SCIENTIFIC AMERICAN

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NEW YORK, APRIL 25, 1891.

[$3.00 A YEAR.
WEEKLY.

U. S. COAST LINE OF BATTLE SHIPS.

The unnamed battle ships, Nos. 1 and 2, are now in course of construction at the Cramp shipyard in Philadelphia. The contract calls for their completion by Nov. 30, 1893.

These vessels are being built under authority conferred by the act of Congress making appropriation for the naval service, approved June 30, 1890.

PRINCIPAL DIMENSIONS.

Length on load line	348 ft.
Breadth, extreme	69 ft. 3 in.
Draught of water (level keel)	24 ft.
Displacement	10,200 tons.
Maximum speed	16·2 knots.
Sustained sea speed	15·0 knots.

These vessels are to be built of steel; to have a double bottom for the distance of 196 feet, extending the length covered by the machinery and magazine spaces; all the vital portions to be amply protected; and every feature being provided to enable them to cope successfully with vessels of the heaviest armor and armament.

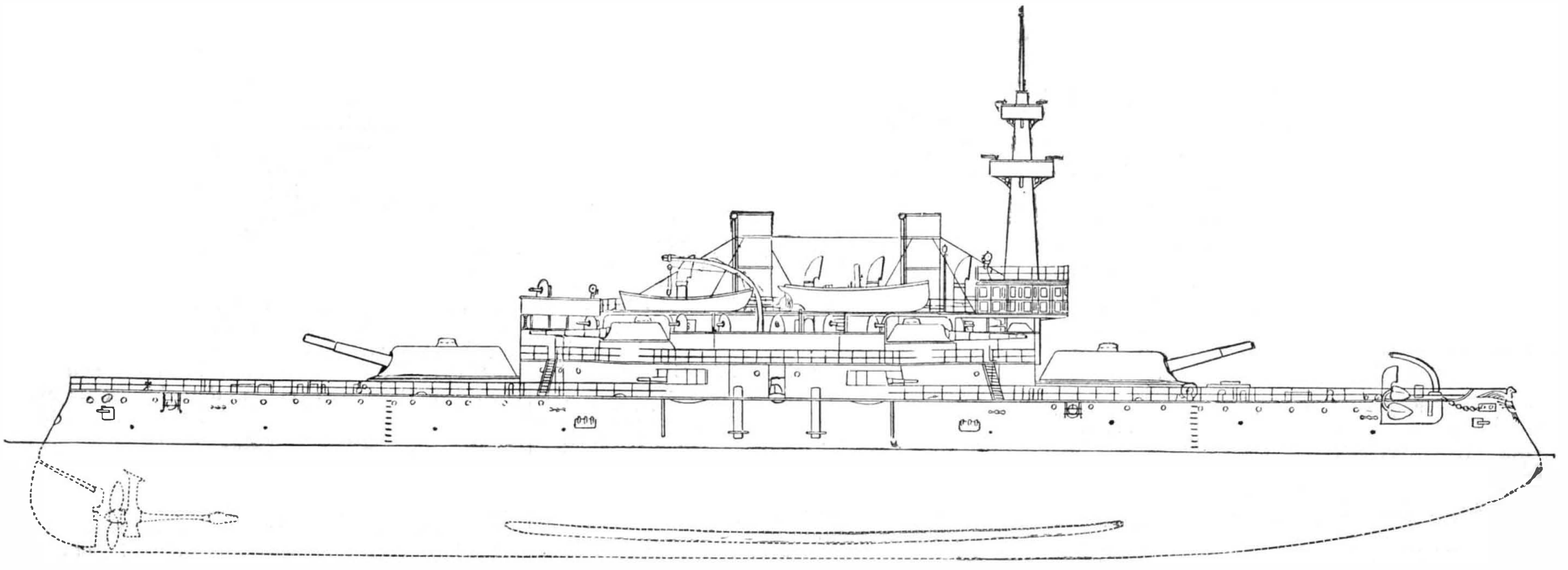
The forward and after turrets for the 13 inch guns mark the extremities of obstructions upon the main deck; from these points forward and aft to the ends of the vessel respectively, no further obstacles present themselves to an uninterrupted fire; means having been taken to remove or turn down any erections which might obviate this end.

Between the turrets for the 13 inch guns there is a superstructure in which are placed the 6 inch guns; and above, or upon the deck erected thereon, are placed the 8 inch guns.

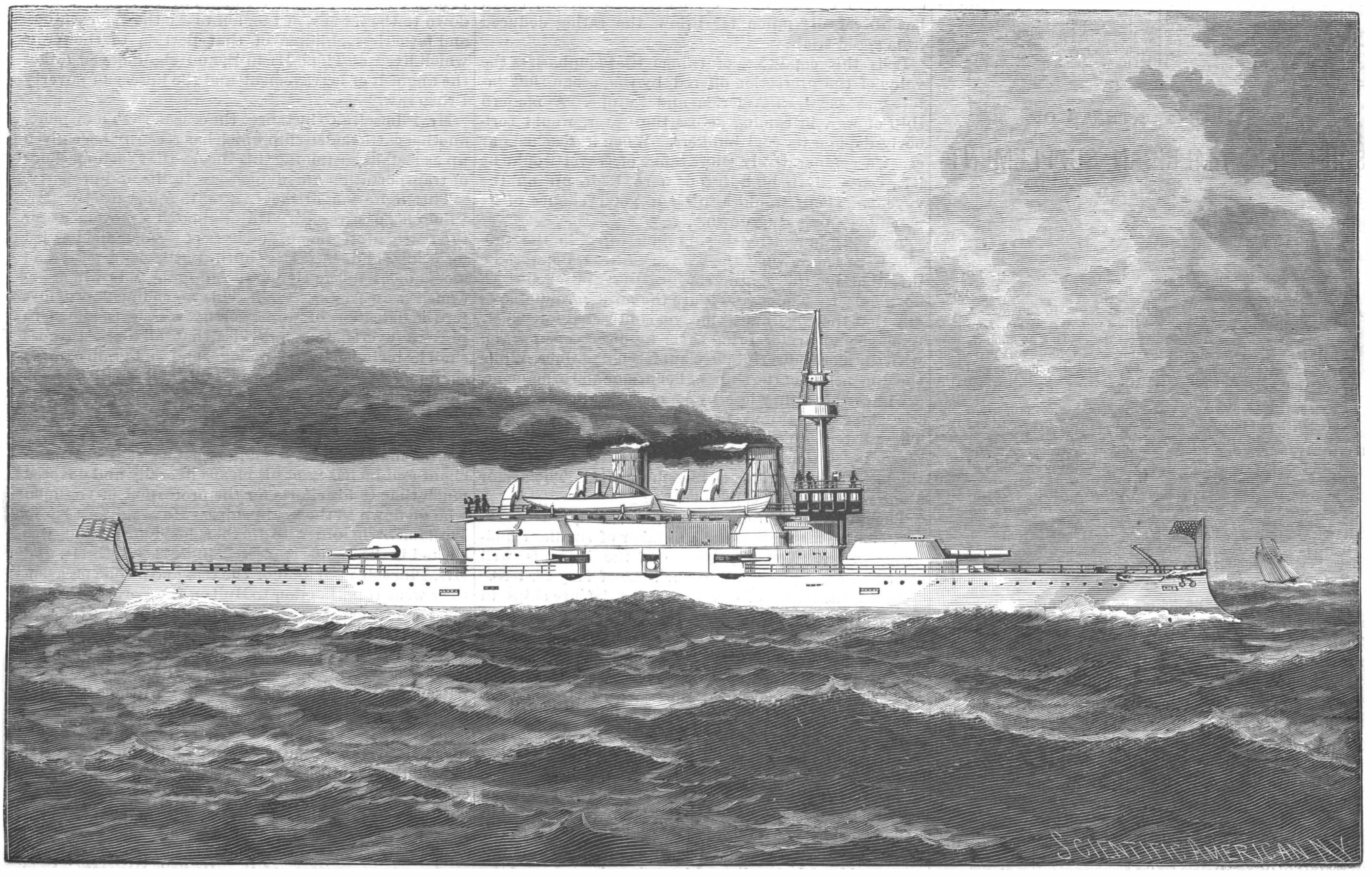
A battery of 6 pounders is arranged along the top of the hammock berthing and bridge, and 1 pounders are placed forward and aft on the berth deck. The double-topped military mast is cone shaped, placed on top of the conning tower just abaft of the forward 13 inch gun turret, two 1 pounders being placed in the lower and two Gatling guns in the upper top respectively.

