SCIENTIFIC AMERICAN

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OPENING OF THE NEW TOWER BRIDGE, LONDON.—[See page 72.]

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 970.

For the Week Ending August 4, 1894.

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WAR BETWEEN JAPAN AND CHINA.

The commencement of hostilities between Japan and China, for some time previous seriously threatened, is said to have occurred on July 25, when a fleet of Chinese transports, loaded with troops, was attacked off the Corean coast by Japanese gunboats, and many Chinese soldiers were killed and drowned. The cause of the difficulty between the two countries lies in their respective claims upon Corea, a peninsula on the northeast coast of China, sometimes called the "hermit" kingdom, and from which foreigners have been generally excluded. Both countries have at different times set up pretensions to the territory, and asserted more or less certain rights of suzerainty. The Japanese are now apparently determined to maintain their claims by force of arms, and have been in advance of China in sending to Corea troops and war vessels, the Japanese also having made the King of Corea a prisoner in his palace, where he is held as a hostage.

In any war between Japan and China, especial interest will be felt because of the fact that both countries have many fine modern war vessels, armored and unarmored, carrying guns of high power, and are also well supplied with torpedo boats. The organization of the Japanese navy has largely been carried out upon English plans and with English ideas of discipline. It includes five armorclads, one very recently built, and thirty-two cruisers and unarmored vessels, with forty-two torpedo boats. The *personnel* of the Japanese navy is probably far superior to that of China, although the strength of the latter is very much greater, representing a complete navy of the modern type. In its North Coast squadron, which would be likely to be first brought into action, are five sea-going armorclads, two of 7,280 tons each, three deck-protected cruisers, three torpedo cruisers, a fleet of over thirty torpedo boats, and eleven gunboats. Many of these vessels represent some of the best features of English, German, and French modern war ships, and in their armor and armament are types of the advancement of European countries in preparation for war at sea. There is much room to question as to whether these vessels will be efficiently handled by their Chinese and Japanese crews, but the outcome of any engagement in which they participate will be looked for with the greatest interest.

It is only within some twenty years past that China has been able sufficiently to overcome prejudices as old as its history to undertake seriously the building of a modern navy. There was as long and violent an opposition in the Flowery Kingdom to the countenance of European ideas upon war ships as there was to the introduction of steam railroads, and during this period the Chinese navy consisted of a countless fleet of high-prowed, piratical looking wooden junks, with antiquated muzzle-loaders. But since the new programme has been entered upon in earnest, China has, in a comparatively brief time, supplied herself with a wonderfully complete equipment in all the details of a powerful modern navy. Their fleets are now officered almost exclusively by Chinamen, and so far as practice maneuvering is concerned, the reports of their operations have been highly favorable.

Party Walls.

An important decision in regard to party walls was given by the Massachusetts Supreme Court the other day. Many years ago a certain land owner, who may be called A, built two houses on Bedford Street, with a party wall between them, and subsequently sold the houses to different purchasers, without any stipulation as to the use of the party wall. B, who succeeded to the rights of one of the purchasers, strengthened the foundations of the party wall, and added to its height, for his own purposes, paying all the expense of doing so himself. Afterward, C, the owner of the adjoining estate, built his house higher, using, for that purpose, the party wall which had already been carried up. The representatives of B demanded of C payment for a part of the cost of the addition which had been made to the party wall, which C had now untilized. C refused to pay anything, and a suit was brought, which has just been decided in favor of the defendant, the court holding that there was no stipulation or agreement in any form, binding the defendant to pay for the use of the wall, and that no such agreement could be implied; and that the defendant was entitled to use without payment, in the way he did, so much of the wall as he found standing on his own land. It may be remarked that there is no general party wall statute in Massachusetts, and no legislation defining the rights of persons who find themselves in possession of a wall built partly on land of another; so that the court probably felt itself obliged to fall back on the common law rule, that every man is the absolute owner of whatever may be built on his land, no matter how it may have come there. Nevertheless, the building of a wall partly on each of two adjoining estates, or even two parts of one estate, indicates that each party receives value from the other, in the form of a saving of expense, and of available land, in return for which he gives the right to place half the wall on his land, and pays half the expense of building it; and it would not be a very violent assumption to consider that the rights and obligations so conceded and incurred attached to the land, so long as the wall built in common was used by both parties. A provision to this effect might with propriety be embodied in future legislation, and would have the advantage, not only of preventing the appropriation without payment of other people's labors, but of promoting the construction of party walls, which, particularly in a city of pile foundations, like Boston, represent, where properly arranged, stability of construction, and great saving of expense and of valuable room.—*American Architect.*

The Motion of the Heavenly Bodies.

It has been said of nature that it detests a vacuum, but it is equally true to say that it has a horror for rest. There is no word which is only so relatively true as the word rest, and none that is more absolutely true than the word motion. There is not an object on this earth, or, in fact, in the whole universe, of which it may be said with certainty that it is at rest. The only point of which we may imagine that it is at absolute rest is the center of gravity of the whole created universe, a point the exact position of which will in all probability never be ascertained. The real motion of the celestial bodies is a subject the investigation of which called into play the highest analytical and observational powers of man, and forms one of the greatest epochs in the history of the astronomical science. That in our solar system to the sun was assigned the central position is by no means a fact of remote antiquity, for even Copernicus, to whom is attributed the establishment of the new system, could not entirely shake himself free from the shackles of the ancient theory that the earth occupies the most prominent place in the solar system; nor did a full conception and conviction of the true state of that system take possession of man until Kepler and Newton, by their great laws, based upon the irrefutable principles of mathematics, once and for all exploded the old theory and placed the new one beyond the possibility of dispute and doubt.

With the establishment of the Copernican system, astronomy received a new and vigorous impulse. Magnifying instruments were improved, calculations put upon a more vigorous basis, the pure mathematical science itself being infused with new power by the Cartesian method of geometry and the grand discovery of the calculus by Leibnitz and Newton, observations were extended into the very infinitude of space, phenomena which before had either not been noticed, or, if noticed at all, had baffled all attempts at explanation, were explained in a manner which left no room for doubt. And so it was announced one day to the marveling world that the sun, the central body of the solar system, around which are whirled in never-ceasing harmonious motion the planets with their satellites, the comets, meteors, and aerolites, was not fixed, but, like his vassals, had a twofold motion on his axis and around some point so distant that its exact position has as yet not been ascertained. The axial motion of the sun was established by the sun spots, but as to its motion through space, we only know that its direction is toward the constellation Hercules.

There is something grand in the idea of satellites revolving about planets, planets around the sun, all of these at the same time rotating about their axes, and the sun itself sailing into endless space, but this is not all. There cannot be any doubt that all those glorious suns we see glittering in the firmament are also moving in their appointed paths. The proper motion of a number of them has been detected, and by the principles of induction and analogy we are not alone justified in, but almost forced to, the belief that motion is a common property of them all. There is a class of stars which, when viewed through powerful telescopes, reveal the remarkable fact of their consisting in reality of two or three, nay, even more stars. At present we know six thousand such systems. In Orion there is a star, known as Theta Orionis, which, when viewed through a powerful telescope, appears as a septuple star, thus presenting the magnificent panorama of seven suns revolving about each other. It is to be supposed that each of these suns is encircled by planets, and these again by moons, exhibiting to the imagination a spectacle sublime beyond description. Though the human eye will never behold the planets that are whirled around those glorious double and multiple orbs, the human mind cannot but be impressed with the divine harmony pervading the astral creation.—*Baltimore Sun.*

New Activity of the Yellowstone Geyser.

A telegram received says a shock resembling an earthquake was felt at Norris Geyser Basin, Yellowstone Park, at 3 A. M., July 21. The new crater geyser, which had been quiet for some time, broke out with terrific force, throwing rocks weighing twenty-five pounds to a height of 200 feet and steam rising 500 feet, accompanied by a roar equaling the combined exhaust of a thousand locomotives, which could be heard for ten miles. Every geyser in the Norris Basin played for hours. It now surpasses any geyser in the park.

Santa Catalina.

As the mainland of California advances in population and importance in the eyes of the world, the attractions of its environment naturally become better known and appreciated. This remark is especially true with reference to the picturesque islands which lie off the coast of southern California and add so much to the beauty of the ocean views westward from the mainland. Until within the last decade these islands were only viewed from this distance, except by fishermen and goat herders and scientific explorers. Their characteristic charms of scenery and climate were unknown to the public, except by hearsay. Recently, however, there has been an enterprising effort to make some of the islands more accessible and available for public enjoyment, and at present Santa Catalina island may be counted among the leading popular resorts of the State.

Santa Catalina island lies in the Pacific Ocean, about 25 miles southwest of San Pedro harbor, in Los Angeles county. It is approximately 25 miles in length, and perhaps 6 miles in width at its widest part, but throughout its greatest length it is but 1 to 3 miles from side to side. This gives the island a long shore line and plenty of room for the visitor who likes long walks or sails. There is much of interest, too, both in its land and water resources. The water teems with fish, and the land abounds with minerals of great interest and beauty.

Catalina is not only a resort of no little prominence, but is fast coming to the front by adding wealth to our southern country. Valuable quarries of soapstone and serpentine, ornamental and building stone have been opened and are causing great interest among the building community. The serpentine stone is very beautiful, having, on account of its different colored veins, the appearance of onyx. The soapstone quarries are situated in a very romantic part of the island, and it adds to their interest to find old excavations where the Indians quarried soapstone to make culinary utensils more than 150 years ago. Thus early did Catalina pay tribute to the mainland.

Both summer and winter the island is a charming resort. Its climate is much milder than the adjacent mainland. All winter long Catalina is lovely, with its mountains and valleys of green, its still, crystal-like waters, and its beautiful little city of Avalon, which has an appearance of its own, climate of its own and natural advantages of its own, unlike any place but Avalon. No frosts visit the valley in which Avalon is built, so bananas and other tropical fruit grow there on luxuriant trees, bearing no signs of cold weather.—*Min. and Sci. Press.*

History of Beet Sugar and the Sugar Beet.

One constantly finds in the general press discussions relating to the origin of the beet and the evolution through which it has passed. Many of these effusions are very erroneous. With the view of keeping our readers in the correct path, we have consulted many authorities, such as M. Briem and others, and find that in some details there is not an entire accord.

In 1747, A. S. Marggraf published his pamphlet giving in some detail the experiments he had made upon corn stalks, grape juice, maple, potatoes and white and red beets. From one-half pound white beets he extracted one-half ounce sugar. From that time serious experiments commenced in several European centers. The principal writers upon the subject were Rampf, Achard, Meyer, Goettling, etc.

Beets were planted everywhere in Europe. The most important of all these experiments were those of Vilmorin in 1775, in Russia during 1800 and subsequently. Experiments under Conrad Adam were carried on in Vienna in 1799. The most important of all, however, were those of F. C. Achard, in 1786. At his farm not less than twenty-two varieties of beets were experimented upon, and as a result of these observations his book on the manufacture of beet sugar was issued.

Considerable money was expended, and the practical results were not published until 1799. The ten pounds of beet sugar extracted were sent to Frederick William III., and a request made for governmental aid, so that experiments might continue. With 50,000 thalers from the King's private purse Achard was able to start the first beet sugar factory of the world at Cunern, in Silesia. The factory worked for the first time in 1802.

Efforts are said to have been made to bribe Achard to declare that he had made a mistake; that beet sugar did not promise for the future what he had supposed. The offer of a fortune was declined, and the world now knows what an important industry it has become. To follow the sugar beet through various stages of its history is almost an impossibility; but it was not until the 18th century that a standard name was attributed to this root; its use at that period was almost entirely for feeding purposes.

Olivier de Serres mentions the beet as early as 1590; other authorities declare that it was brought to Germany from Holland. In Austria it was certainly known during last century.

The white beet, with white neck and skin, was considered the best, and from it was the starting point of all existing varieties.

The name *Beta* has a Celtic origin, and is shown to have existed several centuries before Christ. It was then evidently a sort of mangold. Just whether it comes from a wild variety, existing in Southern Europe, and to which is given the name *Beta maritima*, no one can decide. A fact of importance is, as pointed out by Schindler, that the flower of the existing sugar beet has many points in common with its early ancestor, whose descendants are in existence today. The pollen grains are, however, smaller, and the wild beet has many more lateral roots than the ameliorated types. It is to Achard again to whom must be attributed the methods of early selection, and he demonstrated that it was possible to still further improve the beet, which prediction has proved true.—*Sugar Beet.*

Artificial Fruit Sugar.

Consul Frank H. Mason, of Frankfort, Germany, writes the State Department about a recent chemical discovery which will be of great practical interest in those portions of the United States where the preservation of fruits has become an established industry. The discovery is a process by which fruit sugar may be manufactured from beet juice as an improved product specially adapted to certain purposes. Dr. O. Follenius, director of the sugar beet factories at Hamburg and Hattersheim, near Frankfort, is the inventor. The invention has been patented in Germany and other European countries, but not in the United States. It consists in the inversion of beet sugar at a certain stage of its manufacture by chemical treatment into what is technically designated "laculose," which is chemically identical with the natural fruit sugar developed in greater or less degree in most kinds of fruit. Fruit sugar differs both in taste and chemical composition from cane sugar. Although of recent invention, it is largely used in Germany for perfecting wines, as well as in the manufacture of fine liquors, and is far superior to ordinary sugar for making lemonade or other preparations in which the saccharine principle is brought into contact with acid juices.

Mr. Mason writes that the sugar manufactured by this proces is a limpid, white sirup of great density, containing from 75 to 76 per cent of sugar, and possessing among other valuable qualities a rich, fruity flavor, as of natural fruit sugar, and the capacity to remain fluid and free from granulation for an indefinite period, notwithstanding its high degree of density. It is well known that ordinary white sirup containing 65 per cent or more of sugar crystallizes and forms granular deposits, and when used for preserving fruits often candies to such a degree that the preserves have to be recooked to restore the desired smoothness and fluidity. The artificial fruit sugar, on the contrary, remains smooth and fluid under all conditions.

But the quality which chiefly determines its commercial value is its power to assimilate, develop and preserve the natural aromatic flavor of the fruit to which it is applied as a preserving material. Confectioners, fruit packers and skilled housekeepers, who have tested it quite extensively during the past year in the preservation of cherries, strawberries, peaches and various other fruits, pronounce it far superior for such purposes to any other known form of sugar, and cite among its other advantages that it is always ready for use, and eliminates wholly from the factory all incidental processes of dissolving and refining the sirup.—*Bradstreet's.*

Stone Carving in Paris.

The London carver of stone rarely works from a model, more often from a sketch, and not infrequently without either; the Parisian always has a model. The Londoner, with his plumb-bob, rule and compasses, generally makes an approximate copy of his model when he has one; the Parisian, by means of a mechanical contrivance called a pointing machine, makes an exact copy. The Parisian system no doubt has its advantages, but from the English workman's and from an artistic point of view, the Londoner's method is far the best, throwing the workman on his own resources and developing whatever individuality and artistic feeling he may possess. It has also the not unimportant merit of being the quicker method. The material used in Paris is a cream-colored soft stone, somewhat resembling Bath stone, but apparently freer in working. In London, as is well known, every variety of stone is used, from the soft Corsham to the hardest of Portland among the limestones, and from the softest of red grits to the hard yellow gritstones of the North of England. This has developed a more useful pattern of tools than those in use in Paris. The hard stone and marble tools are similar in both countries, but the French soft stone tools would be thought useless in England. The block of stone is chopped with axes as near to the size required as can be safely done, and the carving is produced with wooden-handled tools and iron hammers, the English pattern of wooden mallet and mallet-headed tools being unknown. It is then scraped over with tools known in England as scrapers, and finally finished with a variety of rasps called "rifflers," or "riffloeur rapes." These rifflers are, though seldom required, unobtainable in England of native make comparable with the French, being generally so badly shaped as to be almost useless, and this applies not only to the riffler rasps as made for soft stone, but to the riffler files as made for marble, a foreign variety known as Roman rasps being far superior.—*The Architect, London.*

The Comino Tree of Colombia.

