon a brief abstract of the principles governing M. Jamin's researches, there are two words which we shall employ, and which may need a previous explanation: first, by a "contact" we mean a piece of soft iron brought into juxtaposition with a magnet; and, second, by "dissimulation" is understood the temporary neutralization of the magnetism of one body by that of another when the same are together, so that, on their being drawn apart, the normal condition of each may be supposed to return.

I. When a steel plate is superposed upon a bundle of already magnetized iron (*faisceau*), the first effect is that two equivalent quantities of opposing magnetism separate in such a manner that the solenoids, which terminate at the surface of the bundle, appear to prolong themselves through the new layer, so that the magnetic power is referred to the new surface, and nothing is added to the primitive state of the magnet. But the latter produces two other actions: it repulses at its exterior the magnetism of the plate, and also determines in the plate a contrary magnetization increasing with its energy. The difference of these two actions represents the gain which the annexed layer brings to the bundle, and this at first considerably decreases with the addition of new layers, until the normal magnet results. The magnetization becomes, at a certain point, maximum, and a limit is reached, which, it may be here stated, is the inferior extreme of the portative force of the apparatus, and which, for the sake of future clearness, we shall call *f*.

II. Suppose that a contact be suitably fixed and supported, and a number of steel plates, magnetized to saturation, be separately applied in connection therewith. M. Jamin, at this point, finds that an indisputable analogy exists between the influence exercised by a magnet upon iron, and that of an electrified body upon an electrical condenser, as, for example, a Leyden jar.

The magnetisms normal to each body dissimulate each other, and the magnet and its contact constitute a true magnetic condenser. Now, in the case of the steel plates and a contact above noted, the magnetism of the first plate is dissimulated by the soft iron, so also of the second, third, and so on, until a point of equilibrium, so to speak, may be considered as reached, when, if more plates be added, a certain quantity of surplus magnetism becomes free. The plates react upon each other, lose polarity, and eventually a new limit is reached, which is the superior extreme of portative force. If, however, we remove the contact, the effect noted in the preceding paragraph takes place; the plates are subjected to their mutual influence, and the lower limit is regained. Replace the contact, remagnetize, and again the superior extreme is found. This we may term F, and it is clearly transitory and without utility, since it disappears on the first removal of the contact; and although the latter may be returned, unless re-magnetization of the plates be accomplished, the lower limit, *f*, remains constant.

III. Arranging two armatures in suitable position, M. Jamin connected his magnetized steel plates with them. If the former touched, he found that they dissimulated all the magnetism of a certain number of plates, but when separated, only a portion of this property became neutralized. In other words, the plates partially discharge each other, and lose a portion of the normal magnetism, but less than if the armatures did not exist, and still less than before they were separated. Now, by applying a contact to the armatures, a permanent portative force was determined, F_1, greater than *f*, and less than F. For example, by proper arrangement, F, or the superior limit noted in our second paragraph, was found to be 380 kilogrammes; on removing the contact, F_1 then appeared equal to 260 kilogrammes; on displacing the armatures, *f* was reached, equal to 170 kilogrammes; on returning the armatures, F_1 was again reached, equal to 260 kilogrammes; and the difference between 170 and 260, in this example, roughly indicates the gain in permanent portative force resulting from M. Jamin's discoveries.

Lack of space forbids our entering in greater detail into the elaborate theories of the investigator. As regards the material composing his steel plates, he adduces the remarkable fact that the degree of temper, re-temper, and of annealing necessary is not uniform, and varies greatly with different kinds of steel, a circumstance which explains the hitherto great uncertainty in the construction of magnetic apparatus.