There are six powerful search lights arranged along the sides, to locate the enemy at night and to guard against small boat attacks under cover of darkness.

(*Continued on page* 262.)



SIDE ELEVATION OF THE SHIP.



THE NEW LINE OF BATTLE SHIPS FOR THE U. S. NAVY.—THE SHIP AT SEA.

Scientific American.

ESTABLISHED 1845.

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NEW YORK, SATURDAY, APRIL 25, 1891.

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THE UNITED STATES' POSITION IN A DEFENSIVE WAR.

The recent diplomatic correspondence between the United States and Italian governments, in connection with the New Orleans riot, if such term may be applied to that outbreak, has awakened attention to the relative power of the different navies of the world. While there has been no well-founded apprehension that war between this country and Italy was imminent, the suggestion of a possibility of the menacing presence of Italian war ships in these waters has reminded us forcibly of our weakness at sea and on the coasts. To-day the three thousand miles of ocean are our best protection against European powers. They operate now, as they did in the Revolution, to make an energetic defense possible with apparently inadequate means. Fortunately the supposition of war at the present time or in the near future is entirely problematical. The necessity for actual measures of defense is no greater now than at any recent time.

In establishing a navy the United States has begun with the construction of unarmored cruisers, protected partly by deflecting steel decks and coal bunkers. Great success has been attained with these, and their speed and general reliability have been adequately proved. No country has surpassed them. The next step is in the direction of armored fighting ships.

The United States high-speed protected cruiser No. 12, now building, is the representative of the connecting link between the ships of the so-called White Squadron and the armored line-of-battle ships alluded to. It is to be 400 feet long, with 21 knots sustained speed and 20,000 sustained horse power. It can carry 2,000 tons of coal, disposed in part in lateral bunkers so as to protect the vital portions of the ship as far as possible. This amount of coal will keep the ship at sea for 109 days, steaming at a speed of 10 knots. Such a ship is a commerce destroyer, and would do immense damage to an enemy's shipping in a single cruise. Three line-of-battle ships, with heavy armor, are also in process of construction by the United States.

The efficiency and value in war of the heavily armored fighting ship of to-day is practically unknown. In the great navies each vessel has its rating. The armament, armor, and speed are the controlling factors to determine her position, offensive and defensive. But to obtain a more practical idea of relative capabilities, trial maneuvers have been instituted by different governments. While one object of these trials has been to try the defensive powers of coast batteries and harbor defense ships, the sea-going qualities of the squadrons have been subjected to the most exacting tests—to tests assimilated to the conditions of actual war.

The result of these operations has been to show that the war ship of the navies of the day, whose value in action is unproved, as a sea-going vessel is seriously wanting. In the English autumn maneuvers, ship after ship has broken down, boilers have leaked, difficulties in coaling have been experienced, and speed has universally fallen far below the rating deduced from speed trials.

It is this condition of things that emphasizes the value of the protection offered by the ocean that intervenes between America and Europe. A modern ship of war, in coming across the water, would seriously deplete its coal bunkers. When it reached our coast, a comparatively short range of travel would be left, especially if high speed were kept up on the voyage. There would also be a good chance of its machinery breaking down.

The coast line of battle ship illustrated in the present issue shows what the United States is doing to be prepared for the contingency of the approach of a hostile fleet. These vessels are the most formidable of any that the government has yet contracted for. Their tonnage and armor bring them in direct comparison with the more powerful vessels of foreign nations. While the dimensions of the ship, of her armor and armament, are impressive, they lose by comparison with the great war ships Italia and Lepanto of the Italian navy. These sister ships are 400 feet 6 inches long, and displace 13,480 tons. The armor in places is 21 inches thick. The side armor is 18 inches thick. The armor alone weighs nearly 3,000 tons.

The guns include four 110 ton guns of 17½ inch caliber, eight 6 inch guns, and a number of smaller rapid-firing pieces. The appearance of the ships is well shown in a cut published in our issue of May 26, 1888.

Again, the status of our new coast defense ships in the matter of armor is indicated by the fact that armor 18 inches and more in thickness is carried by 19 English, 13 French, 10 Italian and 7 Russian ships. The Duilio and Dandolo of the Italian navy, each of 10,960 tons displacement, and each including in its armament four 17¾ inch rifles, are good representatives of foreign practice. It is with such ships as these that our new vessels might be called upon to cope.

But figures alone are deceptive. Immense advances in naval engineering have been made here and abroad during the last few years. Eighteen inch armor of nickel steel is far superior to the plates supplied to the ships now in commission. Two to four inches advantage could safely be allowed in rating the armor of the new ships. The speed will undoubtedly be far better, comparatively, than in the older ships, although it may be rated as less. Thus the Italia succeeded in attaining 17·8 knots on her speed trial. But if put in commission, it would not be surprising if a falling off of several knots were to ensue; at least this is the lesson of every practical trial of the great navies during a number of years.

Again, modern ammunition is far in advance of the work of even five years ago. The value of the largest Armstrong guns, such as are used on the Italian ships cited, is utterly problematical. The tendency now is to abandon the larger calibers and endeavor to secure sufficiently good results with smaller pieces. In the shock of action, heated by the combustion of their charges, with every vent rapidly scored by escaping portions of the charge, the large built-up guns rapidly deteriorate. It is more than probable that the modern 13 inch guns of the American ships would excel in fighting power the heavier pieces of the Italian ships.

The shallowness of our harbors and the narrowness of the entrances thereto protect our cities and coast to some extent. The Italia and Lepanto draw 30 feet, and could not well get past Sandy Hook at the entrance of New York Harbor, many miles from the city. Theoretically they might lie offshore and send shells into New York, but whether they could do so with any practical results is doubtful. A large number of shots would be required to do extensive damage, and it is uncertain how many discharges a 17½ inch gun may stand before disablement. It would not do to send a ship across to fire in a bombardment a comparatively small number of shots before being reduced to the smaller pieces and machine guns for protection, its career as an offensive element thus terminating.

SAMUEL PLIMSOLL.

Samuel Plimsoll, who is known in England as "the sailors' friend," recently arrived in this country. He is prosecuting an inquiry into the business of transporting live cattle across the ocean. In a letter dated in New York and recently published in the London *Times*, Mr. Plimsoll claims that a certain class of ship owners are so indifferent to the lives of the men that they load their vessels with three tiers of cattle. First the "'tween" deck is loaded from end to end and from one side to the other as close as the animals can stand. The main deck is similarly loaded with cattle which cannot lie down, so close are they, and lastly the upper deck is also loaded in the same way.