L. S. Maria, United States consul at Medellin, Colombia, reports as follows:

This tree, called "Comino," produces an excellent wood for the use of cabinet makers, and possesses some exceptional properties, not only for high class furniture, but for building purposes. The common kind of comino is very much appreciated for house building, its merit being that it is a perfect proof against all wood-destroying insects, so prevalent in this part of Colombia. It is a well-known fact that all kinds of timber used for building purposes in this country are assailed and destroyed within a short space of time by insects called "Comejen," a winged insect; and a house built of common timber is fought shy of by all purchasers of property, whereas property built of comino timber will stand strong and unchanged for ages, and is unaffected by either insects, water, soil, or climate.

There is another kind of comino wood, having the same properties as above described, but commanding a very high price and used mostly for veneering purposes. It is of a beautiful dark and light undulating color of a yellowish tortoise shell appearance, as will be seen by the small box I send with the seed. High class furniture veneered with this kind of comino, called here "Comino crespo," presents a magnificent appearance, always bringing a high price, if well worked and properly finished.

This tree is especially grown in the department of Antioquia. It can be successfully cultivated at a temperature of between 18° and 20° C. I have no doubt it can be cultivated and acclimatized in the United States, and will be an important acquisition to the American wood workers.

How the Mind is Affected by the Weather.

The psychology of the weather is suggested by Dr. T. D. Crothers as a promising subject for study. He says, in *Science:* "Very few persons recognize the sources of error that come directly from atmospheric conditions on experimenters and observers and others. In my own case I have been amazed at the faulty deductions and misconceptions which were made in damp, foggy weather, or on days in which the air was charged with electricity and thunder storms were impending. What seemed clear to me at these times appeared later to be filled with error. An actuary in a large insurance company is obliged to stop work at such times, finding that he makes so many mistakes which he is only conscious of later that his work is useless. In a large factory from ten to twenty per cent less work is brought out on damp days and days of threatening storm. The superintendent, in receiving orders to be delivered at a certain time, takes this factor into calculation. There is a theory among many persons in the fire insurance business that in states of depressing atmosphere greater carelessness exists and more fires follow. Engineers of railway locomotives have some curious theories of trouble, accidents and increased dangers in such periods, attributing them to the machinery."

Dr. Crothers adds that the conviction prevails among many active brain workers in his circle that some very powerful forces coming from what is popularly called the weather control the work and the success of each one.

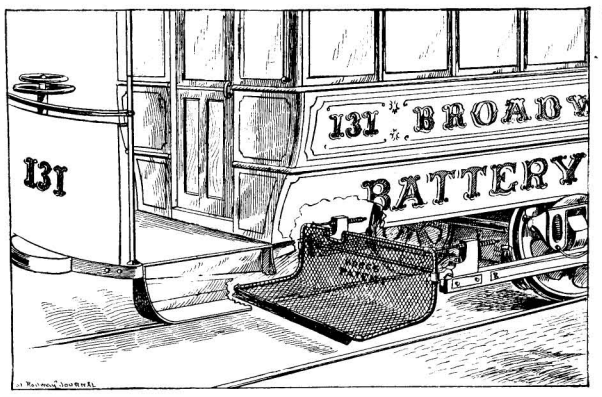
New Research Laboratory.

The Royal Institution, London, is the recipient of a munificent gift from Mr. Ludwig Mond, who has purchased a large freehold house adjoining the present premises of the Institution, and has made arrangements for its conversion into a completely equipped physico-chemical research laboratory, which is to be presented to the Royal Institution. Mr. Mond has also provided funds for the maintenance of this building and for paying the salaries and incidental expenses of the scientific staff, under whose control it will be placed. The laboratory will be free to all persons, without distinction of sex or nationality, who may desire to work there, and at the same time are, in the opinion of the committee of management, qualified to undertake original scientific work. Mr. Mond has suggested that the laboratory be known as the Davy-Faraday Research Laboratory, after the two great Englishmen who made the name of the Institution famous throughout the world. We suggest that the words "The Mond" be prefixed to the above title, so it will read "The Mond-Davy-Faraday Research Laboratory."

THE FIFTH AVENUE THEATER, NEW YORK.

This beautiful structure, of which Mr. Francis H. Kimball is the architect, represents one of the most carefully elaborated plans of a substantially built, conveniently arranged, and artistically decorated building, devoted to amusement, of any of which New York City can boast. Considering the location of the theater and the circumstances under which it was built, the shape of the lot, and the surrounding structures, it would be difficult to suggest improvement. The columns of the portico and the iron structure of the first story back are the same as they were in the former building, which was destroyed by fire, but the cornice and balustrade are parts of the new work. Above the first story all the ornamental features and cornices are wrought in white terra cotta. This exterior, so elaborate, on account of the employment of this medium of terra cotta, while maintaining in a good degree the delicate and graceful characteristics of the period of the Italian Renaissance, expresses in its constructive details the continuity of an idea in harmony with the purpose of the building. It embodies in itself suggestions of the uses of the interior, the grand divisions or principal parts of a theater, namely, the auditorium and the stage, being illustrated most effectively in the architectural composition. The richness and elaboration that such a treatment is susceptible of in clay are very apparent in this illustration, and the architect has availed himself of his opportunities with judgment and a fertility of invention. He has been worthily sustained in this by the skillful and successful mechanical execution of his decorative scheme. These beautiful forms in terra cotta take the shape of theatrical emblems, and abound in the ornamental part of the 28th Street facade. The panels of the large pilasters between the windows of the balcony foyer are rich in these emblems—the grand portico, the large window of the balcony and gallery foyer, and the exit doors from the grand foyer, on the parquet floor, forming the composition of the exterior of the auditorium.

On either side of the central feature of the balcony foyer are windows, with ornamental terra cotta panels between, the one denoting Comedy, the other Tragedy. Again, the mullions of the windows of the gallery foyer are in the form of caryatides supporting the main cornice, and in the panels of the larger piers are bass-reliefs representing dancing and singing figures, all these being of terra cotta. Although the leading architectural lines of the 28th Street side of the theater are carried throughout the entire front there, the stage portion is less elaborate than that of the auditorium just described, calling for but little decoration comparatively in terra cotta; but sufficient of that material is used in the more important division last mentioned to prove not only the adaptability of clay for fine effects in architectural composition, but to exemplify, also, the progress of the manufacture of terra cotta work in this country, where it was never used until 1853, when Mr. James S. Renwick, the well-known architect of the Fifth Avenue Cathedral, made an attempt to introduce it as a building material and as a substitute for cut stone work here in New York City.



HOGG'S CAR FENDER.

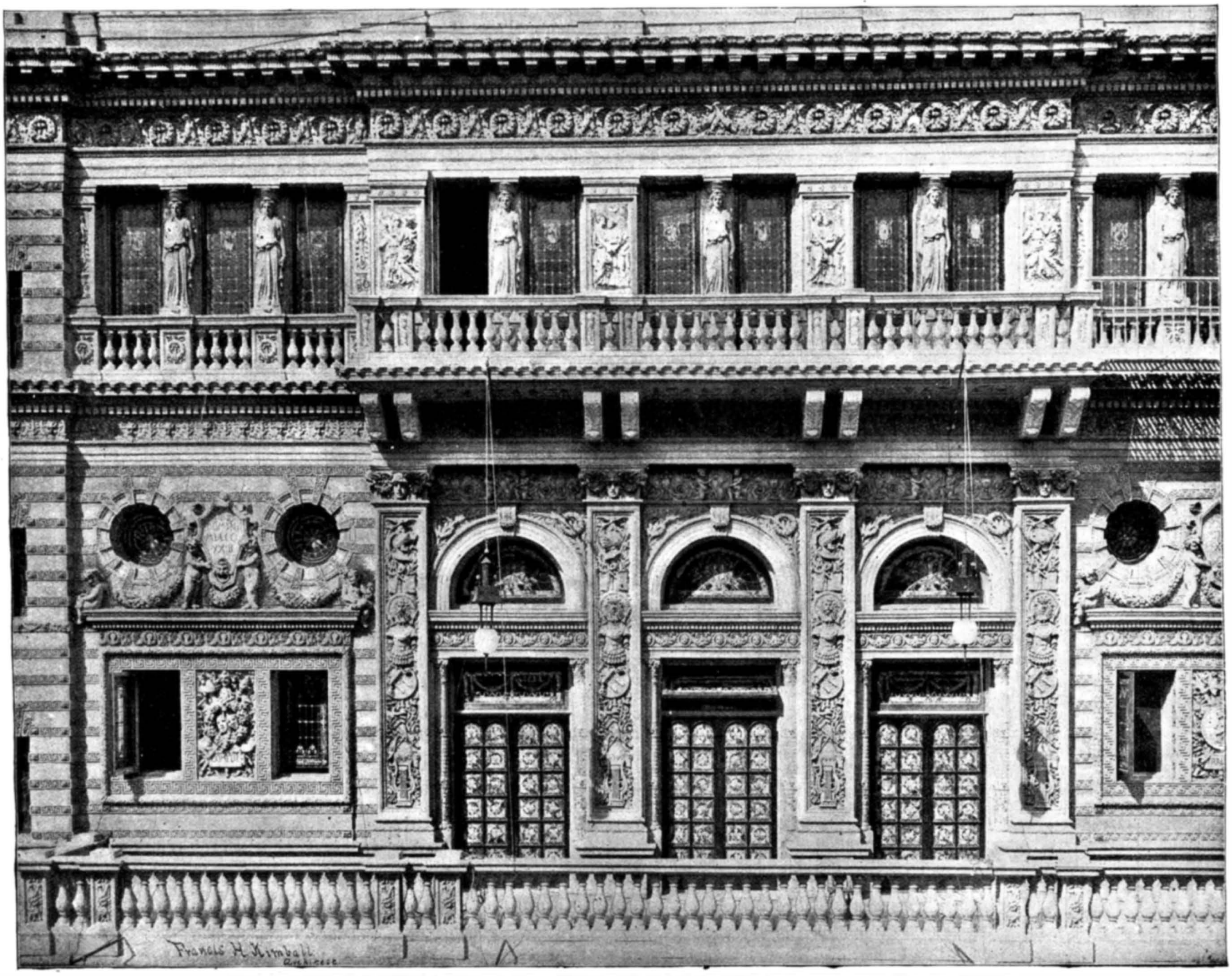
We are indebted to the Architects and Builders Edition of the SCIENTIFIC AMERICAN for the use of the cut and article.

AN IMPROVED CAR FENDER.

This fender is of light, strong, and simple construction, and is designed to be attached to the running gear of a car under one of the end platforms, as shown in the illustration. It has been practically tried for some months on the Broadway cable road, New York City. The improvement has been patented by Mr. Franklyn S. Hogg, of No. 152 East Forty-ninth Street, New York. The fender is of skeleton construction, its frame carrying a bed preferably of woven wire, and it is attached to the car by means of brackets, one on each side of the car truck, to which the brackets are secured by bolts. On the vertical portion of the fender frame, at each side, are rearwardly extending lugs, pivotally connected with ears of the brackets by a cross shaft, whose ends are threaded and have lock nuts, affording more or less frictional engagement with the ears. To hold the fender in normal position, a screw rod is pivotally connected with an upward extension of the frame at each side, and these rods pass through standards of the brackets, a lock nut on each rod engaging the forward face of the standard, while at its rear a spring is coiled around each rod, to bear against the rear of each standard and against lock and jam nuts near the ends of the rods. According to the tension of the springs and the setting of the nuts the horizontal member of the fender may be held at a given distance from the ground, and the distance it will drop under a load may thereby be regulated.

The Invention of the Screw Propeller.

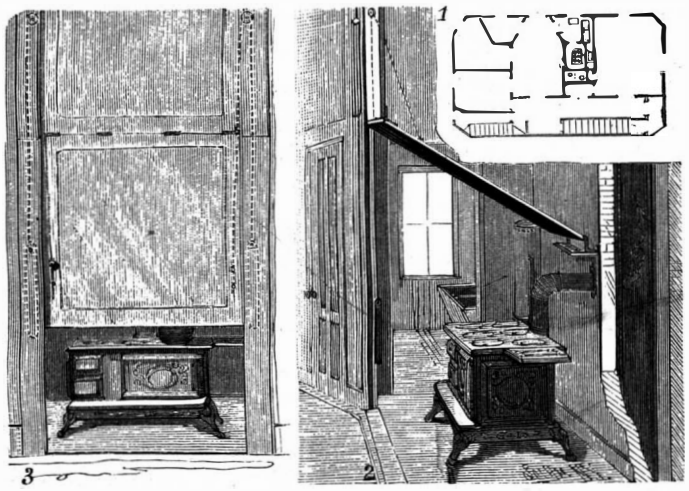
The introduction of the screw propeller into use was accomplished simultaneously by Smith in England and Ericsson in the United States. Both were men of great ability. Each considered himself the inventor of the screw propeller. Each took out patents in England in 1836 and in the United States two or three years afterward. Each patent differed radically from the other. Neither patent, for the general application of the screw propeller, was sustained either here or abroad, and neither Smith nor Ericsson patented additional improvements on the screw propeller. Each built small screw vessels in England that were successfully tried in 1837, Smith's being of six tons burden, with a wooden screw, driven by a six horse power engine, and Ericsson's, named the Francis B. Ogden, having about double the tonnage and power. Each built larger screw vessels that were successfully tried in England in 1839. Smith's vessel, the Archimedes, being upward of 200 tons burden, and driven by engines designed by Rennie, of 90 horse power, circumnavigated the island of Great Britain in May, 1840. Ericsson's vessel, the Robert F. Stockton, smaller and with less power, was tried in England under steam, and then, in April, 1839, crossed the Atlantic under sail. Each introduced the screw propeller on merchant vessels in 1840. Each introduced the screw propeller on war vessels in 1843, Ericsson on the Princeton and Smith on the Rattler.—*F. B. Stevens, in Cassier's Magazine.*



THE FIFTH AVENUE THEATER, NEW YORK—FRANCIS H. KIMBALL, ARCHITECT.

IMPROVED TENEMENT CONSTRUCTION.

The illustration represents improvements in house construction designed to economize both material and room, and especially affording a novel arrangement of combined dining room and kitchen, for which a patent has been issued to Mr. Samuel Sanderson, of No. 308 Crescent Street, Waltham, Mass. As shown in the small plan view, Fig. 1, a private hall extends nearly the full depth of the house, to which leads a small public hall at the back, the stairways at one side. At the front is a sitting room or parlor connected by a passageway with a combined dining room and kitchen, back of which are two bedrooms, while at one side is a pantry. At one side of the combined dining room and kitchen is a sink room, in which is a double wash tub, with removable partition, to facilitate its use as a bath tub, and adjacent thereto is an alcove room, accommodating a stove or range. The latter

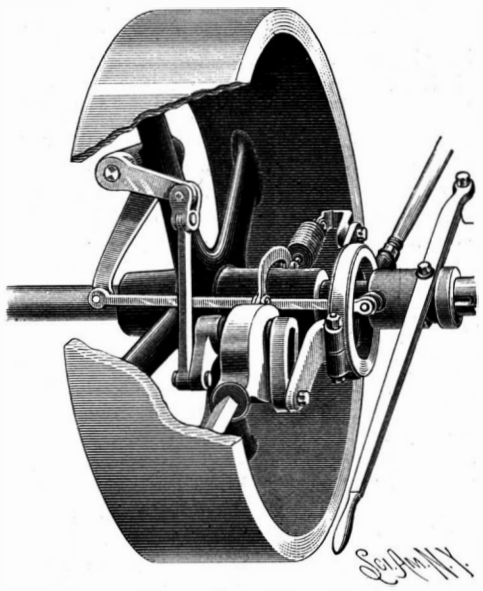


AMERICAN LABORER'S HOME—THE WALTHAM TENEMENT.

room is cut off from the dining room by a partition consisting of a fixed top portion, below which is a movable section or screen formed of two hinged parts, as shown in different positions in Figs. 2 and 3, but normally hanging in alignment. These screens move in vertical guideways, portions of which are cut away to allow the bottom member to swing in, as shown in Fig. 2, when the screen is raised, the swinging section then being engaged by a stop on the mantel. The movable screen or partition is suspended from weighted cords, the weights moving in vertical pockets at each side of the partition. One chimney serves for the front and middle rooms, and adjacent to the chimney is the hot water boiler. At the side of the passageway opposite the stove alcove is a small room for use as a wash room and water closet.