We present herewith an excellent engraving of the great magnet which M. Jamin recently exhibited before the French Academy of Sciences. The apparatus is arranged in a simple machine for testing the portative force, which consists essentially of a graduated lever, on which is suspended a weight of 132 lbs. The latter is gradually drawn toward the end of the lever by a cord, attached to a small ratchet wheel shown, in the hands of the operator, until contact is broken, when a very simple calculation determines the force. The magnet is constructed of two armatures placed opposite to each other, and each weighing 35 lbs. They are rigidly connected by heavy crosspieces of copper, and support a cubical contact of soft iron weighing 28 lbs. From their lower ends the armatures spread out and grow thinner, ending in sharp edges. Secured by screws to the exterior surfaces of both is a thin strip of steel, which takes a natural curve from one armature to the other. All the other plates previously magnetized are placed within and left to assume

a natural position, clinging to each other, as to the armatures, by their own elasticity. On using from 40 to 45 layers, it was found that the force, F, remained constant, and attained a limit of 1,100 lbs., which could not be exceeded with the conditions of armature, contact, and steel used in the experiments. Stopping at 45 plates, the total weight of the apparatus was determined to be 101·2 lbs., and its portative force 1,012 lbs., or ten times the weight. With a greater number of plates, these proportions rapidly diminished, and the power of the magnet no longer bore so high a relative value in comparison with its weight.

As to whether it will eventually be possible to obtain magnetized bars of even higher powers than thus reached, it remains yet to discover. Their utility may perhaps be questioned, or at least their direct and immediate application to scientific purposes; but the answer to this, as to every other interrogatory of the *cui bono* nature, is simply that even the most abstract of theories may, in the light of new investigation, lead to other ideas of considerable practical importance. Suffice it that M. Jamin has taught us how to construct, theoretically and practically, a magnet capable of producing the highest effect of which it is susceptible, and that it rests for inventors to apply these newly found principles toward the improvement or the origination of devices for their scientific and industrial utilization.

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Contents.

(Illustrated articles are marked with an asterisk.)

PUBLISHERS' CARD.

With the next issue of this paper, the time for which a large number of our subscribers have prepaid will expire. In order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of the paper to print at the commencement of a new volume, we hope our friends will signify their intention to continue the paper by early remittances.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

The safest way to send money is by postal orders, bank checks, express, or draft on New York, payable to the order of Munn & Co. Little risk is incurred in sending bank bills by mail, but the above methods are safe beyond any contingency.

THE LOSS OF THE VILLE DU HAVRE.

Another casualty at sea, which, in its terrible details, fairly rivals the horrors of the wreck of the Atlantic, has recently occurred in the sinking of the French steamer Ville du Havre while on her voyage from New York to Havre and Brest, France. She left this port on the 15th of November last, and at 2 o'clock on the morning of the 22d while in mid ocean, was run into by the British ship Loch Earn. All accounts agree in the fact that the steamer was struck amidships on the port side, the effect of the blow being to crush in her iron frame for a depth of at least thirty feet, and to cause her to plunge bow first under the waves twelve minutes afterward. Out of three hundred and thirteen people on board, but eighty-seven were picked up by the colliding vessel, and of this latter number, fifty-four were a portion of the crew, including the captain and some of the officers. A large number of the rescued went down with the ship and were subsequently found by the boats of the Loch Earn, after as long as one and even two hours drifting in the icy water, clinging to planks and spars. Several were killed outright by the crash of the collision, and others subsequently by the almost immediate falling of two of the masts. The Loch Earn experienced serious injuries about the bow, sufficient to excite apprehension as to her safety; and accordingly, on her falling in with the American ship Trimountain, the survivors were transferred to the latter vessel and by her carried into Cardiff, Wales. The Loch Earn, although spoken shortly after the disaster, has not since been heard from, and there is some fear of her loss.

The Ville du Havre, formerly known as the Napoleon III., belonged to the Compagnie Générale Transatlantique and was one of the largest ocean steamers afloat. Her length was 423 feet, beam 49 feet, depth of hold 40 feet, and tunnage 5,500. She was magnificently fitted up, and commanded by experienced officers, drawn from the regular French naval service.

The list of the lost includes a number of well known citizens of New York and Boston, several members of the Evangelical Alliance, who were returning to their homes, and Judge R. W. Peckham, of the Court of Appeals of this State.