Mr. Plimsoll claims that a vessel thus loaded becomes "crank," rolls badly and is apt to become unmanageable. "I feared," he said, "such shocking recklessness would be discredited, and so besides inquiring of many people, obtained written testimony." He closes his letter to the *Times* as follows: "It is not quite a year since the Erin sailed, cattle-laden, from this port with 74 men on board, and never again heard from. I went down to the far east of London to see the poor widows and fatherless children of that portion of the crew which lived at Tidal Basin E, and shall never forget the anguish of bereavement and the misery of poverty I then saw."

Mr. Plimsoll also instances the case of the Thanemore, another cattle-laden ship which has recently been given up as lost, as sustaining his theory that such methods of transportation are dangerous to life and property.

This agitation attracts attention because of Mr. Plimsoll's past record. He originated a movement for the better protection of the lives of seamen and battled for it long and earnestly until Parliament passed an amendment to the Merchant Shipping Acts which became law in August, 1876. This amendment provides for the detection of unseaworthy vessels, is aimed to prevent overloading, provides that all deck cargoes shall be included in the tonnage, and that grain cargoes shall not be carried loose in bulk, but shall be kept from shifting, either by boards or bulkheads or by being carried in sacks. The latter object was further secured by the Act of 1880.

Mr. Plimsoll amassed a large fortune as a coal merchant and he has used his means liberally and devoted much time to his efforts for the protection of the men who go down to the sea in ships. He sought a seat in Parliament in order to further his reform, and was elected in 1868 and re-elected in 1872. Both Mr. and Mrs. Plimsoll were fond of the sea, and on one occasion they went from London to Hull on the Yorkshire coast, a voyage which skirts the most dangerous portions of the British shores. The steamer upon which they took passage seems to have been greatly overloaded, and a very severe storm was encountered, the vessel, crew and passengers being in great peril. In gratitude for their escape Mr. and Mrs. Plimsoll resolved to undertake the agitation which resulted in one of the greatest reforms of modern times, and which he still continues. Mr. Plimsoll's new crusade meets with very vigorous opposition. His opponents claim that the carrying of live cattle is not more dangerous than the carrying of other cargo, notably cotton. The business, however, has been made the subject of special inquiry by the department committee of the British Department of Agriculture, while Mr. Plimsoll is making exhaustive investigations on his own account. He went from New York to Montreal, and has since been reported at several points in the West gathering information about the cattle trade in the same indefatigable manner which characterized his efforts when he was laboring to secure the great reforms which have made him famous. He is now 67 years of age.

METAL AS A SUBSTITUTE FOR WOOD IN RAILROAD TIES.

The report of the Forestry Division of the United States Department of Agriculture on the consumption of wood for railroad ties seems to establish the fact that this consumption is a leading factor in the depletion of our forests. Besides many interesting statements regarding the destruction of young trees, the report also contains the results of an exhaustive inquiry as to the use of metal by railroad managers in this and many foreign lands, and this method of construction is suggested as one remedy for the denudation of our forests, which is generally acknowledged to be going on at the present time.

This portion of the report was prepared by E. E. Russell Tratman, C.E. The statistics are given of 25,000 miles of railroad laid with metal track out of a total mileage of the world (exclusive of the United States and Canada) of 187,721 miles, or a relation of 13·12 per cent to this total mileage.

In foreign countries the use of metal for wood on railroads has passed beyond the experimental stage. Practical tests are now being made in this country, and interest in the subject among railroad men is increasing.

A section of track on the New York Central and Hudson River road, about a quarter of a mile in length, was laid with the modified "Hartford" tie. Mr. Walter Katte, the engineer of the road, reports as follows regarding this experiment:

"The ties (metal) were laid in November, 1889. The line has the heaviest kind of freight and passenger traffic.

"Passenger engines, with a weight of 36 tons, on four driving wheels and a driving wheel base of 6 feet, pass over these ties at speeds of 40 to 55 miles per hour. The ties have not been in use long enough for the expense of maintenance to be determined. Apparently it is thus far no greater than with wooden ties. The reason for using these ties was the desire to secure economy over wooden ties, and to obtain a superior attachment of the rails to the ties. The result has so far been quite satisfactory. I am of opinion that the rolled metal tie is essentially a requisite for first class permanent way in this country. Having investigated the relative economy of metal and wooden tie systems for a term of fifty years, I am led to believe, as the result thereof, that upon the basis of 55 cents for a wooden tie and $3 for a steel tie, and under the conditions of traffic and maintenance expense existing on this line, the relative economy is from 8 to 12 per cent in favor of the metal system."

The general adoption of metal in place of wood for railroad ties would check the enormous consumption of the young growth of our forests. On this point Mr. Fernow, of the Forestry Division, makes this forcible statement: "The use of wood, and the method of using it, are largely matters of custom everywhere. In the United States the enormous supplies which the native forests yielded have not only induced a very extensive, but also a very wasteful use of wood, until now we have reached a point when the prospect of reduced supplies makes the study of economics a matter of national concern, and within a not too distant time private interest will also awaken to the need of it."

To inventors, a wide field of study and usefulness is open, in devising good and economical applications of metal for ties and rail connections.

The Lick Observatory.

The Lick observatory, with its large number of instruments and its famous telescope, is now one of the best equipped observatories in the world. The great telescope has proved to be all that was expected, and has repeatedly proved its unsurpassed power. A recent circular issued by the director, Prof. E. S. Holden, discloses the work in hand there, the great opportunities for future investigation, and unfortunately makes clear its absolute need of funds. It has only five observers, a small number when compared with twenty in the Greenwich, England, observatory, seventeen in Harvard College observatory, nineteen in the Washington observatory, and so on. The great glass, the triumph of Alvan Clark's life, needs better support than this. The demands specifically made are very modest; a computer and an assistant photographic astronomer are all that are asked for. An endowment of $60,000 would secure these and provide for the increase of their rather limited salaries in the future.

We can but hope that Prof. Holden will find his demand attended to, and that success will attend his efforts for the Lick observatory.

Audubon.

Under the auspices of the New York Academy of Sciences a movement has been inaugurated to erect a monument to the memory of the great naturalist whose name heads this article. An Audubon monument committee has been appointed by the Academy, a design has been prepared for the monument, and it is now the desire of that body to raise a sufficient sum of money to erect it. It is estimated that $10,000 will be required. Such sum is but a small tribute to the services of the incomparable Audubon, the prince *par excellence* of field naturalists, and one who combined with his scientific attainments the attributes of the refined sportsman. He studied bird-life in the field. He was not content to work within the closet, and to be a mere classifier of specimens. The scope of his researches included all the habits of birds, their food and even their characteristic positions. His unsurpassed illustrations were the result of study from life, not from specimens, and inaugurated a system of study of natural history that hitherto has had too few followers. Its laboriousness and the patience it exacts from its votaries have probably deterred many from its ranks.

To-day the remains of Audubon rest in Trinity cemetery, within a short distance of his home and of the park named after him. In 1851 the interment took place, and as yet there is no monument there. The neglect thus manifested should be soon disposed of. It is hoped that the monument may be erected this fall. The treasurer of the committee is Dr. Thomas Eggleston, of Columbia College, N. Y., who will gladly receive contributions from all interested.

Hindrances to Inventive Progress.