A STEAM ENGINE GOVERNOR AND REVERSING GEAR.

According to this improvement, both the governor and the reversing lever fully control a single-pivoted eccentric, carried around at its pivot by the driving shaft, and connected in the usual manner with the engine valve. The invention has been patented by Mr. Harry H. Kelley, of Elyria, Ohio. On the shaft is a wheel having on its inner surface a radial guideway, on which slides a weight connected at its inner end by a slotted link with a spring attached to the opposite inner surface of the wheel rim. In the weight is a



KELLEY'S ENGINE GOVERNOR AND REVERSING GEAR.

transverse shaft, on the front end of which is a link with a curved slot engaged by a friction roller on an arm forming part of the inner face of an eccentric, in the form of a ring, through which loosely passes the main driving shaft. The eccentric is rigidly held on an arm pivoted to a bracket extending from the opposite inner face of the wheel, and the eccentric is connected by the usual straps and rod with the valve of the engine. As the weight slides outwardly with the increased speed of the engine, the link is shifted and the eccentric is moved relatively to the shaft to cause the valve to cut off sooner. Provision is also made to shift the link independently of the movement of the slidable weight by means of the reversing lever shown at the right in the illustration. The rear end of the transverse shaft journaled in the weight carries a crank arm pivotally connected by a link with one arm of a bell-crank lever fulcrumed on one of the spokes of the wheel, and the other arm of this lever is connected by a link with a sleeve sliding on and turning with the shaft, this sleeve being engaged by the reversing lever, whereby the movement of the eccentric may be reversed, and consequently that of the valve controlling the supply of steam to the cylinder. The governor and the reversing lever fully control the eccentric, and at the same time the governor and the lever can independently shift the eccentric to control the valve, the reversing of the engine being effected by moving the eccentric across the shaft.

BERSIER'S STEERING COMPASS.

The traditional order, "Don't Talk to the Pilot," that some of our readers have seen posted up on steamers, is upon the point of becoming useless, thanks to a very recent invention of one of our most distinguished naval officers, Lieutenant Bersier. This invention is called the steering compass.

This instrument, in fact, permits of dispensing with the man at the wheel. It is the compass that, in this system, directly actuates the rudder, so as to keep the ship in the proper direction.

Did the use of this new apparatus present no other advantage than the doing away with the pilot, the result, although original and curious, would be relatively of slight importance. But the special merit of this method of steering is the great precision that results from it, thanks to the substitution of the most absolute automatism for the action of the brain of man, which sometimes becomes weary or distracted.

The problem of the automatic steering of ships has often been proposed, since it is an attractive one; but the difficulty in the way of its solution has been the necessity of giving the very delicate and sensitive rose of the new compasses its full liberty, while at the same time utilizing the elementary rotations of the sides of its box with respect to the rose, that is to say, the lurches of the ship, in order to correct such lurches by means of the rudder. In order to govern this part, then, it was impossible to think of utilizing the steering power of the rose; in a word, the latter could not be touched. It is this that explains the want of success of all the tentatives made up to the present to devise warning compasses, that is to say, compasses to signal the deviations of a ship to a distance. In such instruments, a magnetized needle was flanked by two stops forming electric contacts against which it struck, in becoming disturbed, however, in most cases.

As our readers well know, a mariner's compass consists of a glass-covered cylindrical box suspended in gimbals in what is called a binnacle. At the center of the bottom of the box rises a rod that carries an iridium pivot. A light paper disk slit upon an aluminum circle carries eight parallel magnetized needles. Such is the card or rose, which weighs 375 grains, at the most, in the large models. Its circumference is graduated in degrees from 0 to 90 in each quadrant, starting from the north and west points, on the one hand, up to the east and west points on the other. At its center there is a sapphire which rests upon the point of the pivot. The position of the needles below the disk, to which they are attached by silk threads, assures the horizontality of the rose. The feeble magnetic momentum that so light a rose may have prevents, as may be seen, any stress being exerted upon it under the penalty of disturbing it completely.

Lieutenant Bersier, as long ago as the year 1888, thought of employing the electric spark of the Ruhmkorff coil to unite a point of the circumference of the rose and two semicircular plates insulated electrically from each other and the sides of the box that they covered. Some studies successively carried on upon a torpedo boat and a large cruiser were arrested at this epoch by the absence of electric wiring upon many ships. The operation of the coil, in fact, can be practically assured only by a small derivation from a dynamo to the exclusion of electric batteries. Things are now much changed. Upon all modern ships, a few amperes are as easily taken from a general circuit conductor as water is from a cock. So the steering compass will be henceforth easy to install. It operates as follows: In a room located at a few yards distance from the best compass on board is placed a Ruhmkorff coil supplied by a mean current of from 2 to 3 amperes. The induced current of this coil, through a flexible wire, reaches the pivot of the compass, whence it jumps to the aluminum capsule that carries the sapphire, and follows an aluminum wire, forming a radius of the north pole of the rose (Fig. 1).

According as the ship is to the right or left of its course, the current leaps in a spark of about an inch from the north point to the right hand or left hand plate of the box and flows, at a few yards therefrom, into one or the other of two electro-magnets, which close

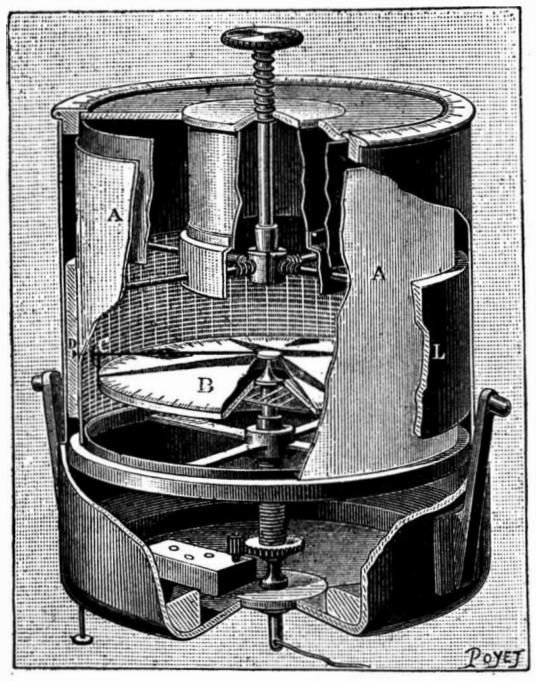


Fig. 1.—GENERAL VIEW OF THE STEERING COMPASS.

AA, band of paper upon which the variations in the route of the ship are inscribed; B, rose; C, bridge of fibrine placed at the north point of the rose; D, circle of metal divided into segments corresponding to the signals; L, cylindrical ebonite guide of the band of paper.

the circuit of a small 150 watts motor, in order to cause it to revolve to the left or to the right. The shaft of this motor is keyed upon that of the rudder motor. One merely replaces here the muscular strength of the pilot without in anywise changing the already existing parts of the ship. This installation is therefore simple and inexpensive (Fig. 3). The box of this compass has been under trial for two months in a squadron and the experiments have proved a perfect success.

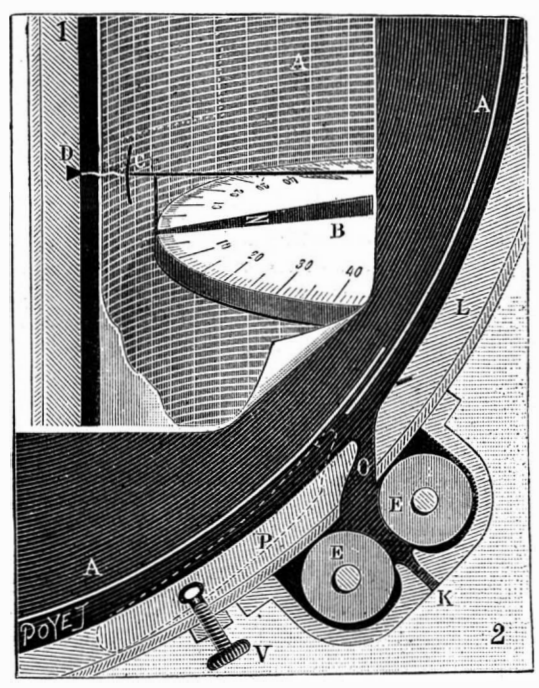


Fig. 2.—EXPLANATORY DETAILS.

A, band of paper; B, rose; C, fibrine bridge; D, circle of metallic pieces set into ebonite and each corresponding to a signal; L, paper guide; O, slit for the introduction of the paper; EE, rubber rollers for the introduction of the band of paper; V, regulating screw.

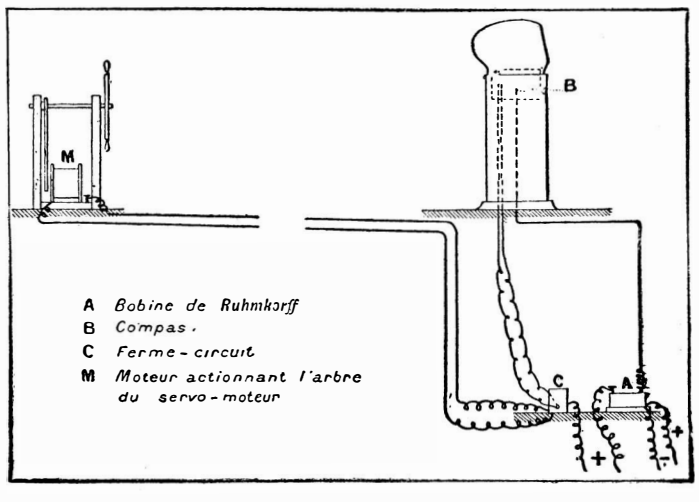


Fig. 3.—DIAGRAM EXPLANATORY OF THE INSTALLATION OF THE REGISTERING COMPASS ON SHIPBOARD.

The absolute indifference of the rose to the electric spark was particularly exhibited, and it was found possible, as the report of the trials proves, to steer within a fraction of a degree or thereabout. Such indifference of the rose evidently results, in the first place, from the fact that the induced current employed has an intimate intensity—it is alternating. Moreover, certain precautions are taken as regards the leaping of the spark. The coil and the electros are at a distance from the compass. Experience shows that it is sufficient for them to be at a distance of five yards therefrom in order to obtain the best result. Thus the induced circuit of high tension, and consequently of relatively difficult insulation, is not ten yards in length. The number of the coil is so selected as to prevent all accidental losses.

Lieutenant Bersier has patented this new instrument under the name of registering governor. When the apparatus acts as a register, the box is higher and its sides are covered with a band of paper which receives from a clockwork mechanism an ascensional movement of 3 inches in four hours, a length of time that constitutes the duration of one point (Fig. 2). The electric spark pierces this paper in its travel from the north point of the rose to the plates. The result is that every lurch of the vessel, however short be the duration of it, is registered. Thus responsibility can be clearly established in the case of a running foul of another vessel.

Finally, the box of the steering compass, provided with six plates, for example, instead of two, each being connected with a distinct Geissler tube placed in front of the man at the wheel, serves, under the name of automatic transmitter of course orders, to steer by hand from any point whatever of the ship with a compass placed no matter where. It is this instrument that has been tried in a squadron, and two new specimens of which are now in course of construction for our navy by Mr. Postel-Vanay. The solution of this problem was very necessary, since, upon our new ships, the binnacle compass, always placed too near masses of iron, possesses no sensitiveness, but "sleeps," according to the technical expression. A method of steering with the standard compass placed under the best conditions possible became necessary, and it became necessary, too, to find a means of sending its indications to a distance. Experience has proved that six or eight of these indications are more than adequate to permit of effecting all the changes of route and of steering with a precision hitherto unknown. Only a mariner can appreciate this point, which is important because of the great simplification that proceeds from it. As long ago as 1888, Lieutenant Bersier steered with four signals only, which, through the rapidity with which they succeeded each other, gave an accurate idea of the velocity of rotation of the ship. The manner of effecting the changes of route with this instrument is, in truth, interesting. A simple revolution of the cover of the compass by hand, carrying along the plates with it, is immediately followed by an identical rotation of the ship.

The edge of this cover, moreover, is graduated like the rose itself, and, in order to hold any route whatever, North 25-East, for example, it suffices to place in the axis of the vessel, opposite an appropriate index, the division 25, comprised between the North and East of the cover. The pilot then takes the new route without even being aware of the fact, in thinking that he is correcting a lurch. The straight route or zero indication can be transmitted to him only when there is an absolute superposition of the graduation of the cover and of that of the rose. The spark then leaps both to the first plate to the right and the first to the left. The slightest lurch has the effect of making it leap to only one of them.

The entire precision of the apparatus that we have just described rests upon the sensitiveness of this zero signal.

Upon the whole, the following are the advantages that large steamers, for example, must derive from the use of these new apparatus, which, moreover, can make but one, since the box and the coil are always single: great precision, and consequently, security and economy in navigation. At present, steering is done within about one or two degrees, that is to say, with a lateral deviation of twelve miles for a day of 480. With the apparatus under consideration, the lateral deviation would be annulled, as the steering is done within a fraction of a degree. Finally, the steering would be done with the best compass on board, and this in many cases, in which the common compass is defective, would present a great advantage. All this is of value, especially in foggy localities, where astronomical observations cannot be taken. To such advantages must be added that which gives a better estimate of the route obtained by the registering.—*La Nature.*

What the Strikers Have Learned.

We are in the habit of saying that, in a government such as ours, the people must be educated, and of supposing that the necessary education is to be had in schools. But experience keeps the only school that most people learn practical wisdom in, and it is by forming trade unions and trying what they can accomplish that workmen learn the nature of law, the powers of government, and the fundamental principles of political economy. They have now learned that such a strike as that of the American Railway Union must necessarily fail. They have learned that when the police and the militia fail to preserve order, the United States forces can be called in. They have found that while the great body of the people have kind hearts and are glad of the prosperity of laboring men, they do not sympathize in any attempts to promote this prosperity by interrupting all industry and destroying property. The cost of this education has been considerable, but it seems probable that the lesson would have had to be learned, sooner or later, and upon the whole the present time was the best that could have been selected. The rights of action possessed by associations of workmen having received this practical definition, are not likely to be immediately exceeded again; and we may well remember, therefore, that laws tending to limit the freedom of workmen to form such unions as they choose, and to utter their complaints and aspirations, are questionable.—*D. McG. Means, in the Forum.*

Effects of Imperfectly Balanced Locomotives.

For the past ten years, and possibly longer, there have been practical evidences, upon certain railroad lines upon which speeds of 70 miles an hour and over are attained, that imperfectly balanced engines are great track destroyers, and that in extreme cases they make a permanent bend in the rails. These bends are peculiar, and differ entirely from any bend or deflection that could possibly occur by any other force exerted by a locomotive. They are *downward* and *inward*. The bent rail in the track shows a downward bend of a half-inch or slightly more, and an inward bend from one-eighth to one-half inch. When these rails are removed from the track, the permanent bend, both horizontally and vertically, is from six to eighteen inches, measured on an ordinate of the chord between the ends of the rail. These bends have been found at regular intervals equal to the circumference of the driving wheels that made them, and for distances varying from one-quarter of a mile to a mile or more.