In the absence of the complete details of the disaster, to be elicited by a court of inquiry now in progress, for which the arrival of the mails will have to be awaited, it is difficult to assign the immediate cause. That there is gross negligence and carelessness to be imputed to both vessels, there is hardly room for doubt. It was the steamer's business to give way to the sailing ship, but that the latter could not have, by proper management, lessened the shock of the collision seems very improbable. There are conflicting accounts regarding the sighting of the lights of the Loch Earn, though it is conceded that the night was clear, in which case it is hardly possible that the rapid approach of so large a vessel could fail to have been perceived by the watch of the Ville du Havre.

In this case as in that of the Atlantic, the Metis, and previous wrecks, we are again compelled to revert to that incomprehensible economy on the part of owners which sanctions the lavishing of large sums upon elegant upholstery, gorgeous furniture, and luxurious table at the expense of the provision of the simplest and best known appliances for the preservation of life. As a preventive of just such disasters as the present, there is the electric light, which, placed at an elevated position on the bow of the ship, can be seen at a distance of 15 miles, and which illuminates the surrounding space like a room. The apparatus could be driven by the main engine or donkey at an expense of four horse power. In cloudy and foggy weather or at night, the steam whistle, the ship's bell, fog horns, and the firing of guns, precautions which are never omitted on board of men of war, afford a means of signifying the position of one vessel to others in the vicinity. As for life-preserving apparatus, there are so many excellent and well tried inventions that their mere enumeration would fill columns of our journal. Every mattress on board should be stuffed with cork, and the cabin settees and chairs, if similarly filled, would make admirable supports, sure to float in the roughest sea. Life preservers of the most approved pattern should be placed in every berth, and distributed in the most prominent places throughout the vessel, in numbers largely exceeding the aggregate of people carried. Life rafts should be placed on the upper deck, and conspicuously marked so that they might be resorted to, in sudden danger, without confusion or delay. Buoys also might be arranged outside the vessel, and provided with chemicals which ignite on becoming wet, so that brilliant light might be shed around, enabling people in the boats to pick up others. The buoys could be fixed so as to be easily detached, or to disengage themselves on the sinking of the vessel. Similarly, a number of long copper tubes, hermetically closed and provided with life lines might be conveniently stowed in the chains; these would also float clear. In fact there should be, if anything, a superfluity of these devices. Every boat should be practically unsinkable; and to avoid such losses as were occasioned on the Ville du Havre by crushing, a nest of boats should be stowed amidships, and a part of the space now given up to deck houses be devoted to that purpose. There are also numerous inventions of folding and canvas boats, which could be placed around the decks, occupying little space, and which would also do good service in time of need.

The great desideratum, however, is an unsinkable ship, and to this need we desire particularly again to call the attention of inventors. The compartment plan, though it has been the saving of many vessels, has failed to counteract the effect of severe injuries, which rack the entire frame of the ship. What we require is a hull built with a double skin and honeycombed with air spaces, so that, no matter how big a hole is made, the fabric will still float: either this or some similar device which will keep the deck above water, no matter if the entire hold or lower works fill.

There is a need of compulsory legislation on this subject, which will reach not only our own vessels but those belonging to foreign owners sailing to and from our ports. A clearance might be refused to any passenger ship unless she could show a satisfactory certificate from proper officials that her life-preserving apparatus was adequate and in perfect order; or there might be such exemplary penalties attached to the loss of a vessel, which, upon investigation, it could be proved was not in every particular sufficiently provided, as would force her owners to look to the lives of their passengers with at least as much care as they now give to the insurance of their ships.

A STEAM SNOW MELTER.