What are the chief discouragements to inventive progress? One of these is the hindrance imposed by the existence of inferior methods for accomplishing works of the same class to which improved means would apply. To this is allied the suppression of valuable patented devices in the interest of monopolies, their suppression in the interest of labor, and the competition among inventions themselves. Great as the influence of the patent system has been and is, in the encouragement of invention, it has nevertheless been very considerably abused in enabling the purchase and suppression of valuable inventions by parties interested in maintaining methods that the new means would otherwise supplant. Persons controlling corporations, or exerting, either directly or through connections, a powerful influence therein, are often enabled to secure a preference for one device over something that may be far superior. Great corporations enjoying monopolies of their business are likely to be indifferent to the improvement of their service in the interest of their patrons and the employment of better means for the convenience of the latter, unless they have been thoroughly taught that it is for their interest to do so. The telegraph and telephone monopolies in this country are instances of this; the former resting upon the assimilating capacity of a large accumulation of capital in one enterprise, and the latter upon the proprietorship of a basic invention. The practical adoption of any improvement in the telegraph or telephone would not at present be possible without the consent of these companies. The supplanting of one form of machinery by an improved form, and the injury or destruction of enterprises with their capital invested in the old, is one of the greatest elements of cost or waste in modern production, and manufacturers are obliged often to figure very closely to see whether it would profit them to adopt some improved method.

It frequently happens that no sooner has a new way of doing something been perfected and set in operation than some one else comes forward with still another means of reaching the same result, and either by his competition prevents the other from reaping fully the anticipated harvest of his skill, or supersedes the former method entirely and ruins the enterprise. The opposition of labor to the introduction of new inventions is very old. From the early days of the power loom and the railway down to the present time the story has been the same—on the part of the workers the most strenuous opposition to the employment of labor-saving devices, for fear of being thrown out of work. Experience has shown us that, on the whole, there has been no loss of occupation for the working classes from this cause, since the increased production attendant upon the use of labor-saving machinery and the creation of new industries causes a demand for labor under the new conditions at least equal to that existing before. Yet nearly every mechanical device that does the work formerly performed by several persons can hardly fail to effect great injury to many individuals, and even to large classes of workingmen, by reducing them from the ranks of skilled to unskilled laborers, and disturbing the equilibrium of industry.

The progress of invention would be, doubtless, very much more rapid were it not for this opposition on the part of labor, and production would be correspondingly cheapened. Organized labor has of late years exerted a powerful influence against the substitution of mechanical processes for the more slow and costly hand work. That strong organization in the boot and shoe industry, for instance, the lasters' union, forbids the employment of machinery to do any part of the work within its province, and, in consequence, some very costly devices in shoe shops have been compelled to stand idle. Owing to the objection of the Knights of Labor, the use of power presses in the engraving department of the National Bureau of Engraving and Printing at Washington is not allowed, although the cost of production is enormously increased to the government by the employment of hand presses. Labor cannot be blamed for this opposition in its own behalf, any more than capital can be blamed for combating any measures that tend to limit its liberty of action.—*Sylvester Baxter, in the Cosmopolitan for April.*

The Relation of Bacteriology to Nose and Throat Diseases.

At a recent meeting of the British Laryngological and Rhinological Society, Dr. John Macintyre, of Glasgow, gave an interesting lecture, introductory to the discussion on the relation of bacteriology to the diseases of the throat and nose. In the course of his lecture Dr. Macintyre discussed the general facts concerning bacteriology, such as classification, vital phenomena, etc., and stated the arguments for and against the vitalistic theory of disease. He demonstrated a large number of specimens of well known forms of micro-organisms under the microscope, as well as numerous micro-photographs on the screen, and made special reference to those of interest in throat and nose work. He showed several found in the mouth and nose of healthy people, which are apparently harmless, and others found in diseases where there is decomposing material such as in ozæna. He referred to the specific forms found in diseases of the lower part of the respiratory tract, as tubercle, lupus, diphtheria, pneumonia, and suppurative diseases. Lastly, he discussed the question how protection was to be got from the diseases associated with micro-organisms, noting the result of inoculation, and criticised the theory of phagocytosis. He explained some interesting experiments now being made in Glasgow with reference to the hypodermic injection of chemically pure carbolic acid, which bid fair to demonstrate the possibility of rendering the effects of certain pathogenetic micro-organisms inoperative within the body. In considering the possibility of rendering the tissues unsuitable for the growth of organisms after their entrance into the system, he cautioned his audience not to be carried away too hastily by Koch's or Liebreich's methods of treatment for tuberculosis.

[The above, is from *The Lancet*, London, considered good medical authority. The remedy proposed for ordinary throat and nose diseases may be worthy the consideration of physicians who have cases of la grippe under their charge. It is a fact that the latter disease is very prevalent in a great many of our populous places, and that it seriously affects the nose, throat and respiratory organs, and it is not improbable that the cause may be produced by some form of bacteria which the remedy proposed may relieve. But persons should beware of the use of carbolic acid in the manner suggested, except under the direction of a skillful physician.—ED.]

Dangers of Bad Steering Gear.

A decision given out recently by Judge Swan, of the United States district court in Detroit, contains a warning to vessel masters to look after their steering gear. On April 28 of last year, the steamship Cayuga, entering the St. Clair River, met the propeller Wilson towing the schooner Manitowoc. The steamers passed all right, port to port, but the Cayuga had hardly passed the Wilson when she suddenly sheered, until she caught the tow line of the Manitowoc on her stern. She then scraped down the line until she struck and sunk the Manitowoc. The Cayuga's defense was that the accident was unavoidable. It was claimed that the chain of the Cayuga's steam steering apparatus became suddenly and inexplicably out of order, and that as soon as this was discovered she was reversed at full speed. Upon these proofs Judge Swan decided that the Cayuga was entirely to blame. The Manitowoc showed that the chain of the Cayuga was very improperly adjusted to the quadrant. The latter is a fan-shaped device attached to the rudder shaft, provided with grooves for the chain to run in. It was shown that when the helm of the Cayuga was put hard over one way or the other, the free chain would become so slack as to slip out of the groove in the quadrant and became useless when called upon again in putting the helm the other way, unless replaced in the groove. This Judge Swan held to be very clear negligence.

DECORATING WALLS.—A rich and brilliant effect, according to *Furniture and Decoration*, is obtained in walls intended to be decorated by mixing an equal quantity of marble dust with the lime used in making the plaster. This gives a softness of tint which cannot be obtained with ordinary plaster. In Italy it has long been the custom to give a final coating of marble dust to walls intended to be treated by the wet process.

ROTARY PRESS FOR PRINTING IN COLORS.

A few months ago, when describing Mr. Domery's rotary press for printing several colors simultaneously, we expressed the hope that this would soon be rendered complete, we scarcely suspected that before the end of the year we should see this phenomenon (we might almost say prodigy) of a rotary machine striking off more than a million copies of a journal illustrated with the most diverse superpositions and mixtures of colors, and that, too, without the least admixture and under extraordinary operating conditions. This improvement marks a new page in the history of rotary presses, which we shall sketch in a few lines.