In a number of instances, the upward throw of the counterbalances was so great as to throw the drivers alternately clear of the rails, and in descending the wheels did not resume their proper position on the rails, but instead the flanges descended on the tops of the heads of the rails, sometimes as far from the gauge lines as the centers of the heads. An examination of the driver tires showed that the flanges of the rear drivers alone had been riding the tops of the rails, and the marks on the flanges were all directly under the counterbalances.

On one road the number of bent rails removed from the track was very great, and they had to be sent to the rail mill by the car load to be straightened by machinery, as the ordinary rail benders used by the section men could not do the work. The introduction of much heavier rails and more care in counterbalancing for high speeds reduced the number of bent rails, but the bent rails now in the same line of road show that heavy rails, within reasonable limits, will not prevent their being bent in service, neither can it be assumed that the rigidity of the track will prevent the development of the forces that do the damage.

The bends referred to are distinguished, as before stated, by being downward and inward. The inside spikes, for a distance of about four ties, are moved inward, while the rail has left the corresponding spikes on the opposite side of the rail. The downward bends are best observed by glancing over the surface of the rail. The bends are peculiarly short, both vertically and horizontally.

While these remarks apply particularly to one road as far as they apply to specific details, they apply generally to all roads where extraordinary speeds are attained, and it is believed that a person who can recognize a rail that has been bent by an improperly balanced locomotive can find them in any track where speeds of over 70 miles per hour are reached. The danger of running improperly balanced engines at high speeds is obvious, no matter how perfect the track and bridges. Again, the wear and tear upon a locomotive is extraordinary in broken frames, broken springs, spring hangers, driving wheel centers, etc.

The locomotives known to produce the effects as stated are generally described as express passenger engines four wheel connected, 36 and 44 tons, four wheel truck, 68 inch drivers and running speeds reaching 80 miles an hour at times. It is not intended to intimate that no damage to track is done unless rails are permanently bent. On the contrary, the same forces which, when developed to their maximum, bend rails, are developed to a certain extent at all high speeds, and when those speeds are not high enough to make the forces great enough to actually make permanent bends in the rails, they are sufficient to knock the track out of line and surface, and thereby greatly increase the cost of maintenance of way.

Locomotive engineers have been known to report bad places in the track, when actually the jumping of their engines was the only cause for the apparent bad riding of the track. With the increased demand for high speeds, locomotives will have to be designed that are perfectly balanced. The limit of safe speed with unbalanced engines has been reached and passed. As a matter of economy in track and motive power repairs alone, the perfectly balanced locomotive is a necessity upon high speed lines.—*Headlight, in The Railroad Gazette.*

The Great Siberian Railway.

The Siberian Railway, one of the greatest enterprises of the century, must attract attention by reason of the important commercial, political and strategic objects it is designed to serve. In length it will exceed by more than one-fifth the length of our transcontinental lines from New York to San Francisco. Besides connecting Vladivostok, its eastern terminus on the Pacific, with Moscow, distant 9,500 miles, it will reach ports on the Black Sea, the Caspian and the Baltic. At present the English for the most part carry on the commerce of China, Japan and India with Europe, but the new railway will, it is hoped, largely alter the route of this commerce and make the Russians its beneficiaries. In twelve or thirteen days it will carry goods from the Baltic to Vladivostok, as against the six or eight weeks now required. The tea and silks of China would go west via the Siberian Railway rather than by way of the Suez Canal or around the Cape. The railway will, moreover, vitalize the resources of vast regions now torpid for want of communications. The empire is wanting in arteries of commerce. It has but 29,000 miles of railroad. Its navigable streams are numerous, but by reason of extremes of heat and cold they are navigable, as a rule, only in the spring and autumn. The Black Sea may be blocked by Turkey or England. The rivers of Siberia emptying into the Arctic Ocean are practically of no value for transportation except in their upper courses and for part of the year. The isolation of vast areas of Siberia practically destroys their great value for purposes of agriculture and mining. With better means of communication population would in Russia flow east, just as in the United States the construction of our transcontinental lines caused it to flow west. The natural resources are there; accessibility will bring them speedy development. Already the annual product of gold and silver in Siberia is very large, though its production is made expensive from want of modern means of transportation, but with the building of the Siberian Railway the product will probably be much increased. The wealth of the region to be traversed in iron, coal, salt and precious stones is well known.—*Baltimore Sun.*

A Trolley Without Poles.

Chemnitz, Saxony, has banished horses from her street cars and substituted the trolley. In a report to the State Department on the subject Consul J. C. Monoghan says one of the principal novelties of the adopted system is that no poles are used. The method of stringing wires is by means of ornamental rosettes fastened into the woodwork or walls of houses, having projecting hooks to which the wires are attached. These hooks are firmly fastened and are tested with seven times the weight they will be called upon to bear. Owners of houses without exception preferred to allow the use of their houses free rather than have posts on the sidewalk. The streets through which the cars wind their way are wider than Washington Street, Boston, or Westminster Street, Providence. The system has now been in operation for six or eight months, and has proved satisfactory and successful. The railway tracks, in conformity to the law, are level with the pavement, and accidents to vehicles of all kinds are rare. The gauge is narrower than in America, but the cars keep the track and run as rapidly and smoothly as in the United States. In the heart of the city they run 220 yards per minute and in the suburbs 330 yards per minute.

The increase of traffic since the introduction of electricity has been 60 per cent notwithstanding the strenuous opposition to the change and the year of exceedingly hard times. The cars have no conductors. The motorman is the only person on board who represents the company. By doing away with conductors the company saves 44,000 marks annually. The fare is only 10 pfennigs, or trifle less than 2½ cents, on all routes, including transfers. Should 150,000 persons evade payment in twelve months, the loss would be only 15,000 marks. It would take 450,000 evasions in fare to offset the company's savings by dispensing with conductors' salaries. Among a people who pay for food and drink in restaurants, saloons and gardens on their honor alone, it is unlikely that the company loses much. Culprits in this regard when detected are punished by having their names advertised in the newspapers as a warning to others. Fare boxes are attached to both ends of the car; so there is no such excuse offered as "difficulty in getting forward."

AN EFFICIENT CALCULATING MACHINE.

The mechanism of this machine consists of a series of adjustable toothed racks arranged in relation to a series of toothed recording wheels so as to perform the operation of addition direct, and to compound it for the performance of multiplication and division. The number to be added is set up by moving the pins in the figured slots, and then added to whatever number may be upon the opposite recording wheels when the crank is turned.

The machine is about ten inches square. All the working parts are of metal, all are positive in their operation, strong, and not liable to get out of order, making the machine able to stand up to the hard and constant use it receives.

The calculating machine bears the same relation to computation that the type writer does to correspondence. Its utility is now generally admitted.

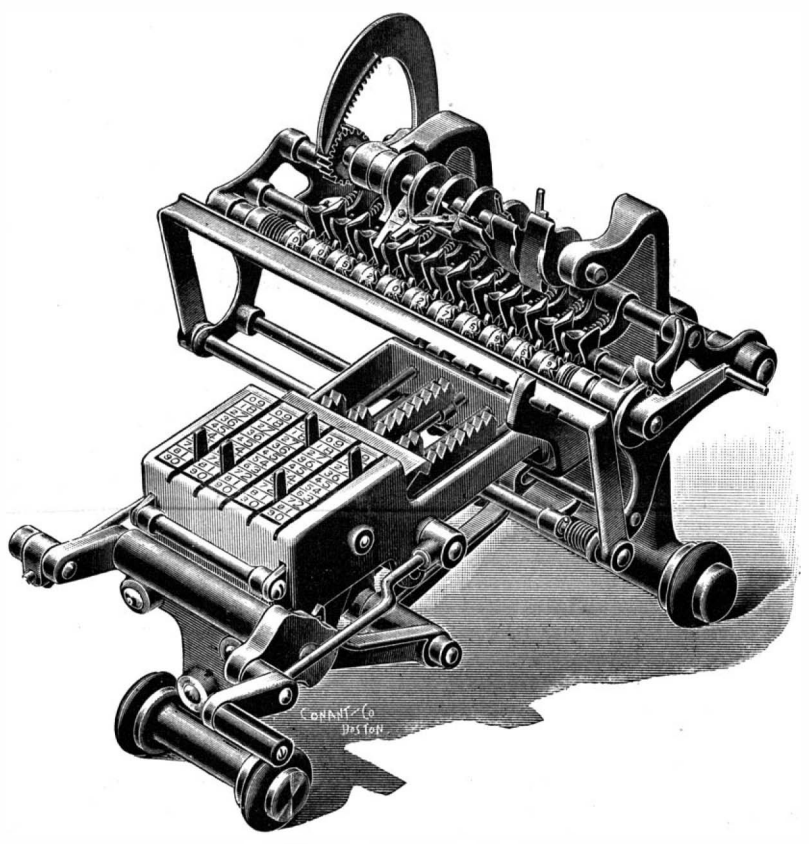
It is not claimed that the calculating machine will save time upon straight addition in column. But it is claimed that it will save time in many cases, such as, for example, adding a lot of numbers on separate slips, adding across columns, interrupted work, etc.

For multiplication and division, however, the machine has no mental competitors. The United States Lake Survey made a competitive test and reported that the machines were two and a half times faster, and that the errors, all due to the computer, were only half as numerous. The officer reporting said: "I think it safe to say that it is as much superior to logarithmic computation as the latter is superior to common multiplication and division." The method of logarithms ranks as one of the great labor-saving devices of man.

The comparison between mental and mechanical computation should not be confined to rapidity alone, for the saving of error is of the greatest importance, and the saving of brain labor comes next to accuracy as an object. The mental processes of computation, although they appear to be very simple, are, in fact, very complicated, and the chances of error are so numerous that the brain is under continual strain. The amount of labor involved in a simple computation would be astonishing if it could be measured and expressed in figures, and the machine, in avoiding all the processes of memory, transfers the greater part of it from the brain to the hand and leaves the former in better condition for work that cannot be avoided. The late President Barnard of Columbia College said: "A calculating machine offers relief from an intolerable amount of drudgery."

This machine is an improvement on the original Grant machine, which was first proposed in 1871, and which has since received the Centennial medal, the Scott medal of the Franklin Institute, and the Gold medal of the Massachusetts Mechanics' Association.

The Grant Calculating Machine Company, of 145 Fletcher Street, Lexington, Mass., are manufacturers of this machine.



GRANT'S CALCULATING MACHINE.

The Bulrush Caterpillar.

We are indebted to Mr. H. L. McFadjen, of Rotura, New Zealand, for several interesting specimens of the above object. An engraving of the aweto will be found in the SCIENTIFIC AMERICAN of September 27, 1890. Our correspondent also sends the following:

The following is a description of the bulrush caterpillar (*Sphoeria Robertsia*)—native name aweto.

This singular plant, which is a native of New Zealand, may be classed among the most remarkable productions of the vegetable kingdom. There are birds which dispossess others of their nests, and marine animals which take up their abode in deserted shells; but this plant surpasses all, in killing and taking possession, making the body of an insect--and that too very probably a living one—the foundation from whence it rears its stem, and the source from which it derives its support. It certainly forms one of the most surprising links between the animal and vegetable kingdom yet noticed, and as such merits as circumstantial a description as our present imperfect acquaintance with it will allow.

The aweto is chiefly found at the root of the rata (*Metrosideres robusta*). The plant in every instance exactly fills the body of the caterpillar. In the finest specimens it attains the length of 3½ inches, and the stem which germinates from this metamorphosed body is from six to ten inches high; its apex, when in a state of fructification, resembles the club-headed bulrush in miniature. There are no leaves; a solitary stem comprises the entire plant, and if any accident breaks it off, a second arises from the same spot. The body is found buried, and the greater portion of the stalk as well. When the plant has attained its maturity, it soon dies away. These curious plants, when fresh, have the flavor of a nut. The natives eat them, and likewise use them when burnt as coloring matter for their tattooing, rubbing the powder into the wounds, in which state it has a strong animal smell. When newly dug up the substance of the caterpillar is soft, and being divided longitudinally, the intestine channel is distinctly seen. Most specimens possess the legs entire, with the horny part of the head, the mandibles and claws. The vegetating process invariably proceeds from the nape of the neck, from which it may be inferred that the insect, in crawling to the place where it inhumes itself prior to its metamorphosis, while burrowing in the vegetable soil, gets some of the minute seeds of this fungus between the scales of its neck, from which in its sickening state it is unable to free itself, and consequently, being nourished by the warmth and moisture of the insect's body, then lying in a motionless state, they vegetate, and not only impede the progress of change into the chrysalis, but likewise occasion the death of the insect. That this vegetating process thus commences during the lifetime of the insect appears certain from the fact of the caterpillar, when converted into a plant, always preserving its perfect form. In no one instance has decomposition appeared to have commenced, or the skin to have contracted or expanded beyond its natural size.

In a Ferryboat Pilot House.

I shall stop you a moment and ask you to step on the upper deck of a New York ferryboat. You must not expect me to ask you into the pilot house, as, unless you have a pilot's license, the law forbids it, and if we should have a collision the court may think that you "rattled" the pilot, and mulct our boat in damages. Now look around and see the everyday life of the lower Hudson. There to the southward you will see an ocean tramp threading his way along. Astern are a steam lighter and a tug with a car float in tow, while a couple more tugs are hunting around for jobs, like beagles searching for a trail. The giant Campania is backing out of her berth, her monster stacks witnessing the industry of her stokers, who are now beginning to shovel coal to again lower the eastbound record. A Sound steamer is making her pier further down, while one of the steamboats bound for Coney Island is rushing down stream and an excursion tow is heading slowly for Glen Island. In between them all, steadily and surely, a dozen ferryboats are carrying their human freight to do the daily work of the great metropolis. All this is crowded into a square mile of water, which itself is moving to or from the sea at two and a half miles an hour.

Now, think of the problem set to the ferryman. He must carry, in safety, across this crowded harbor, with its rapid and changing currents, a large portion of the business population of one of the world's great centers of business. It is estimated that the yearly passenger trips between New Jersey and New York number 70,000,000; that the total for all New York ferries will exceed 170,000,000; that the number of boat trips equals 1,800,000, and the number of teams carried 5,000,000. All this immense traffic is carried on with remarkable safety. The lamentable accident to a Staten Island ferryboat, some twenty years ago, and a single collision afford the only cases of death from accident on record among North River ferry passengers. There have been other cases of death, but they are such as are not directly connected with the risks of the business, such as falling down companionways, being run over by teams, etc.—*Col. E. A. Stevens, in Cassier's Magazine.*

Accidents with Explosives.

The annual report by her Majesty's inspectors on the working of the Explosives Act for the past year gives evidence, says *The Chemist and Druggist*, not only of the efficiency of the act, but also of the rigid manner in which the various safeguards are enforced by the inspectors. Fatal accidents by fire or explosion in manufacture, so far as these come under the control of the act, numbered 6 in 1893, which is a slight increase on the ten years' average, which was 5·9. Considering that 127 factories are reported upon, exclusive of those where small and toy fireworks are produced, this does not seem high in so risky a business. It is very much lower than was the case before the act came into operation, when the output was nothing like so large. A large proportion of the accidents reported are due either to spontaneous combustion or to the sensitiveness of the sulphur-chlorate mixtures to friction and percussion. So great indeed has the danger of the sulphur-chlorate mixture been found to be in the manufacture of fireworks, that the inspectors intimate that an order under the act will shortly be issued by the Secretary of State prohibiting the manufacture or importation or sale of any fireworks containing the mixture, except with the express authority of a government inspector.