A new machine for cleaning the tracks of street railways of snow, the invention of John Mullaly of this city, was lately tried here on the Lexington avenue railway. It consists of a car, on which is mounted a steam boiler and a superheater. Under the floor of the car, arranged between the wheels, is a steam chamber, three feet wide, seven feet long, from the bottom whereof project a large number of little pipes or openings. The steam issues from the superheater into the chamber, and is there discharged directly upon the snow beneath, which is instantly melted. The steam tank is surrounded by an apron or curtain, which encloses the escaping steam. On the trial mentioned, the machine worked with success, so far as the melting of the snow was concerned. In regard to the actual expense of its use, we have no data. But considering the large amount of heat theoretically required to melt ice, and the great waste of fuel in the practical heating of steam boilers, it would seem as if this must necessarily be an expensive method of clearing the streets. It would probably be cheaper to shovel up the snow and remove it in carts. But this sort of removal, prompt, economical and effective as it is, the railway companies take especial pains to avoid. Perhaps they will prefer the more expensive method of melting down the snow.

In Park Row, in front of our office, some half dozen different street railways have their *termini*, and the operations of their workmen in clearing the snow from the tracks, after a storm, are something ludicrous to behold. The street is occupied, for a distance of about one thousand feet, by the convergence of the various tracks, of which there are four. It might, perhaps, occupy two hours of time, if all the companies would unite and cart away the snow. But instead of this, they go to great expense in annoying each other by tossing the snow from one track over upon another, by means of snow plows; and this sort of fun they keep up sometimes for days. One company sends down a great snow plow and brush, drawn by eight or twelve horses, which throws aside the snow upon the adjoining track, and makes a clean sweep. Fifteen minutes later comes along a similar machine, running upon that other track, throws the said snow back again. So it goes on, until the air becomes milder, or the snow solidifies and is no longer loose.

A NEW FUEL---CARBONITE.

A new fuel has recently made its appearance in our market, which, on account of its intrinsic value as well as its novelty, is deserving of notice. Although a natural production it can hardly be called a coal: and although possessing to some extent the properties of coke, it is not produced by any of the methods common to the manufacture of coke. The proprietors have given it the appropriate name of "carbonite." It is found to a limited extent in the bituminous coal fields of Central Virginia, constituting a distinct vein by itself, which is now fairly developed and yielding a steady supply. It is sold in lumps like cannel coal. The surface when broken is dull in appearance instead of glossy, as is the case with cannel or anthracite coal. It burns with a bright flame when first ignited, and almost without smoke, and subsequently settles down into a bed of bright coals not unlike anthracite in appearance, but lacking the intensity of heat produced by anthracite, and at the same time more enduring. It seems to be especially suitable for open grates, and more particularly for parlor use, on account of its freedom from smoke or bituminous smell, and also from the small proportion of ashes (only 2¼ per cent) resulting from combustion. The ashes are also of such density that, in the process of stirring or removing, they do not rise into the room.

The analysis recently made by Dr. Wallace, of Glasgow, and given below, shows a larger proportion of combustible matter than is found in any known fuel, being 96 per cent that is available for producing heat. It has but a slight trace of sulphur, and is therefore free from the pungent odor and gas incident to anthracite coal. It is superior to any other fuel in the power of producing steam, and may prove especially desirable for steamships making long voyages, on account of its economy of space.

ANALYSIS.

Volatile combustible matter	14·26
Fixed carbon	81·61
Sulphur	·33
Ash	2·24
Water at 212° Fah	1·56
	100·00

This unique product of the earth is accounted for as follows: Originally a vein of bituminous coal, but lying upon and covered with a fine clay, it appears to have been subjected to heat by an overflow of trap rock on the surface, thereby expelling the gaseous and volatile properties of the coal. A process of nature has thus accomplished on a grand scale a more perfect result than is attainable by artificial means, and has delivered for human use a deposit of natural coke, so condensed, by the process under which it was formed, as to acquire a specific gravity nearly the same as bituminous coal, and possessing a heating power fully equal to our best anthracite.

THE COAL TAR INTEREST.

The traffic in coal tar is a comparatively new industry, and its growth has been very rapid. This is attributable to the many wonderful transmutations which have rewarded the chemical tests to which the substance has been subjected. From being considered but the worthless refuse resulting from the manufacture of gas, and of no commercial value whatever, it has within a few years attained an importance of no common order and the promise it affords of almost illimitable future development is evidenced by the