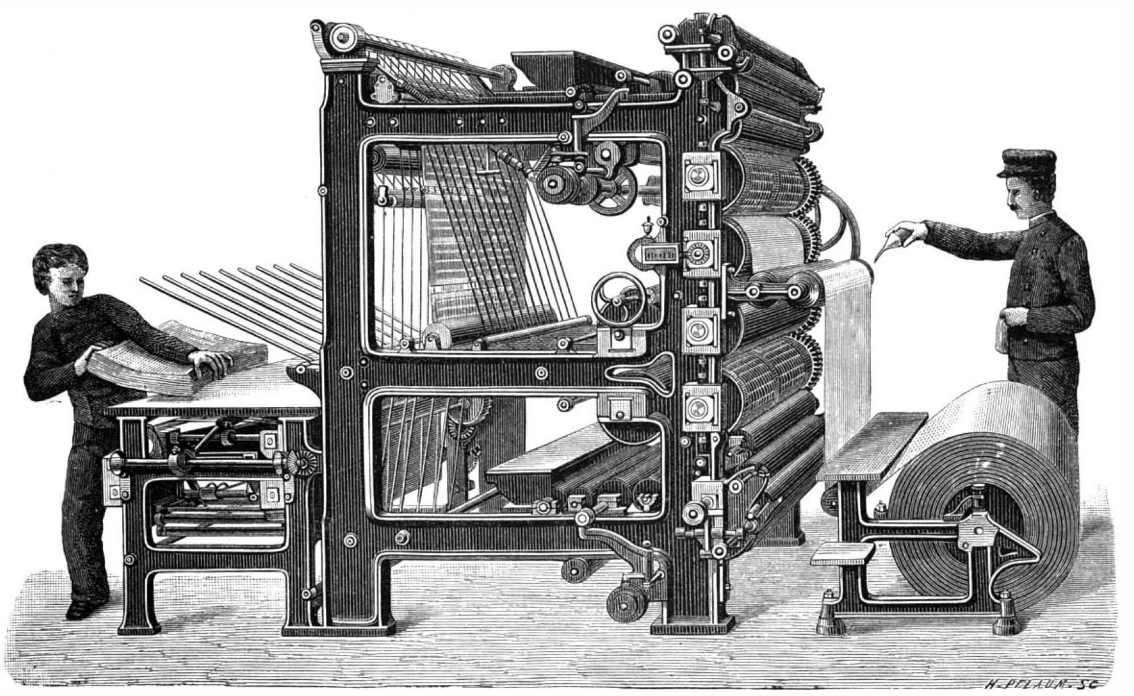


Fig. 1.—ROTARY PRESS FOR PRINTING IN COLORS.

We shall merely speak by way of parenthesis of the first experiments made by Nicholson and Hoe and afterward by Kinsley. The presses devised by these inventors were comparatively crude. The first machine that gave really good results was brought out at Paris in 1867. This was constructed by Mr. Worms, of Argenteuil. At the same epoch, Mr, Derriey sent to the Paris Universal Exposition a machine that attracted much attention by the simplicity and perfect working of its mechanism. Again, another manufacturer, Mr. Marinoni, in January, 1868, installed in the offices of the *Petit Journal* (which at this period was beginning to obtain a large circulation) four rotary presses which were capable, all together, of printing 36,000 copies per hour—a feat that was considered phenomenal at this epoch. From that period, improvements have rapidly succeeded each other, and the presses now employed for the printing of daily papers easily strike off 30,000 copies per hour. Our engraving (Fig. 1) represents a rotary press in operation.

In order that the new machine may be well understood, we give a diagram (Fig. 2) that permits of following the movement of the paper upon the different cylinders, from the starting point of the white paper roller (figured to the right) up to the reception of the printed journal, cut and folded, upon the table to the left. The paper coming from the roller passes under the cylinder, *a*, called the blanket, which presses it against the stereotype plate cylinder, A, which is inked by means of the small rollers shown in the engraving, and prints the recto of the sheet. Thence the paper passes over a second blanket, *b*, which presses it successively against the cylinders, B and C, and gives an impression of the plate upon the verso, and then over the blanket, *c*, and the cylinders, D and E, which continue and finish the impression upon the verso. Then the paper passes between the cutting cylinders, *m* and *n*, whose function is explained in the name. The forward end of the cut sheet is driven toward the folding cylinders, which give it successively two folds and allow it to fall afterward upon the receiving table.

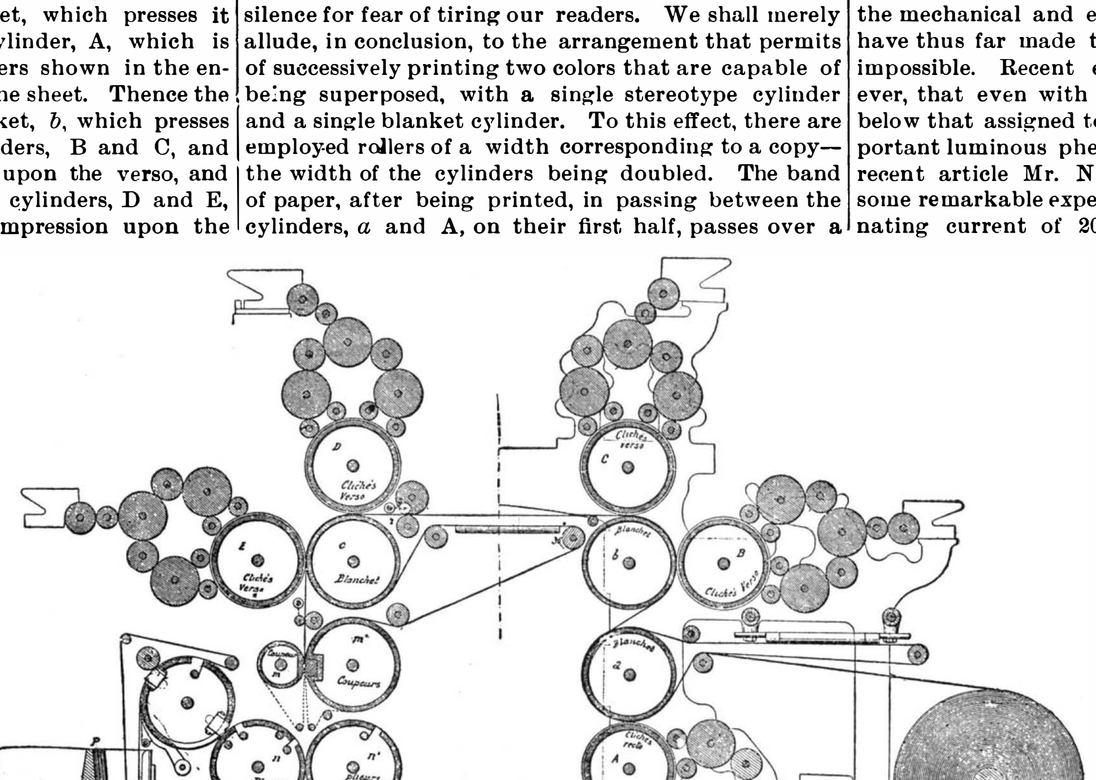


Fig. 2.—DIAGRAM OF THE MECHANISM.

Between the blankets, *b* and *c*, the paper traverses a wide space without being supported. In order to prevent it from undulating, there is arranged in the vicinity of the blanket, *c*, a roller, *r*, that carries balls, *s*, which press against the margins of the impression. As the velocity at the circumference of this roller is so regulated as to slightly exceed that of the printing cylinders, and consequently that of the paper, it results that the latter, far from undulating, will always be somewhat taut, thus securing an exact registering.

From what precedes, it will be seen that the sheet has been printed on the recto by the cylinder, A, and then on the verso by the cylinders, B, C, D, and E, each of which may have been capable of printing a different color, since each is provided with a special inking apparatus.