Among the accidents recorded in the report several may be quoted as of special interest to pharmaceutical readers. A striking instance of sensitiveness occurred at Nobel's Stirling factory, when about five ounces of "priming composition," consisting of sulphide of copper, phosphide of copper and chlorate of potash, was exploded through friction from a hardened drop of shellac varnish which had dropped on the table. An explosion of peroxide of sodium suggested a series of experiments which proved that peroxide of sodium is in itself a perfectly stable body. When, however, the peroxide is mixed, or even in contact, with any combustible substance it becomes at once highly dangerous, the addition of water causing instantaneously either an outbreak of fire or an explosion. An accident in the City Road was due to the fumes of ether and alcohol coming into contact with a gas jet. It was found on examination that a bottle containing about one-half pound of ether and alcohol had burst, owing to the high temperature of the day and the proximity of the gas. The vapors came in contact with the gas jet, which was burning at a distance of about thirty inches from the bottle, igniting the contents. A serious fire was avoided by the gas being promptly turned off. The manufacture of xylonite, or, as it was originally called, celluloid, was the origin of another fire. The following is an occurrence which should be noted by amateur manufacturers of colored fires. A Manchester professor of chemistry was carrying with him on the Manchester, Sheffield and Lincolnshire Railway a mixture for producing a colored fire, "Bengal fire," on the occasion of the Duke of York's wedding. The mixture was in a bottle placed in a leather bag, on the middle seat of compartment of a first-class carriage, when just as the train was being pulled up the explosion occurred, and the three passengers in the compartment, including the professor himself, were injured. The composition, it appeared, contained unwashed flowers of sulphur and chlorate of potash. This was an undoubted and very interesting case of spontaneous ignition, the risk from which, in the case of mixtures of this sort, has long been recognized and frequently called attention to by the chemical adviser of the department. Although the whole case was attended with various illegalities, the railway authorities consented, under the circumstances, to withdraw proceedings.

Increase of Strength in Metals at Low Temperature.

When the earth shall have cooled until the air is condensed as a liquid sea above the land and the frozen oceans, the non-crystalline metals, as Prof. Dewar has shown in one of his latest lectures, will be much stronger than they are now. Small bars of the metals, cooled by liquid oxygen or air, were stretched in a cement-testing machine until they broke with the strain. At about 290° below zero Fahrenheit, the breaking strain of copper, which is 22·3 tons per square inch at ordinary temperatures, was increased to 30 tons; that of iron rose from 34 to 62·7 tons; of brass, from 25·1 to 31·4; of German silver, from 38·3 to 47 tons; and of steel from 35·4 to 60 tons. Frozen quicksilver broke at 32 pounds. Of two equal rods of the same metal, suspended at the ends, the one at 290° below zero was unaffected by a weight that at once bent the warmer one. The vibration of the metals was affected, as was proved by two tuning forks, which were in unison under equal conditions, but became dissonant when one was cooled.

THE NEW TOWER BRIDGE, LONDON.

June 30, 1894, was a gala day in London, the occasion being the opening of a new bridge over the Thames River, located near the Tower. No ceremony is considered of any consequence in England unless the Queen or her representatives take a conspicuous part therein. On this occasion Her Majesty was represented by the Prince of Wales and a galaxy of princesses, princes, dukes, duchesses, and other notables. There was a grand procession, then addresses, the Prince touched an electric key, which caused the draw to operate, and then declared the bridge opened, the Bishop of London pronounced a blessign, and a royal salute followed. A procession of gayly decorated steamboats passed through the draw, the Prince gave a reception on the bridge, the royal party embarked on a steamer and landed at Westminster Bridge, thence home in carriages. We are indebted to *Black and White* for our two photographic views and to the *Graphic* for our large drawing.

The act authorizing the work was passed in 1885, and the foundation stone was laid by the Prince of Wales June 21, 1886. As a whole, it is a heavy piece of work, occupying much more valuable space than was necessary. But it was considered by those who had the say that such a work, located, as it was, near the historical Tower of London, ought to be massive, and present a mediæval architectural look. So they sank a pair of great piers in the narrow river, erected strong steel frames thereon to carry the cables and other parts, and then clothed the steel work with a shell of stone, the work, as a whole, being thus made to represent a structure of massive masonry.

The London *Builder* denounces the work as a case of false pretenses. But there is no denying that the bridge looks well, and makes a solid, grand, and substantial appearance.

The construction is peculiar. The draw consists of two leaves called bascules, which open vertically to allow the passage of vessels. These bascules are weighted at their lower ends and turn easily on pivots arranged in the bases of the towers. The width of their span is 200 feet. Between the towers, at their upper ends, and 140 feet above high water level, extends a permanent bridge for the use of foot passengers. There are elevators in the towers to take up the passengers, so that when the draw is opened foot passengers may still use the upper bridge. It requires five minutes to open and close the draw and allow a vessel to pass. The bascules are operated by pinions that engage quadrants on the lower ends of the bascules. The entrance to the bridge on the Middlesex side is opposite to the Mint. The approach passes along the east side of the Tower to the shore, where the northern abutment is placed on the west side of the wharf belonging to the General Steam Navigation Company. The south abutment is

THE NEW TOWER BRIDGE, LONDON—THE BASCULES CLOSED.

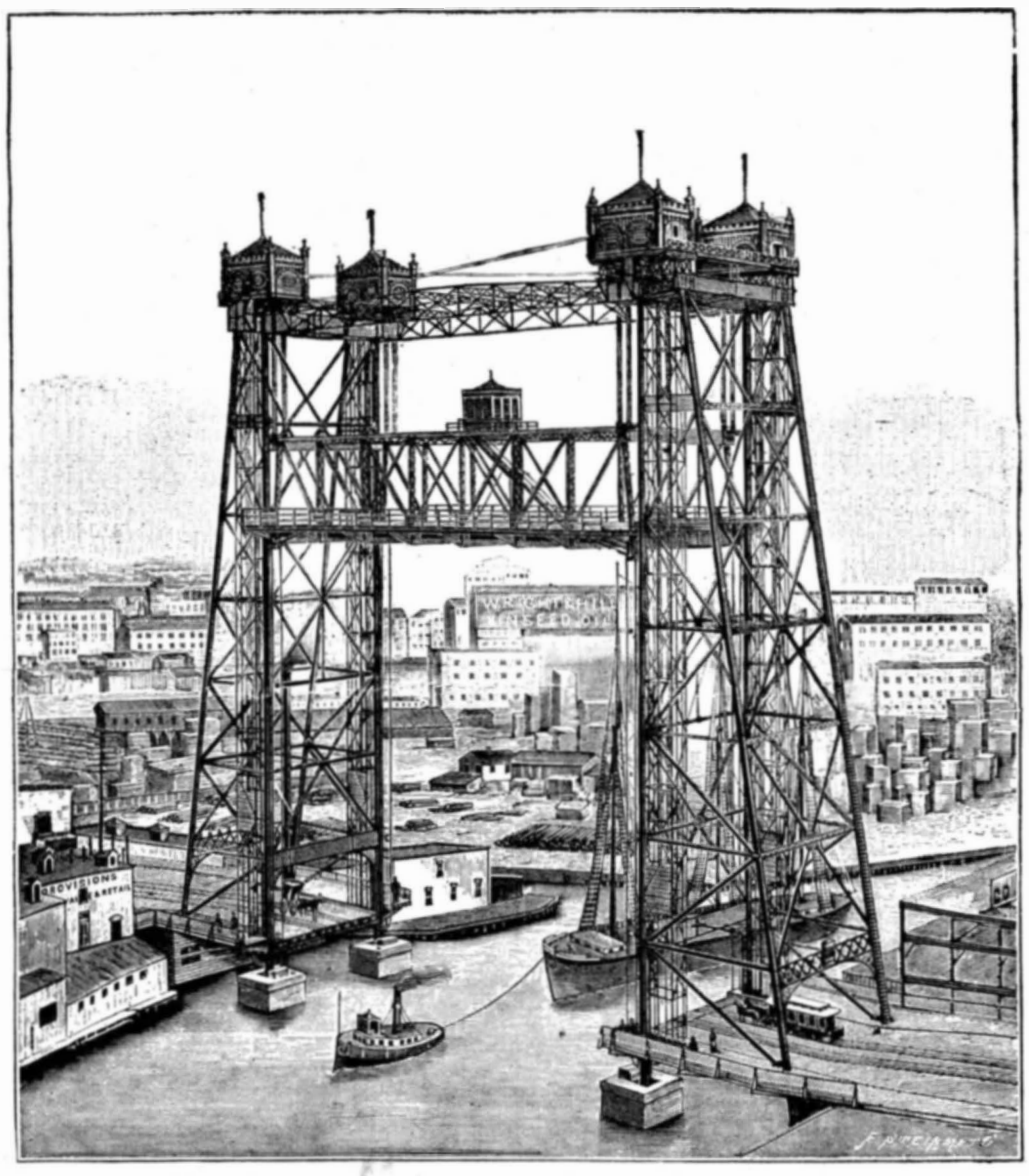
THE NEW TOWER BRIDGE, LONDON—THE BASCULES OPEN.

placed a little to the westward of Horselydown Stairs, and the approach on this side of the river is about 800 feet long, and runs in a straight line from this point, on a falling gradient of 1 in 40, until it meets Tooley Street. The north and south river piers are similar in all respects, and are, we believe, the largest of their kind in the world, the area of the two piers at the level of the foundations being about equal to the whole of the twelve circular piers carrying the Forth Bridge. The only other foundations of such dimensions are those of the Brooklyn Bridge, the two main piers of which support a roadway of 1,606 feet span. The total length of the bridge, including both approaches, is just half a mile. The total height of the towers on the piers, measured from the level of the foundations, is 293 feet. For the construction of this bridge some 235,000 cubic feet of granite and other stone, 20,000 tons of cement, 70,000 cubic yards of concrete, 31,000,000 bricks and 14,000 tons of iron and steel have been used.

The mode adopted for spanning the landward openings is the suspension system—that is, by stiffened chains anchored in the ground at each end of the bridge, and united by a horizontal tie across the central opening at the high level. This tie is carried by two narrow bridges ten feet in width, forming foot bridges, which come into use when the opening span is open for the passage of vessels. Above the landings from which the foot bridges start, and on which the foot passengers land from the lifts, come the roofs of the towers, the tops of which are 162 feet above the roadway level, or 264 feet from the bottom of the foundations.

The original design for a bridge on this plan is credited to the late Sir Horace Jones. But the modification and construction of the great work as it now stands is due to Mr. John Wolfe Barry, an engineer of great ability. The bridge has cost the enormous sum of $5,500,000.

Apropos of the way in which the Yankee sometimes deals with such jobs as the bridging a narrow stream like the Thames, we give a view of the new lift bridge over the Chicago River at Halsted Street.



THE NEW LIFT BRIDGE, HALSTED STREET, CHICAGO.

THE HALSTED STREET BRIDGE OVER THE CHICAGO RIVER.

We publish this week some further illustrations of the lift bridge, says *Engineering*, to which we are indebted for our cut and these particulars. (In some respects the problem to be solved was much the same as at the Tower Bridge, London. Some form of structure was required which, while giving when necessary a free way for high-masted ships, should obstruct the waterway and the river banks as little as possible. Hitherto the bascule type has been generally adopted under such conditions, and it was the favorite form of draw bridge during the middle ages, when such structures had a military rather than a commercial object. A moderate span was then all that was required, but when, at a more recent period, provision had to be made for the passage of large vessels, the swing bridge was invented, and up to the present it is still the favorite form where a large opening is required. In certain cases the swing has been as much as 450 feet long. A bascule bridge of similar span would be much more expensive, and, in fact, the Tower Bridge is, we believe, the only instance of a large bascule opening in existence. The increased expenditure in this latter case was considered justifiable on the ground that the bridges in a large city should be as picturesque as possible, and it would have been disgraceful for a wealthy community like that of London to have permitted the erection of a structure that would not harmonize with the old tower to which the new bridge is so close a neighbor. These latter considerations do not seem to have had much weight in the case of the Halsted Street Bridge, which, though a capital piece of engineering and a great credit to its designer, Mr. J. A. L. Waddell, can hardly be considered a success from the æsthetic point of view, though this defect is not inherent in the type, and we have no doubt Mr. Waddell will be able to embody his idea in a more graceful form whenever he finds a community ready to pay for the luxury. Apart from this, the lift type seems to have great advantages, and there is no reason why the system could not be applied to an opening of as much as 500 feet to 600 feet if desired, and the cost in such a case would certainly be considerably less than that of a swing bridge giving an equal opening, and if the foundations were difficult, it might cost less than a swing bridge giving two 250 feet openings.

In general plan the type of bridge under consideration consists of an ordinary truss span, resting on masonry abutment as usual, but so arranged that the truss can be raised from its seat and lifted high above the water level, so as to permit of masted vessels passing beneath. The truss is of the ordinary pin-connected type, 130 feet long by 23 feet high, connections being formed for the roadway by prolonging the verticals below the bottom chord. This roadway is 34 feet wide between curbs, but the distance apart of the trusses, center to center, is 40 feet. The cross girders are of the plate type, and have the longitudinals, consisting of 15 inch I beams, riveted to their webs. The lower lateral bracing is fixed to the bottom flanges of these I beams. The pathways, 7 feet 8 inches wide, are carried on brackets, the pull of the top flange being carried round the vertical post. To guide the span while it is being lifted, two rollers are employed at each end of each top and bottom chord. One of the rollers is intended to take up side pressure, while the other checks any tendency to longitudinal swaying, but as provision must be made for expansion, this roller is fitted with powerful springs behind its bearings. The side pressure rollers are connected to the chords by a breaking piece, so that if the span is struck by a vessel the effect will be to shear this roller off, rather than to damage the span more seriously. A small hut for the bridge attendant is erected on the top of the lifting span.

The principal interest of the structure, however, centers on the lifting arrangements. As usual in the States, steam is employed for this purpose, an engine house being built on the river bank underneath one of the side spans of the bridge, and in this two 70 horse power engines have been erected, together with ample boiler power. These engines run at 240 revolutions per minute, and drive the pulleys for the lifting tackle by means of gearing. This tackle consists of 16 steel wire cables, ⅞ inch diameter, eight of which attach to the top of the span and the other eight to the counterweights, the lead of the cables being so arranged that as one set is wound on the winding drums the other set is wound off. The main sheaves on the top of the towers are 12 feet in diameter, and as the span and its counterweights each weigh about 250 tons, these four pulleys have each to carry about 75 tons each, and thus require a rather large shaft and long bearings. A 12 inch shaft has been adopted. To take the pull of the cables the two towers are connected together between the pulleys by a light truss. The abutment towers are very stiff, and consist each of two main vertical posts, which serve as guides for the lifting spans as well as taking most of the weight, while two raking posts support them against any end sway of the span when in its topmost position.

The bridge was designed by J. A. L. Waddell, C.E., of Kansas City, he having planned the same on a larger scale for Duluth Harbor. W. W. Curtis, engineer of the Pittsburg Bridge Company, made all of the working drawings of the structure, while the details of the lift gear were worked out by Superintendent T. W. Hermans, of the Crane Elevator Company.

The primary idea on which this type of bridge is based is the elimination of a center pier in cases where the bridge spans a navigable stream and a draw is necessary, thus securing the free use of the whole channel with very little obstruction of the docks in the immediate vicinity. This is accomplished by lifting the roadway to a sufficient height to allow passage of vessels with their spars and rigging, only for such time as is necessary, and immediately lowering to place, giving as little obstruction to street traffic as is possible. The bridge is so equipped as to be raised to full height in less than one minute, one engine being sufficient for the work, so that in this respect it is fully up to the ordinary center-pivot swing bridge, with the further advantage that in most cases it is only necessary to raise it part of the way, with the corresponding saving of time.)

An accident which caused not a little excitement occurred recently in the working of this bridge. When the bridge was raised on the morning of July 16, to allow a vessel to pass under it, a pinion in the hoisting apparatus broke as the bridge reached its uppermost position, and it was impossible to lower the structure until repairs were made, which it took thirty-six hours to accomplish. At the time of the accident, there were on the bridge eight passengers, of whom three, a policeman and two boys, were lowered in a chair tied to a rope, but five others, all men, were kept prisoners in their elevated position. A basket of provisions was sent up to them by a rope, and they passed the night as comfortably as they could in the signalman's little house.