That is the arrangement adopted, for example, for printing the illustrated supplement of the *Petit Journal.* The recto is entirely reserved for the text, and the verso for the colors. But it is evident that it would be possible to modify this arrangement, and to print in colors on the recto also. It would suffice, in the place of the cylinder, A, to install an apparatus of the nature of the verso cylinders. The press may be arranged for printing two copies broadwise. These copies will then be separated by the cutting disk, which is figured at the top of the last cylinder to the left. It is possible, too, with this press, to obtain a 16 page copy formed of two parts of 8 pages, superposed and folded together with two folds. To this effect, there is arranged above the roller, *r*, a cutting disk, which separates the 8 page parts, one of which descends between the small roller and the balls shown under the cylinders, E and C, while the other entirely covers the cylinder, C, and afterward passes over an arrangement of rods upon which we shall not dwell for fear of complicating our description. On leaving these rods, the band passes successively over two small rollers and finally reaches the cutting cylinders, where it is superposed exactly over the other band. Both descend between the folders after being cut at the same instant. They first receive their first fold, and then their second, and reach the table in the form of a 16 page copy. Still other combinations may be made according to the number of pages that the circumference of the cylinder accommodates. We shall pass them by in silence for fear of tiring our readers. We shall merely allude, in conclusion, to the arrangement that permits of successively printing two colors that are capable of being superposed, with a single stereotype cylinder and a single blanket cylinder. To this effect, there are employed rollers of a width corresponding to a copy—the width of the cylinders being doubled. The band of paper, after being printed, in passing between the cylinders, *a* and A, on their first half, passes over a system of rods (shown to the right of the figure) like the one already mentioned. Thence it returns in passing over two small rollers and engages with the other half of the cylinders, where it receives a second impression upon the same side. It suffices, therefore, in order to obtain two different colors, to divide the inking roller corresponding to the cylinder, A, into two parts.

The great difficulty of this system of printing in colors has always been the question of impasting and the quick drying of the colors. The first part of the problem has been solved in the press just described by a special arrangement of the printing plates. Without entering into long details upon a patent which is as yet not made public, we can say that this arrangement consists in striating the plates. The drying of the colors is a more difficult question, at least as regards bright tints. But at the point that has been reached, it may be foreseen that all difficulties will soon be overcome. However this may be, the press, as now being constructed, is capable of rapidly printing a journal illustrated in colors, and a progress is here made that is a new success for rotary presses, and that solves one of the most interesting problems in printing—that of the cheap striking off of illustrated journals.—*Les Inventions Nouvelles.*

Photo. Transfer.

Place the chromate paper containing the photo. for ten minutes between two sheets of paper which have been saturated in a 1-5 solution of nitric acid in water. Upon the zinc plate place a piece of paper which had been previously soaked in nitric acid, and pull through the hand press, which will cause a slight etching of the surface of the zinc plate. The sheet of paper is taken off and all traces of nitrate of zinc are carefully removed from the zinc plate by means of a blotter.

The photo. is then transferred upon the plate, gummed over, etc. It is then rubbed in with ink, which has to be thinned with olive oil, and when all details appear sufficiently strong, the plate is etched with a preparation made by adding a small quantity of phosphoric acid to a gum solution. When a drop of such a preparation placed upon a polished zinc plate discolors the same and affects its purity, then it is of sufficient strength.—*Lithographic Art Journal.*

Alternating Currents of High Frequency.

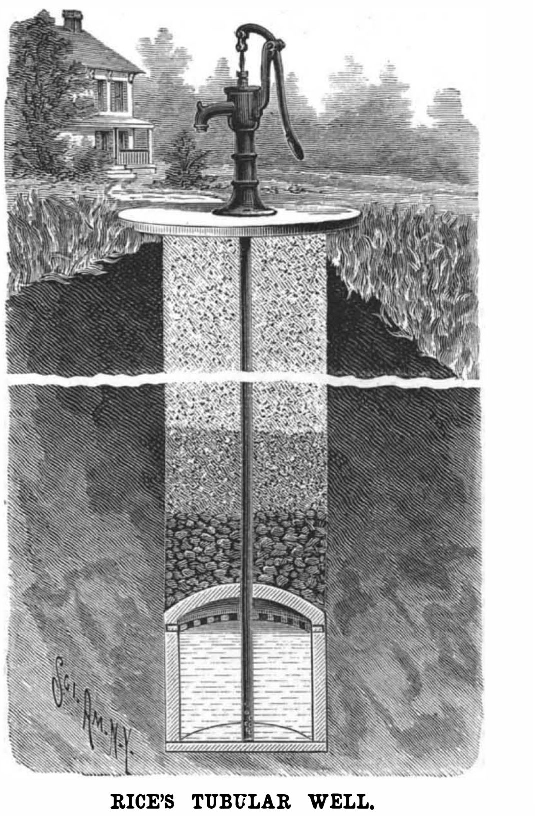
It has more than once been suggested that if we could but construct an alternating machine capable of giving us a frequency of alternations approximating to that of light, we should be able to obtain luminous effects without the accompaniment of heat, and thus obtain an ideal method of illumination. Unfortunately, the limits of the strength of materials, and of the mechanical and electrical means at our disposal, have thus far made the realization of this suggestion impossible. Recent experiments have shown, however, that even with a frequency of alternation far below that assigned to the light-producing waves, important luminous phenomena are observed, and in a recent article Mr. Nikola Tesla gives the results of some remarkable experiments effected with an alternating current of 20,000 reversals per second. In these the condenser action of lamps and conductors is very forcibly brought out, and points to the fact that the condenser will play an important part in the methods of distribution of light in the future, if not, indeed, of power. Referring to the same subject, Prof. Elihu Thomson gives results of experiments made in the same direction, which cannot fail to draw attention again to this subject, and which, taken in connection with the recent inaugural address of Prof. Crookes, illustrate forcibly the tendency of modern work in the attempt to obtain light without heat. Prof. Thomson also contributes a valuable note on the physiological effects of alternate currents of high efficiency, in which it is shown that at very high rates the current is less dangerous than at the lower rates now in vogue.—*Electrical Engineer.*

Stockings of Human Hair.

The Anthropological Department of the Smithsonian Institution has received from Dr. Macgowan a pair of stockings manufactured from human hair. They are worn by fishermen over cotton stockings (being too rough for the naked skin) and under straw shoes as protection against moisture. Hair unsuitable for textile purposes is collected from barbers' shops and sent to a part of the province for manuring rice fields, which, it would seem, are deficient in silica.

NEW TUBULAR WELL.

Where driven wells are feasible, they have become very popular, because surface drainage into the well is avoided and the entrance of foreign matters into the water chamber is prevented by a thick stratum of earth, but driven wells are objectionable in some places



RICE'S TUBULAR WELL.

on account of the liability of the strainers, the valves, and even the pipe to stoppage by gravel and sand.

To avoid these difficulties Mr. John Owen Rice, of Hutchinson, Minn., has invented and patented a device by which the advantages of the driven well may be secured, while its disadvantages are claimed to be avoided. As will be seen by reference to the engraving, the improved well, which is of considerable diameter, is dug down to the water-bearing stratum, and at this point is built a reservoir of brick, cement or wood, provided with perforations for the entrance of water, and arched over the top. At some point in the arched top of the reservoir, preferably at the center, is inserted a tube which extends from the bottom of the reservoir to the pump above. The lower end of the pipe is perforated to allow water to enter, and the space above the arched top of the reservoir is filled with stone, gravel, and earth, preferably arranged in the following order, stone being placed upon the arch, gravel upon the stone, and earth above the gravel.

With the well constructed in this manner, the water in the reservoir is perfectly protected against contamination from surface drainage or from the entrance of foreign substances, and at the same time gravel, sand, and earth are prevented from entering the pump chamber.

THEATRICAL ILLUSIONS.

An explanation of the illusions employed in theaters is always welcome, and the spectators take more interest in seeing a mystery performed whose hidden working is familiar to them than do those who do not possess the key of the enigma.

We are going to describe two tricks which, though now old, have had much success. The first of these, called the palanquin or stretcher, was employed in an old fairy scene whose name escapes us. It was almost as much of an illusion as is obtained in prestidigitation, and the rapidity with which it was performed did not allow the secret of it to be perceived.

One of the heroines of the play was presented on the stage in a palanquin carried by four slaves (Fig. 1). At a given moment the curtains were drawn and then immediately opened, when it was seen that the actress had disappeared; and yet the palanquin was well isolated on the shoulders of the carriers, who resumed their journey and carried it off the stage.