Remarkable Fossils.

Prof. J. B. Hatcher and his party of students from Princeton College, who have just completed a tour through the Bad Lands of South Dakota, in search of fossils and petrifactions, have met with good success. The party has been in the Bad Lands between the Cheyenne and White Rivers since March 1. After completing their task, they started on an overland trip to Yellowstone Park. The collection of fossils has been shipped to Princeton. It weighs 9,000 pounds and consists of rare specimens of extinct animals.

The choicest and most valuable specimen was the elotherium, or extinct pig. The specimen was found protruding from a bank of one of the deep hollows in the Bad Lands. This is the only skeleton ever found of this character in that district, and was perfect, no bones being missing. This caress is much larger than the modern pig; in fact, it is larger than the living rhinoceros.

One specimen was the titanotherium, or extinct rhinoceros, which was twice as large as the modern rhinoceros. They also found several specimens of the rhinoceros family and the metamydor, a relative of the rhinoceros. Then there are skeletons of numerous small animals. They found a few fish skeletons, the only fish skeletons ever found in those beds. Last year's expedition from Princeton succeeded in obtaining the only crocodile ever found in the Bad Lands. On this trip a good specimen of the amphisbaenold lizard was unearthed, the only specimen of this reptile ever found in the world. This has no limbs at all, and was a very low order of the lizard.

GERMANY is now the best educated nation of the Continent, yet only one hundred years ago German teachers in many parts of the country were so poorly paid that they used to sing in front of houses in order to add to their income by odd pence.

Different Ways of Carrying Children.

La Province medicale for June 30 contains an abstract of an article on this subject by Dr. Felix Regnault, published in *La Medecine moderne*, in which the author writes as follows: Our customs with regard to the manner of carrying children are well known. They are carried on the left arm in order to leave the right hand free for use, but this practice evidently is not the best, for, aside from the fatigue entailed, one is obliged to pay the closest attention to the child, to watch all its movements while it is thus carried. Such a custom could not prevail among savages and half-civilized nations, where the necessities of existence do not permit of the same freedom from care, and where the women are obliged to work in the fields. The French peasants, says M. Regnault, leave their children in the cradle, and, if necessary, tie them in. This is the custom also in Armenia, in Morocco, and in Tartary. In Russia and among the Ostiaks the baby is put into a light willow basket, which is carried on the back and held firmly by means of straps. The custom among the Africans is still better. There the child is carried directly on the back and held firmly in place by means of a piece of cloth which is brought forward and fastened in front of the chest. In this manner the child is always carried by the mother, whether working in the fields or carrying water jugs on her head.

This custom has spread to other countries, and it has become a constant practice among the Japanese, who, it is well known, are the most careful people with regard to their children. M. Vidal, in the *Revue d'anthropologie* for 1874, gives many interesting details on this subject. From the time of the child's birth until it is three or four years old it is carried always, and everywhere, on the back. A garment called *kimono* is of such ample dimensions that when the folded sides are spread open it forms between the chest and the back a large funnel-shaped space into which the child is put, the head alone showing above the edge of the garment; the hands and arms are free, so that the child's movements are not restricted, and thus there is little danger of a fall or a blow. In this way, too, the baby is not exposed to cold, the mother's body giving sufficient warmth. Another advantage to be derived from this way of carrying babies is that the mother has her hands free to perform her daily work.

It is quite common, says the author, to see children of five or six years carrying their younger brothers and sisters in this manner on their backs. European children also are carried in this way by native nurses, and they do not seem to find it uncomfortable.

Among other nations the custom varies, and the hip, usually the left one, supports the child's feet. In this case a band holds the baby in place and leaves the left arm of the person who carries the child free. Among the Malays this band is a piece of cloth which is fastened on the right shoulder; among the Niams-Niams it is a large piece of hide which is crossed over the left shoulder and passes under the right one. When the women carry anything on their heads the back is chosen for the child, and when objects are carried on the back the child is placed on the hips, where it is fastened with bands. This custom prevails among many negro races. On the Congo coast objects are put on the head, and the child is carried on the back. In the interior, where there is more danger of accidents occurring, loads cannot be carried on the head, as they would be exposed to a fall; consequently they are put into a basket on the back, which is fastened with a large piece of goat skin on which the child is seated.

M. Lapicque, in his voyage to the Andaman Islands, has also seen the women of that country carrying children on the left hip and a basket on the back. In this way, says the author, have savage nations solved the question of being able to carry on their work and at the same time watch over and take care of their children.—*N. Y. Med. Jour.*

Royal Exhibits at the Chicago Exposition—Report on Women's Work, British Section.

The following report of the Ladies' Committee of the British Section has been transmitted to the Royal Commission:

In October, 1892, at the request of the Royal Commission, of which Sir Richard Webster, Q.C., M.P., was chairman, H. R. H. Princess Christian, of Schleswig Holstein, Princess Helena, of Great Britain and Ireland, accepted the presidency of a Committee of English women to represent, as far as possible, the work of women in England at the World's Fair in Chicago.

A large and representative Committee was formed, and the work of collecting and choosing the exhibits was undertaken by the different vice-presidents of each section of work, with the assistance of their separate sub-committees. Miss Fay Lankester was appointed secretary to the Committee by the Commission. A small Finance Committee, with Sir Douglas Galton as chairman, was appointed by Her Royal Highness.

The Committee was divided into eleven sections, the presidents of each section undertaking to form subcommittees and regulate the collection of exhibits—thus Scotland, Ireland, and Wales were represented. Education, handicrafts, lace, literature, needlework and embroidery, philanthropic work, and nursing, with the Countess of Aberdeen, Lady Aberdare, Mrs. Fawcett, Lady Roberts and Miss Webster, Duchess of Abercorn, Mrs. Gordon, Lady Henry Grosvenor and Lady Amherst, the Baroness Burdett-Coutts and Mrs. Bedford Fenwick, as presidents of the sections, each lady forming an active sub-committee to assist her in her work.

Mrs. Roberts-Austen kindly undertook the decoration of the vestibule, which was most beautiful, with panels on one side, by Mrs. Swynnerton, representing Nursing, in three groups, and on the other side by Mrs. Lee Merrett, representing Kindergarten; a group of women embroidering and women receiving degrees at the London University.

Miss Roper and Miss Halle furnished bass-reliefs, which were placed over the entrance.

Mrs. Roberts-Austen also sent out a few selected paintings by eminent women artists.

Miss Helen Blackburn kindly undertook to lend a collection of portraits of eminent women. They were arranged in periods—in Mediæval period, in Tudor period, Civil Wars, early half of 18th century, pioneers in Philanthropy and General Advancement of Women, pioneers in Education; Central Group, Science, History, etc.; General Literature, Poetry, Fiction, Drama and Music, Art; in all, nigh upon 200 portraits.

Mrs. Fawcett, besides being president of the Education Committee, was kind enough to write the report for the catalogue to the Women's Building, and this she did in the most able manner, explaining the objects and aims of the Women's Committee.

Some of the vice-presidents also wrote short prefaces on their own particular work in the catalogue: Mrs. Fawcett, for the Education Committee; Mrs. Bruce Clarke, for the Lace Committee.

Lady Priestley contributed a paper on "Hygiene in the Home" to the Congress, and Miss Blackburn undertook to provide one on "Patents taken by Women."

Thus about a hundred educated women were energetically interested in the active occupation of forming a suitable representative exhibition of the work of their fellow country women. The expenses of the collections, show cases, freight, and insurance were heavy, but the Commissioners most generously undertook the expenses of freightage, insurance, and return of goods.

Her Royal Highness attended all the meetings personally, and was actively interested in the promotion of the work. The Committees have every reason to be congratulated on the speedy, economical, and businesslike way with which their work was accomplished, the English Women's Section being the only one that was ready on May 1, when the Exhibition opened, mainly owing to the energy of Mrs. Cope, the lady sent out in charge of the exhibits. As the ladies did most of the work themselves, there was very little expense attached to the undertaking, except the most absolutely necessary expenditure. Mrs. Cope was sent from England in charge of a certain number of exhibits—royal exhibits, needlework, handicraft, lace, Welsh, and Indian work sub-sections.

Her Majesty the Queen and the Royal Family of England sent several paintings and work executed by themselves; also other exhibits:

1. Six original sketches from nature in one frame, by H. M. the Queen.

2. Copy in water colors from an oil painting, size of life, of H. M. the Queen's Munshi and Indian Secretary, Ab-dul-Karim, 1892, by H. M. the Queen.

3. Two pictures in oil by H. R. H. the Princess Christian of Schleswig Holstein.

4. Study from nature in water colors, by H. R. H. Princess Louise.

5. A picture by H. R. H. Princess Beatrice (Princess Henry of Battenburg).

Two napkins made from flax spun by H. M. the Queen.

A hat plaited by H. M. the Queen and given to her granddaughter Princess Victoria of Schleswig Holstein.

Corner chair of carved oak and cut and embossed cowhide, H. R. H. the Princess of Wales.

Embroidery on linen; knitted jersey—H. R. H. Princess Helena (Princess Christian of Schleswig Holstein).

Music stool of carved oak and cut and embossed cowhide, by H. R. H. Princess Victoria of Wales.

Stool of carved oak and cut and embossed cowhide, H. R. H. Princess Maude of Wales.

These Royal exhibits were received with especial interest in America.

The sales of work were not large, partly on account of the heavy duty to be paid on English goods and partly on account of the restriction that visitors could not take away purchases from the building until after the closing of the Exhibition.

The British Nursing Section received particular distinction in the way of medals and awards.

The collection of lace sent by the Duchess of Abercorn was particularly beautiful, as were the exhibits and specimens of lace sent by the Countess of Aberdeen.

The Scottish industries have profited by sending exhibits to the Exposition, as many sales took place in the way of Harris tweeds, Shetland shawls, hand-knitted stockings and gloves.

The cottage industries at the Welsh Section attracted considerable attention, more especially the hand-loom weaving, where 928 yards of flannel was woven during the Exhibition by a young Welsh woman in national costume, sent out for the purpose. The spinning wheels, both of North and South Wales, were very interesting, and "Welsh Section" was always popular among the visitors.

Two lady custodians, Mrs. Bond, an English lady residing in Chicago, and Mrs. Cope, sent out from England, were actively employed during the whole time of the Exhibition, and votes of thanks were sent to England by the Board of Lady Managers on account of the active services rendered by these ladies, and letters expressive of warm appreciation of British women's exhibits have been received from Chicago.

Three lady judges were appointed by the Committee at the request of the Board of Lady Managers, viz., Miss Knealy, Nursing, etc.; Mrs. McAllum, Philanthropic Work; Mrs. Crawford, Art and Handicraft.

Several members of the Ladies' Committee visited Chicago during the Exhibition. Mrs. Bedford Fenwick made two journeys to install the nursing exhibits, and obtained medals for the nursing appliances. Miss De Pledge also attended and read papers. Mrs. Roberts-Austen personally superintended the decoration of the vestibule with panels. Mr. Osborne also went on account of the Baroness Burdett-Coutts.

Notices of the numerous medals and awards which have been gained by British women have been sent to the president of each section; they are too numerous to mention in this report. An official list can be seen at the offices of the Women's Work, 53 Berners Street, W., or at the Society of Arts.

The thanks of the Ladies' Committee are due to Sir Frederick Abel in lending space at the Imperial Institute for the packing of exhibits and the reception on their return to England; and to Sir Somers Vine and the officers of the institute for their courtesy in assisting the Ladies' Committee in every possible way.

The exhibits not sold have been returned, with very little damage.

SCOTLAND.

President.—Countess of Aberdeen, in conjunction with the Scottish Home Industries Association. *Hon. Secretaries.*—Miss Munro Ferguson and Miss Meta Donald.

IRELAND.

President.—Countess of Aberdeen, in conjunction with the Irish Industries Association.

WALES.

President.—Lady Aberdare. *Hon. Secretary.*—Miss Adeane.

EDUCATION.

President.—Mrs. Fawcett. Miss Buss, Miss Julia Cock, M.D., Miss Davenport Hill, Miss Gurney, Miss Tod (Belfast), Miss Kingsley, Miss F. Stevenson (Edinburgh), and Miss L. Stevenson.

HANDICRAFTS.

Presidents.—Lady Roberts and Miss Webster. Mrs. Jack Johnson, Miss H. Blackburn, and Miss C. Holden (hon. sec.)

LACE.

President.—Duchess of Abercorn. Lady Clinton, Lady Ernestine Edgecumbe, Lady Susan Fortescue, Lady Iddesleigh, Lady Kenmare, Lady Kennaway, Lady Morley, Hon. Mrs. Marker, Hon. Mrs. Peek, Mrs. Bruce Clarke, Mrs. Alfred Morrison, Mrs. Reeve, and Miss Constance Hargrove (hon. sec.)

LITERATURE.

President.—Mrs. Gordon. Mrs. Humphrey Ward, Mrs. Clifford, Miss Gayford (hon. sec.), Mrs. Green, and Miss Kingsley.

NEEDLEWORK.

Presidents.—Lady Henry Grosvenor and Lady Amherst, of Hackney.

NURSING.

President.—Mrs. Bedford Fenwick. Lady Jeune, Lady Priestley, Miss Emily Shaw-Lefevre, Miss Isla Stewart, Matron St. Bartholomew's Hospital; Miss K. Hendie Close, Lady Superintendent for Sick Children, Great Ormond Street; Miss De Pledge, Matron Chelsea Infirmary; Mrs. Cheadle, late Inspector Queen's Nurses; Miss S. Cartwright, Gordon House Home Hospital; Mrs. Walter Lakin, Miss Edith Kirwas Ward, Miss Annesley Kenealy, and Mrs. Holmes Spicer (hon. sec.)

PHILANTHROPY.

President.—Baroness Burdett-Coutts. Countess of Harrowby, Mrs. Boyd Carpenter, Miss Mary Steer, Mrs. Holmes White, and Miss Ellen E. White.

(Signed)

HELENA,
Princess of Great Britain and Ireland,
Princess Christian of Schleswig Holstein.

FAY LANKESTER,
Secretary

The Newspaper Museum of Aix-la-Chapelle.

At Aix-la-Chapelle there is a museum which is probably unique of its kind, and which contains more than five hundred thousand journals in various languages. It was founded in 1886 by Mr. Oscar Forkenbeek, a distinguished amateur, who for forty years devoted his entire income to the acquisition of rare or curious specimens. A subscriber to several hundred journals coming from all parts of the globe, Mr. Forkenbeck received and read every morning a large number of papers published in thirty different languages. In founding his museum, he endowed it in the first place with ten thousand complete collections that he had got together, and then he sent a circular letter to the press of the entire world requesting it to second him in the colossal work that he had undertaken.

Most of the journals, especially those of Europe, are sent regularly to the museum, which now finds itself in the possession of complete series and some very rare specimens. Among the latter may be mentioned a number of the *Illuminated Quadruple Constellation*, published in New York in 1859. This very extraordinary journal is no less than eight and a half feet in length by six in width. It contains eight pages of thirteen columns each. The columns are forty-eight inches in length, and, if placed end to end, would therefore form a strip of printed paper about one hundred and twenty-five yards in length. It was printed with the greatest care upon a specially prepared and very strong paper that weighed about three quintals to the ream. Forty men worked night and day to set up and print the first number of this monster journal, which is to appear but once a century.—*La Nature.*

THE HARMONY AND MEASUREMENT OF PERFUMES.

The manufacture of perfumes is a thoroughly French industry, and it is no exaggeration to say that it affords a living to three-fourths of the rural population of the environs of Nice, Cannes, and Grasse. Yet this so prosperous branch of our horticultural industry has recently witnessed the birth of a rival one, that threatens to strangle it; we refer to the obtaining of perfumes through synthesis.