This trick, which preceded by many years Bualtier de Kolta's experiment, in which also a woman was made to disappear, but by an entirely different process, was performed as follows:

The four uprights arranged at the four corners of the apparatus were hollow, and each contained at the top a pulley over which a cord passed. These cords were attached by one end to the double bottom of the palanquin, and by the other end to a counterpoise concealed in the canopy.

At the precise moment at which the curtains were drawn, the carriers disengaged the counterpoises, which, sliding within the uprights, rapidly raised the double bottom, with the actress, up to the interior of the canopy. The person thus made to disappear was quite slender and took a position such as to occupy as little space as possible. By making the shadows of the mouldings of the canopy and columns more pronounced through painting, and by exaggerating them, the affair was given an appearance of lightness that perplexed the most distrustful spectator.

This illusion appeared extraordinary, and has hardly been surpassed except by the disappearances effected by prestidigitators. The second trick that we shall describe is employed in the *Peau d'Ane*, for producing the fairy robes of the story—color of the sun, color of the moon, and color of the sky—required by the play. In the midst of a brilliantly illuminated procession come two porters carrying quite a large chest by its handles. Having reached the royal throne, they place the chest on the floor and raise its cover, when there is immediately seen a fabric of the color of the sun, that is to say, of a luminous golden yellow, that overpowers the dazzling luster of the cortege. Afterward, two other porters come with a similar chest, which, when opened, exhibits a fabric as if phosphorescent, of a slightly bluish white. The third chest contains the sky-colored robe, that is to say, of a celestial blue, luminous like the two preceding colors. These wonderful fabrics are moved about by the porters, who make them sparkle.

The bottom, B, of each of these chests is capable of being opened over a trap, A, and, by means of an electric light device, C, a powerful ray is directed upon the light and transparent fabric, which seems to be on fire.

The yellow light suffuses the fabric of the same color, envelops it, and incorporates itself with it. After the cover has been shut down upon the stage, the bottom is closed from beneath, the trap is shut, the light is extinguished, and the chest is carried away by the porters.

The same is done with a slightly bluish white fabric, and a white light for the moon-colored fabric; and then with sky-colored tarlatan and a light with a bluish tinge for the sky-colored fabric. These effects, if not the most astonishing, are at least among the most dazzling of any of those that have been employed in the theater.—*La Nature.*

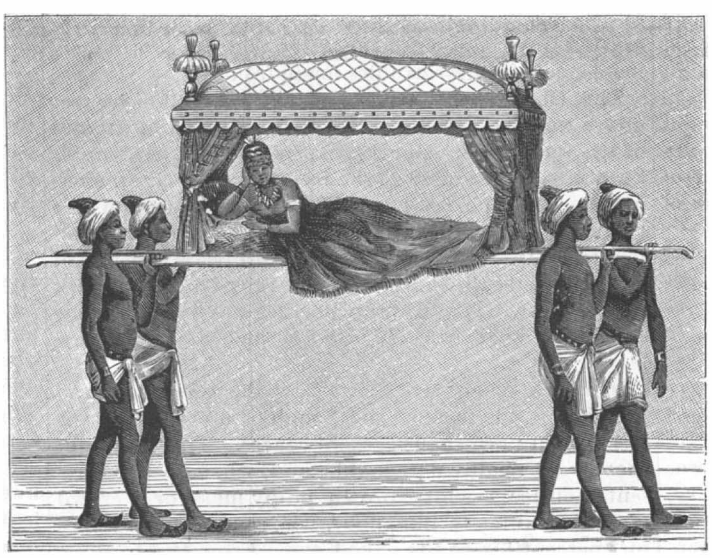


Fig. 1.—THE MAGIC PALANQUIN.

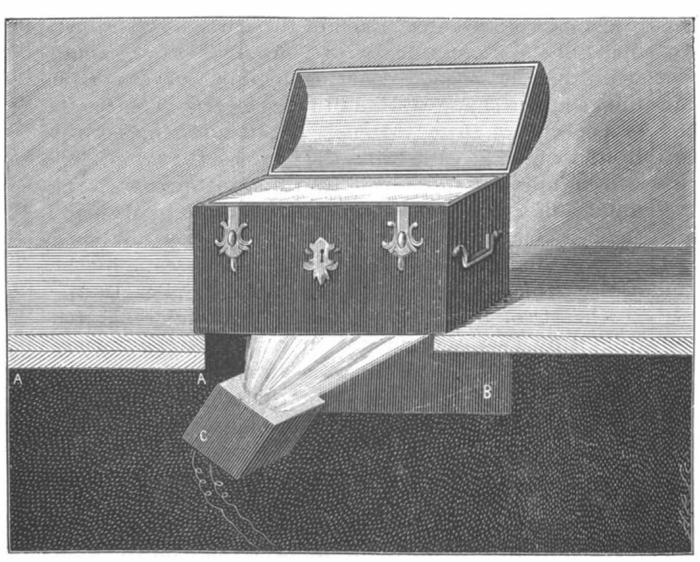
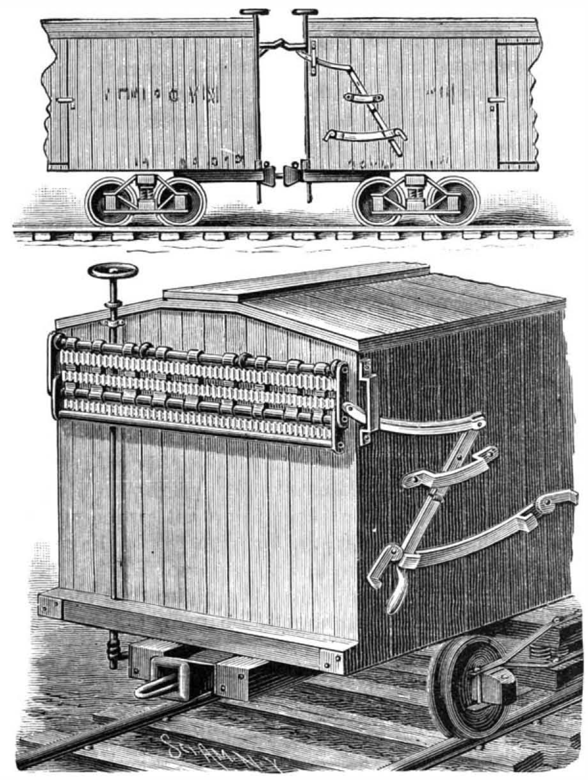


Fig. 2.—THE SUN ROBE IN THE FAIRY SCENE OF THE PEAU D'ANE.

A NOVEL method of strengthening iron castings has been brought out by Mr A. Jepson, of Manchester, England. The process consists simply in casting the metal around a wrought iron core. Thus, for thin plates, like stove plates, a thin wrought iron perforated plate is placed in the center of the mould, and the metal is poured around it. Wire (either straight or in coils), rods, bars, sheets or any form of iron, may be used according to the shape of the casting. It is stated that the close union of the cast iron with the wrought is assured by plating the wrought core with a thin coat of tin.

PLATFORM FOR FREIGHT CARS.

An inquiry into the cause of accidents which happen to trainmen on freight cars reveals the fact that the great majority of such accidents are caused by the trainman losing his footing in passing from one car to another, causing him to fall between the cars. This is sometimes owing to irregularity in the running of a



TYRRELL'S PLATFORM FOR FREIGHT CARS.

train, and at other times to inadvertence on the part of the man.

The frequency of these accidents has led Mr. Thomas C. Tyrrell, of Glendive, Montana, to devise a platform for the ends of freight cars, which will not only prevent such accidents, but will also facilitate the work of the trainman in operating the brakes.