What is to be done in the face of such competition? Abandon the culture of flowers and leave the manufacture of perfumes to all the chemists of Europe? But, then, what use shall we make of our beautiful sunshine of Provence and the privileged climate that France enjoys in the south? No; it is preferable to react, not by endeavoring to obtain products as cheap as those furnished by chemistry, which would be simply chimerical, but by doing better—that is to say, by producing fine, delicate perfumes, capable, consequently, of competing with the always quite coarse products obtained by synthesis. In order to reach such a result, it is necessary to determine in an accurate manner the methods of formation and localization of

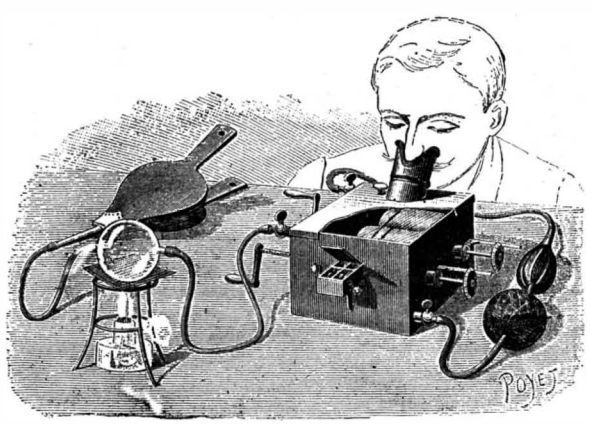


Fig. 2.—MEASUREMENT OF PERFUMES BY MEANS OF THREADS.

the perfumes in flowers, to observe their variations in the life of the same plant; to learn the conditions of culture that give maximum renderings, to devise rational methods of extraction, and to classify the perfumes. It is these various problems that Mr. E. Mesnard has attacked, and in part solved. We shall occupy ourselves here merely with his researches upon the measurement of the intensity of perfumes, and which are of a nature to interest the public at large.

It must not be thought, in fact, that, in order to excite our olfactory nerve agreeably, it suffices to mix, in any proportions whatever and in any manner whatever, odors which, isolated, are agreeable to smell, any more than it would suffice to drum upon a piano in order to play a harmonious air. There is, says Mr. Piesse, in his treatise upon perfumes, an octave of odors, just as there is an octave of notes; certain perfumes unite with each other like the sounds of an instrument. Thus, bitter almond, heliotrope, vanilla, and clematis blend very well, each of them producing nearly the same impression, in a different degree. On another hand, we have lemon, orange peel and verbena that form a higher octave of odors, and which associate with each other likewise. The analogy is completed by what we call semi-odors, such as rose with rose geranium for a half tone.

It is curious to note that upon mixing a small number of perfumes in definite proportions, we can obtain the majority of the odors of flowers, with the exception of that of jasmin, which is *sui generis.* With long practice, it is possible, if we may dare to so express ourselves, to educate our nose and become composers of perfumes, just as musicians become composers of music. Certain perfumers succeed in distinguishing more than four hundred odors and in blending them without difficulty in a proper manner. But these are exceptions; so Mr. Piesse, in order to aid the manufacture of perfumes, has conceived the ingenious idea of selecting the odors that are more especially employed in perfumery and of placing the name of each odor in a gamut in the position corresponding to its effect upon the olfactory sense (Fig. 3).

The odors that are not designated in the tables in question are easily interposed between those that are

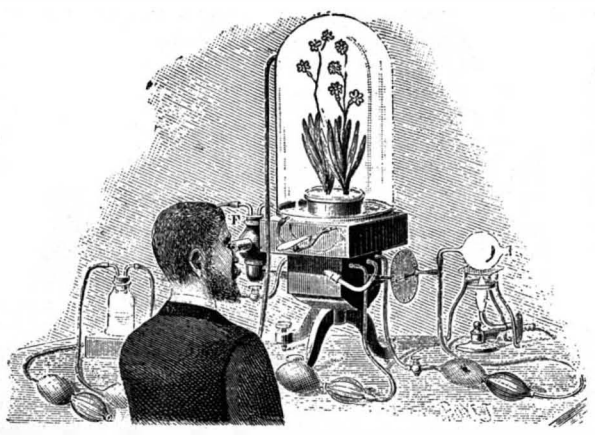


Fig. 1.—MEASUREMENT OF PERFUMES THROUGH THE EXTINCTION OF PHOSPHORUS.

here inscribed. Some of them admit neither sharps nor flats. Others, owing to their diverse varieties, might form a gamut by themselves alone. When a perfumer wishes to make a bouquet of primitive odors, he must select those that accord, and the perfume will then be harmonious. Upon glancing at the gamut, we shall see what harmony and discordance are as regards odors. Just as a painter blends his colors, just so a perfumer must blend aromas. When a bouquet of several perfumes is made, the latter must be so mixed that when brought together they shall form a contrast.

The following is an example that shows the method of compounding perfumes according to the laws of harmony:

BASS.

Sol	Pergularia.....	Bouquet, chord of *sol.*
Sol	Sweet pea.....	
Re	Violet	
Fa	Tuberose.....	
Sol	Orange flower.....	
Si	Southern wood.....	

This method of gamuts is ingenious and renders very great services, but it cannot be denied that it is very artificial, scientifically speaking, and this is what led Mr. Mesnard to the measuring of the intensity of perfumes in a more accurate manner. The matter is extremely delicate from all points of view, and it is interesting to see the roundabout method by which Mr. Mesnard has reached it. The method consists essentially in the introduction, into a given vessel, of air laden with a known perfume and of air that has passed over a special and easily procured volatile oil—essence of turpentine. Although the sense of smell is not capable, as may be supposed *a priori*, of estimating the intensity of an odor in absolute measure, it is capable of being a wonderful comparer. It is possible, therefore, to form a mixture in which the sense of smell shall succeed in perceiving only a neutral odor, that is to say, an odor such that it would suffice to cause a slight variation in the proportion of the essential oils in one direction or the other, in order to smell either the perfume or the essence of turpentine. At this moment, it may be admitted that the two odors are equivalent. It now only remains to determine the quantity of essence employed. As a basis for this is taken the curious property that essence of turpentine possesses of extinguishing the phosphorescence of phosphorus. The proportion of essence is easily calculated, by knowing that, in order to prevent the phosphorus from shining in a given space, it is necessary to introduce thereinto a volume of air so much the greater in proportion as it is charged with a less weight of vapors of turpentine essence. The intensity of the perfume will evidently be so much the stronger in proportion as it has been necessary to employ a larger quantity of essence in order to neutralize it.

In Fig. 1 we represent one of the apparatus used for such measurement. The observer watches in a ball of blackened glass, F, for the moment in which the phosphorus contained therein is extinguished. The numerous rubber bulbs observed are designed for stirring up the odorous vapors and for obtaining very homogeneous mixtures—this being a very important condition.

We show also (in Fig. 2) the last and not least curious model devised by Mr. Mesnard. The nose of the observer will be seen communicating with the cavity of the apparatus, into which is introduced the perfume and the essence by means of two threads that they impregnate. These threads may be seen through a hole that the engraver has represented in the cover for that purpose. We begin by introducing a determinate length of perfume thread, and then, in the same way, a certain length of essence thread, until the two odors neutralize each other. The intensity of the perfume can then be expressed in length of thread. To measure a perfume by the surveyor's chain is something that one would not have expected!—*L'Illustration.*

Mountain Sickness.

Mountain sickness is a complaint well known to most ascensionists to great heights. It is at the altitude of about 12,000 feet that they generally experience this peculiar trouble, which becomes more and more marked in measure as this height is exceeded in order to reach altitudes of 14,000, 15,000, and nearly 16,000 feet, as in the ascent of Mont Blanc.

Reaching such heights, the ascensionist is attacked with extreme lassitude and a desire to breathe more frequently. Scarcely has he made a few steps when he is obliged to stop in order to take breath, as if exhausted by the slight effort that he has just put forth. With this is joined, in certain persons, a feeling of nausea and a tendency to syncope. De Saussure, in one of his first ascensions, noted all these peculiarities, but was able to control the sensations caused by the trouble. Dr. Lortet, Dean of the Faculty of Lyons, who has made a thorough study of these physiological troubles, noted the same phenomena. More recently, Mr. Egli-Sinclair has made the ascent of Mont Blanc and has given a scientific account of it of the greatest interest. In company with Messrs. Infeld and Guglieminetti he started under the habitual conditions and reached the summit without tremors of the limbs and without shortness of breath. It was not until the ascensionists were installed in the hut erected upon the summit by Mr. Vallot that they felt the first attacks of the mountain sickness. Their respiration became difficult, their muscles were sensitive, and the sickness was completed by headache and a slight nausea. The party remained in the observatory four days, and the same symptoms persisted during almost the entire time. These symptoms, which are exactly the same as those experienced by other observers, will confirm the existence of a mountain sickness.

What is the nature of the complaint? It is due to anoxhæmia, that is to say, to an insufficient quantity

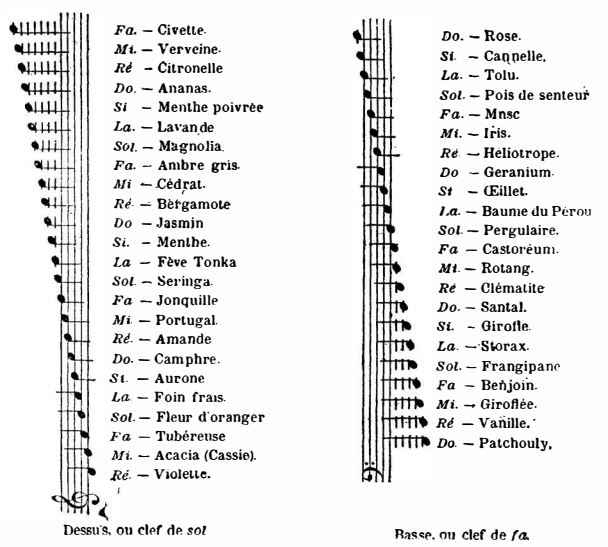


Fig. 3.—GAMUT OF PERFUMES.

of oxygen being absorbed by the blood. Messrs. Jourdanet and Bert have demonstrated that the rarefaction of the air prevents the organism from receiving the quantity of oxygen necessary for respiratory and organic combustion. Mr. Egli-Sinclair has shown the reality of this fact by careful analyses of the blood. In his companions and himself, the proportion of hemiglobine of the blood was reduced by a third, and even a half, and rose again, and that but slowly, only after their descent to the valley. The connection between mountain sickness and the amount of oxygen furnished the blood, therefore, appears evident. This, however, is not the sole cause, for another factor intervenes, and that is the fatigue, the exhaustion that is experienced, and which is variable according to the subject, his resistance, his training, and the conditions under which the ascent is made. In measure as one ascends a high mountain, then, the expenditure of oxygen is increased and the loss is not compensated for by an atmosphere that becomes more and more rarefied. The more the walk is forced, the more laborious becomes the effort, the more apparent becomes the decrease in oxygenation, and the more marked the disagreeable symptoms above mentioned.

Science Notes.

Application of Compressed Air to Dusting.—*Cosmos* makes known a new application of compressed air which may be destined to become widely used. In all times it has been customary to blow the breath instinctively upon an object in order to expel the dust from it, and yet no one has hitherto thought of applying this very simple process upon a large scale. Whisk or bristle brushes, feather dusters, etc., are the enemies of furniture, which they ruin, and of bric-a-brac, which they break. A flexible tube provided with a nozzle and connected with a reservoir of compressed air may usefully replace them and perform their duty much more quickly and much better, the air searching out and dislodging the dust from the minutest crevices in the very body of a fabric. Air under a pressure of 3·5 atmospheres suffices for this operation. It is employed in precisely the same way that we use water derived from a garden hydrant to wash objects. The extremity of the nozzle is directed toward a piece of furniture, and in an instant the dust and bacteria will have been forced out of it and blown away. Every house that is provided with a motor will be able to connect a compression apparatus with it. In certain cities the supply may be obtained from a compressed air pipe line. Elsewhere the air may be compressed by hand into reservoirs. The cost of the first installation would not be much and would be fully covered by the saving in manual labor and implements for cleaning and by the preservation of household objects.

Glass Impermeable to Heat.—Workmen employed in metallurgic or other establishments often suffer greatly when they are obliged to labor near furnaces heated to a high temperature, and it would therefore prove of interest to have a glass through which the heat rays could not pass. A glass that supplies such a want is composed, according to *Dingler's Polytechnisches Journal*, of the following materials:

Sand	70 parts.
Kaolin	25 "
Soda	34 "

After this mixture has been melted, we find by analysis: 74·6 per cent of SiO^2; 8·4 per cent of Al^2O^3; traces of Fe^2O^3; 15·4 per cent of NaO^2; and 0·9 per cent of CaO. A plate of this glass 7·6 mm. in thickness allows but from 11 to 12 per cent of the total heat of a butterfly gas burner to pass.

Cryostase--a New Body.—A German chemist, says *Die Natur*, has just discovered a new body which, it appears, possesses the remarkable property of solidifying under the influence of heat and of becoming liquid again at temperatures below zero. This body, which has received the name of cryostase, is obtained by mixing together equal parts of phenol, camphor and saponine, to which is added a slightly smaller quantity of essence of turpentine. Up to the present there has been no product known that possesses this property of liquefying when cold and solidifying when warm; for, although certain bodies, such as albumen, harden at a slightly elevated temperature, it is impossible to bring them back to a liquid state, even under the influence of very low temperatures.

Destruction of Books by Insects.—Although the destruction of books by insects, says *Nature*, is not so great in Europe as in India, it is sufficient to give general interest in the result of an inquiry into the means of preservation adopted in Indian museums. In the library of the Revenue and Agricultural Department of the government of India the books are disinfected by pouring a few teaspoonfuls of refined mineral naphtha, or what is known as benzine collas, into the crevices of the binding, and then shutting up the volume for a few days in a close-fitting box to prevent the escape of the fumes. Books so treated have to be afterward sponged over lightly with a very little of the finest kerosene oil, which should be rubbed off with a cloth before it has time to penetrate into the binding. Dr. George King reports very favorably upon a system adopted for preserving books in the Royal Botanical Gardens, Sibpore. It consists in brushing the books over with a saturated solution of corrosive sublimate made by constantly keeping a few lumps of the poison at the bottom of a jar of alcohol, so that the maximum amount may be absorbed. In the Indian Museum Library the books are kept in close-fitting glass cases with a few ounces of naphthaline upon each shelf, with the result that little or no damage is caused by insects. It appears that the paste used in binding the Indian Museum books is poisoned by adding about half an ounce of sulphate of copper to each pound of paste, while books already infested are disinfected by shutting them up for four or five days in a close-fitting box of loose naphthaline with as much of this substance as possible between the leaves.

Imitation Gold in Russia.—In addition to its large production of genuine gold, says *Die Natur*, Siberia frequently furnishes commerce with a false gold that sharpers quite easily succeed in palming off upon inexperienced gold seekers. This article is an alloy of lead, zinc, and copper which is poured into water, or into the ground through a wet broom. In this way there are formed very small globules which, when solid, closely resemble the small pepites that are found in auriferous sand. It is not rare, moreover, to see the defrauders cover these grains with a layer of pure gold in order to more surely deceive their credulous customers. The false pepites thus manufactured are sold at a discount under the pretense that they are derived from a robbery committed in a neighboring exploitation. The buyer, allured by the relatively low price, allows himself to be persuaded, and purchases these grains, which he mixes with the gold furnished by his exploitation. This imitation gold is often sold not only in Russia, but also in Germany and other countries.

Tea and Coffee.

Professor Schutzenstein has been investigating the effect on processes of digestion produced by these beverages. For this purpose the professor prepared an artificial gastric juice and mixed it with coagulated egg albumen, with and without additions of tea and coffee infusions. The results obtained are extremely instructive, for while the gastric juice by itself was able to digest ninety-four per cent of the egg albumen in the space of eight hours, when tea was added the proportion digested was reduced to sixty-six per cent, while when a decoction of coffee was mixed with the albumen the gastric fluid was only able to digest sixty-one per cent, or less than two-thirds of the albumen. The digestive power of the gastric juice appeared to vary with the strength of the infusion, the disturbing effect being less when the solutions of tea and coffee were weakened. The professor is of opinion that the deleterious effect produced is due to the tannin which is extracted during the process of making, and not to the presence of thein and caffein, and he mentions that tea which has not been allowed to stand more than two or three minutes is less injurious because a smaller quantity of this undesirable ingredient, tannin, has been produced than when it is boiled up or left in contact with the leaves for a considerable length of time. But it should be remembered that the weaker infusions, besides containing less tannin, also contain less of all the poisonous properties contained in the tea leaf and coffee berry, and that it is not only the obnoxious tannin which is thus kept in subjection.

THE progress of the illumination of the Dark Continent is indicated by the fact that 700 locomotives cast the rays of their headlights through the gloom.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM JET BLOWER.—David J. Crozier, Brooklyn, N. Y. This inventor has devised an attachment for the ash pit door, with which the steam supply is so connected as to permit the free swinging of the door, while a flap valve seals the draught aperture in the blower casing and affords means to graduate the inflow of air. The peculiar formation of the casing and jet producer affords a wide, thin, injected sheet of air and steam, speedily blowing the fire uniformly throughout its area, and designed to give much better results than circular jet blowers, while the fire chamber may be completely sealed when the fire is to be banked.

WATER POWER MACHINE GUN.—Pardon B. Tyler, Spokane, Washington. This gun has a number of circumferentially arranged barrels, in the rear of which is a feed wheel carrying a cartridge belt and operatively connected with a water wheel, in connection with mechanism for exploding the cartridges. There is little mechanism liable to get out of repair in the gun, which is designed to automatically fire a continuous stream of bullets, and it may also be operated by hand if the water supply fails.

Electrical.

INCANDESCENT LAMP.—William E. Forest, New York City. According to this improvement a compound stopper of two or more elements is inserted in the neck of the globe, one element tightly closing the neck and supporting the leading wires, and the other hermetically sealing the stopper and wires, while a third element may be added to give increased stability, forming a head for holding the lamp in its socket and for protection against breakage, the head acting as a buffer between the glass bulb and socket. The stopper is preferably of rubber, and in the neck and on the outer surface of the stopper is a plastic cement.

ELECTRIC RAILWAY.—Henry A. Doty, Janesville, Wis. This invention provides a conduit conductor, mostly insulated, but having thereon projecting uninsulated lugs, while flexible contact shoes are arranged to make sliding contact with both sides of the lugs, thus avoiding sparking and preventing leakage. The trolley used with this conductor may be applied to any kind of a car, being adapted to run smoothly in the slot of the conduit, while having such freedom of lateral movement that it always retains its correct position without regard to the rocking of the car or the rounding of curves.

Mechanical.

SPRING MOTOR.—Sigismund B. Wortmann, New York City. This is an improvement on several former patented inventions of the same inventor in a class of motors deriving their power from coiled springs, the design being to concentrate power from a number of springs and transfer it to a power shaft, the springs being wound singly or collectively while the shaft is still or while it is in motion. Any number of springs in suitable drums may be grouped around the drive shaft, by the revolution of which all the springs in the group may be simultaneously wound up, and any number of groupings of drive shafts and springs may be employed, each shaft being in communication with a common power shaft. Great economy of space is obtained by the improvement and the friction is reduced to a minimum.

FLOOR JACK.—John L. Kobler, Le Sueur Center, Minn. This device consists of a lever and a clamp having a U-shaped loop at one end, one leg of the loop being extended outwardly, forming a lateral arm to which the lever is shackled near one of its ends. A dog is formed integrally with the lateral arm, joining at its base with the outer end of the arm, the dog being disposed at an acute angle to the arm. With this implement one person may readily secure flooring, sheathing or ceiling boards in place with one hand, driving the nail with the other hand.

Agricultural.

THRASHING MACHINE ATTACHMENT.—William Taylor, Carman, Canada. This is a band cutter and feeder which may be quickly attached to any thrashing machine, the band cutter being readily and positively adjustable to or from the feed belt, as required in different kinds of grain. When the thrasher is not in use the conveyer may be folded down and locked out of the way of the tram. A governor in connection with the attachment automatically stops the machine when the speed drops below a certain degree, thus preventing the clogging of the machine and insuring a uniform feed.

THRASHING MACHINE ATTACHMENT.—David Harper, Scott County, Ill. (Post office Neelyville, Morgan County, Ill.) This is a self-feeder and band cutter consisting of a shaft tapered in each direction from the middle, and provided with a series of threaded knife seats and a like series of knives having threaded openings differing in diameter according to the different locations of the knives on the shaft. As the gavels of straw-bound grain are thrown upon the feed board the pivoted teeth of the elevator carry them up to the rotating knives, where the real teeth assist in forcing them along and hold them down on the cutters.

GRAIN DRILL CLEANING ATTACHMENT.—Edward J. Kemper, Hermann, Mo. This inventor has devised a simple and inexpensive attachment whereby the hoes of a grain drill may be quickly and conveniently cleaned from foreign matter, such as weeds or soil adhering thereto. This cleaning is accomplished without trouble by the driver of the machine, by means of foot levers so arranged that any one of the hoes in a drill may be passed in cleaning engagement with its cleaner, without interfering with any of the other hoes carried by the drill.

Miscellaneous.

SPIKE PULLER.--Linville McC. Shattuck, Brookline, N. H. An upright bar or lever with a fixed yoke near its lower end has side toes adapted to rest on a railroad rail, while an inner yoke is pivoted at its lower end to the fixed yoke. A pair of opening and closing spike-pulling jaws are pivoted together, and a series of links connect the jaws with and suspend them from the inner yoke, springs operating to close the jaws. The tool is a most efficient one, the greater the resistance offered by the spike, the firmer being the grip of the jaws.

SHADE ROLLER BRACKET.—Charles F. F. Flos, Brooklyn, N. Y. This bracket consists of a base fitted to slide upon a support, a shank projected from the base having its free end adapted to receive the trunnions of a shade roller, while a brake is projected from the outer surface of the shank in direction of the base support. These brackets may be quickly adjusted to rollers of any length, and need no auxiliary fastening devices when adjusted. They are durable and inexpensive, and do not mar the window frame to which they are applied.

GUARD FOR SLIDES OF REPEATING WATCHES.—George E. Humbert, Brooklyn, N. Y. This invention consists of a segmental bead or beads on the center of the watch casing, to form a guideway or guard for the slide to prevent foreign matter, such as threads and other substances, from passing under or catching on the slide, to bend or otherwise injure it.

SHIELD.—Thomas Keely, Memphis, Tenn. This is a device for use on express cars, vaults, buildings, etc., to enable an occupant to resist attempts at robbery, or for purposes of defense against an enemy. It consists of a port closure comprising a bearing in which freely turns a carrier supporting the barrel of a firearm. Peep holes permit the occupant of the vault or safe to view the entire surroundings, and the device facilitates firing in any desired direction.

LOGGING SYSTEM.—Richard Lamb, New York City. This inventor has designed a tramway especially adapted for hauling logs from within woods or swamps and delivering them for transportation or to a mill. This invention comprises a bearing cable supported by a bracket constructed to be easily attached to or removed from a support, a car on the cable having a hanging arm and hanging sheave blocks, while a hauling cable resting in the sheave blocks is attached to the hanging arm of the car. The tramway can be readily put up in any swamp or forest and as readily removed.

GATE.—John F. Ferris and Warren M. Thomas, North English, Iowa. These inventors have devised an improvement in farm gates, providing a gate which may be opened from either side of the fence by drawing downward upon a handle lever at one side or pushing up the lever at the other side, when a swing lever is swung upon its pivot, and a link connected with the lever draws on the free end of the gate to lift it from the keeper. Although the gate may be readily opened and closed by one passing through, it is a difficult matter for an animal to open the gate.

BAKING POWDER CAN AND MEASURE.—Henry R. Brown, Greenville, Tenn. This improvement consists of a horizontal cylindrical body with a bottom outlet closed by a measure, spiral brushes being supported in the body, while a sieve is located at the central outlet opening, whereby the material will be thoroughly mixed and the powder withdrawn without undue exposure of that remaining, the powder being mixed and sifted as discharged.

ELEVATOR HATCHWAY GUARD.—John W. Burdwin, Chicago, Ill. This hatchway inclosure is fitted with an arm adapted to be raised by hand when the car is at the landing at which freight is to be unloaded or passengers discharged, and the arm is so made and connected with a counterbalance that when it is raised the car or platform will hold it in elevated position. When the car or platform passes the hatchway, either up or down, the arm automatically drops to a position to protect the hatchway. The device is more especially designed for hatchways of freight elevators, and is inexpensive and trustworthy.

HEATER.—Harriet C. Cowdrey, New York City. This is a simple form of heater, more especially designed for use in halls, etc., where sufficient heat may be obtained with the aid of this improvement by the employment of a lamp, and without vitiating the air. The lamp is supported in the lower part of a sheet metal shell closed at the top, with open bottom and low down side slits, above which is a door with mica panel, while near the top of the lamp chimney is a second row of slits and shields, whereby a portion of the heated air is deflected into the room, the smoke, gases and odors being carried off by a pipe leading either to the chimney or through a window.

HOOF WEIGHT.—Frank D. Scott, Mount Morris, Mich. The block to be secured to the hoof, according to this invention, has a longitudinal recess in its inner face, in which is a spring latch consisting of a plate spring with a lug received by an opening in the block, while a releasing lever has a shank in the outer face of the body, with a recess in its head into which the end of the plate spring is received. The latch is not affected or released by any jar, the parts are all strong and durable, and the device is readily applied to or removed from the hoof without removing the shoe.

CASH REGISTER.—Charles J. Passick, Seward, Neb. This is an improvement in a formerly patented invention of the same inventor, perfecting details of construction and particularly the registering mechanism, that the machine may work more positively and efficiently.

TAIL BOARD CATCH FOR DUMPING VEHICLES.—Henry B. McKee, Brooklyn, N. Y. According to this improvement, a hook journaled on the tail board is adapted to be engaged by an oscillating catch journaled on the cart adjacent to the tail board, there being a rod connection between the catch and a stationary portion of the cart. The device securely holds the tail board closed until the cart is dumped, when the tail

board is automatically released to prevent the escape of the load.

GRIP BLOCK.—George S. Fouts, Aberdeen, Washington. This device is designed to operate as well on a rod or chain as on a cable, and also for drawing bridge rods, etc., together, or for hauling. It has a recess with converging walls, in which fit keys having racks, there being roller bearings between the keys and the walls, and pinions, each meshing with one of the racks of the keys and connected to turn together.

SHOE POLISHER. — Herman Parsons, Savannah, Ga. This device consists of a bail-shaped handle having square-sided loops formed on its ends to facilitate retaining a strap under tension. The device is designed to facilitate the polishing of russet, patent leather and enamel shoes.

WATER HEATER AND RANGE.—Isaac N. Hall, Mediapolis, Iowa. This improvement consists of an upper water-distributing chamber, pendent feed pipes bent to form a fuel-holding pot, their ends extending inward to form a grate portion, while a centrally disposed water-heating chamber connects the ends of the grate portions of the pipes. The construction is such that a large quantity of water can be heated and forced up through the pipes with but a small outlay of fuel.

DAMPER FOR STOVES.—Ernest C. Cole, Council Bluffs, Iowa. This invention has especial reference to "air tight" stoves, where the draught openings are to be closed as tightly as possible, and the damper consists of two concentric pipes arranged to form an annular tapering space between them, and having coincident air holes in combination with an adjustable tube section closed at one end and adapted to pass between the concentric pipes to cut off communication between their coincident holes.

DESIGN FOR A CARPET.—Walter B. Brown, Newark, N. J. The body and border of this carpet are decorated with connected leaf scrolls, reversely curved, rosettes and leaf figures.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6169) F. M. S. writes: Will you please give me the best method of putting fire brick lining in an arch? I have a 48 inch tubular boiler 14 feet long, and find it hard to keep the lining in, especially in the front. Is it best to put salt in the fire clay? I also have a 10×15 slide valve engine. It is set about 250 feet from boiler. The valve as it is set at present has no lead. The eccentric stands at 90 inches. Would I save any steam or lose any power by advancing the eccentric enough to give a little lead? A. For lining a boiler furnace use the best fire brick that can be procured, free from warp and with a sharp mould. Lay the brick as stretchers as close as possible, and breaking joints. Use pulverized fire brick, which can be purchased from the fire brick makers, or the old brick can be pulverized in a mortar or iron pot as fine as ordinary mortar sand. Sift, to remove all lumps, mix to a mortar with ¼ good fire clay and water. Use no salt or other flux, press and rub the bricks as close as possible; the least thickness of mortar joint makes the most durable lining. If there are any old headers running into the outer wall, they should be used, if in good order, or others inserted at 2 to 3 feet above the grate. The closing in at one or two courses below the lugs should be done by uncovering the top of the wall each side of the lugs, so as to make a good bearing weight on the lining wall at the top. This is much better than to wedge in the upper course.

(6170) G. M. B. says: Two dynamos with the same size pulleys are run by two belts from the same engine pulley, one belt being run over the other; do the two dynamos run at exactly the same speed? If not, which runs faster? A. The dynamo with the outside belt runs the faster by the difference in the circumference of the pulley and the circumference of the enlargement of the pulley due to the thickness of the inner belt.

(6171) W. J. C., Queensland, writes: I have a 100 feet head of water which I wish to utilize to drive a 10 head stamper battery, requiring say 45 actual horse power. The water to be conveyed through pipes a distance of one thousand yards. What size Pelton wheel and pipes would be suitable? The smallness of pipes being greatest consideration. Would I lose power by reducing size of pipes near discharge end? What size pipes and wheel would develop 25 actual horse power under same circumstances? A. For 45 horse power, a wheel 6 feet diameter of the Pelton or other good hurdy-gurdy type should be used; 398 cubic feet of water will be required per minute giving a wheel velocity of 125 revolutions per minute. With 3,000 feet of 24 inch pipe the water velocity will be 2·2 feet per second, with a loss of head by friction of five feet, making the working head 95 feet. Pipe may be tapered for a short distance from the nozzles to advantage. The nozzles should be two, each of 2¾ inch diameter. For 25 horse power, same head and distance, a 4 foot wheel, using 176 cubic feet of water per minute, will be required. Will run at 180 revolutions per minute. The pipe should be 16 inches in diameter, giving a velocity of 2·2 feet per second, with a friction loss of head of 5½ feet, making the working head 94½ feet. For this wheel and power one nozzle of 2⅝ inches diameter or two nozzles of 1⅞ inches diameter will be required. Smaller pipe than above stated will largely reduce the working head and power.

(6172) Denver Club asks: Will you please state in your columns what the chances are of throwing a given two numbers with two dice, for instance a 5–4? A. The chances of throwing two specified numbers with dice are a multiple of the total numbers, or 6×6=36, one chance in 36.

(6173) J. B. J. says: Cannot phosphorescent light and sunlight be stored or absorbed by some material that will give it out again, and cannot this fact be made of practical use? Did not your paper publish some facts of the kind? If so, in what issue? A. Barium sulphide, calcium chloride, calcium sulphide, strontium sulphide, and phosphureted oil are all phosphorescent substances. Luminous paint is of some practical value; it is described in SUPPLEMENT, No. 497. Our "Scientific American Cyclopedia of Receipts, Notes and Queries" contains information on this subject.

(6174) J. E. S. asks if white plaster images, statuettes, or busts can be made washable without destroying or affecting the absolute whiteness of same, and if so, how? A. Heat and dip in melted paraffine, polish with a woolen cloth.

(6175) D. H. B. asks: What preparation will remove japan from finished work after it is baked and leave the metal clean and in good condition to be again coated with japan? A. Try using a saturated solution of caustic potash in water.

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