A single car having this improvement applied is shown in perspective in the lower view, and the adjoining ends of two freight cars are represented in the upper view, showing the platform in the position of use. The platform consists of two parts hinged together, one of the parts being connected with the end of the freight car, so that it may be raised up into a horizontal position for use, or dropped down parallel with the end of the car when out of use, as shown in the lower figure of the engraving. The main portion of the platform is formed of three rods secured to end pieces, and cross bars connecting the said rods and supporting strips of corrugated iron which afford a suitable footing for the trainmen. The upper rod of the three is pivoted in eyebolts screwed into the timbers in the end of the car. Upon the lower or outer rod is pivoted the second part of the platform, which is free to turn upwardly, but its end pieces are shouldered so that it cannot turn in the opposite direction. This construction is designed to prevent injury to the platforms when the cars are forced toward each other, as in the case of coupling, or retarding or stopping the train by reversing the locomotive.

To the side of the car is pivoted a lever, which is connected with one of the end bars of the platform by a curved connecting rod formed in two sections, the shorter section being pivoted to the longer section, to allow the platform to turn upwardly when the space between the ends of the cars is very small. The lever which operates the platform is made in two parts hinged together, the lower end being arranged to swing outward laterally to permit of passing it over clips at the ends of a curved bar secured to the side of the car, and designed to hold the lever in either of the two positions in which it may be placed. The extremities of the curved bar are provided with eccentrics, either of which may be closed down upon the side of the lever to hold it in place in the clip.

This invention, which is covered by a patent, is well calculated to lessen the danger and discomfort of trainmen, and to facilitate the operation of the brakes.

When the car is not in use, the platform is folded down closely against the end of the car, as shown in the larger view of the engraving.

MAYER has calculated that, if the motion of the earth were suddenly arrested, the temperature produced would be sufficient to melt and even volatilize it; while, if it fell into the sun, as much heat would be produced as results from the combustion of 5,000 spheres of carbon the size of our globe.

Patents and Copyrights.

The country has just completed its first century of experience with patent law. The first statute enacted concerning patents was in 1790. Mr. Madison is supposed to have been the author of the patent provision in the Constitution, he having introduced the clause in 1787. It is difficult to estimate the influence of patents upon the wealth and progress of the country. During the year after the first statute was enacted, but three patents were granted. Now thousands are granted yearly, and over 450,000 in all have been granted up to the present time. Counting the aggregate wealth of the country at $43,000,000,000, it is estimated that two thirds of it is due to inventions upon which patents have been secured. There is a close analogy between a patent and a copyright, the latter being practically a patent secured on some kind of mental invention put in type or found in a map, drawing, or picture of some kind. The subject of patents and copyrights has an unceasing interest for people who think, since it involves the very interesting question of the proper limits of property in ideas. There seems to be little doubt, however, that the notion of "perpetual property in an idea" is not tenable. The fact that both patents and copyrights are made the subjects of statute law is in itself pretty conclusive evidence that they are proper subjects of statutory limitation. It is said that if Shakespeare had taken out a copyright on his plays, and it had remained as the perpetual property of his legal heirs and assigns, a fortune would have been amassed equal in value to half of Great Britain. Such things show the absurdity of the claim that ideas and combinations of words should be property like other property.—*Boston Globe.*

The Faith of Inventors.

Unshaken faith in their ideas and a determined perseverance to overcome obstacles are gifts with which inventors have been endowed, or, in common parlance, they have their inventions "on the brain"—mount their hobbies and ride them continually. If they were influenced by rewards, or hopes of reward ultimately, it would seem, in the eyes of the world at large, that there was a "method in their madness," and that the tangibility of wealth was the terminus of the "hobby" race. But we find a large proportion of inventors unbiased and uninfluenced by any hope of wealth, money or reward. They labor and experiment as though their existence depended upon it; they labor with the hope only of ultimate success in accomplishing what they proposed to perform, and that labor is with them a labor of life and love. This labor is ever constant to their minds, ever uppermost in their thoughts, ever exerting itself in every movement and every action. They are determined in overcoming every resistance. It is an example of the power of mind over matter—of intelligence over the powers of nature.

And what does the world not owe to inventors? Civilization, arts, and commerce are the fruits of the inventors' "hobbies," and the greater part of these fruits have been the product of toil, many years of labor, at a cost of life, privation, and poverty; yet such was the inventors' faith that all obstacles have been overcome, and often after the results are obtained the fruit is left for others to mature and gather. Galileo declared the world "did move," and a prison was the result. Columbus, on the eve of his discovery, was nearly being thrown overboard by his discontented mariners. Harvey, the discoverer of the circulation of the blood, and Jenner, who first practiced vaccination, may be cited as examples of how great discoverers may be treated by the world before their discoveries are appreciated. Among the mechanics of a later day, Fulton, who was declared crazy; Colt, who had to mortgage his little stock of tools to obtain money to make his pistol; Goodyear, patiently toiling to obtain his results in the manufacture of rubber: Howe, bravely meeting all adversity to finish and introduce the sewing machine, may be cited as a few—very few—examples of struggling but afterward successful inventors. The list might be extended almost *ad infinitum.* Yet when success is achieved and the true value of the invention appreciated, the tardy meed of praise is tendered to the persistent faith of the inventor who accomplished the results.

Nor are poverty and adversity all that tries the inventor's faith in his projects. The ridicule of the masses and the sneers of the ignorant are perhaps as great discouragements as the former. Want of appreciation must be the only excuse for such undeserved and unmerited echoes, which rebound upon the faith of the inventor.

We might say that all workers are inventors, few in the extreme, but all in a degree. He is an inventor who produces a cheaper product or goods of a better quality—who brings about a better result; he who simplifies a process—who modifies proportions of ingredients, or he who excludes an unnecessary portion from a machine, producing like results with fewer parts and motions. Anything of benefit to humanity is invention, and the author or producer is an inventor. A test of invention is the faculty to adapt means to an end without complexity, and an ability to advance human knowledge. Faith in this ability is omnipotent and tantamount to success, and this success is purchased with self-sacrificing and energetic action, and a zeal to introduce the blessing of the results of their inventions and labors.

It is well the inventor has faith in the project of his brain, and the prospect of ultimate success is ever before him, and the dream of each night is that the morrow will produce the brilliant results which his dreams have depicted. It is well that it is so; for were it otherwise—were there no inventors—the world would be even now a barbaric chaos.—*The American Engineer.*

Chinese Insect Wax.

In his notes on Chinese materia medica the late Daniel Hanbury, writing thirty years ago regarding Chinese insect wax, said that this wax was "secreted by *Coccus pe-la,* Westw., upon the branches of *Fraxinus chinensis,* Roxb., which is cultivated for the purpose, and possibly upon other trees. Some accounts of the habits of the insect by a competent observer are much required, the Chinese statements on the subject being extremely obscure." Since that time it has become known for certain that the wax is mainly secreted on the tree *Ligustrum lucidum,* but there was no proper response to Mr. Hanbury's suggestion until Mr. Alexander Hosie, M.A., of our consular service in China, took up the matter when he resided in the Szechuan province in order to study the conditions of British trade in that western region of the Celestial Kingdom. While there Mr. Hosie made several journeys for specific purposes, and a narrative of his observations was published in book form two years ago. This book we commented upon at the time, and now give an abstract of his observations regarding insect wax, a subject in which interest has recently revived.

Mr. Hosie's third journey was in one sense the most interesting of all, for, although the country traversed was not all new, the object was to study carefully, for the Kew authorities, the Chinese insect wax industry. A special chapter of the book is devoted to the insect, and the industry associated with it, in which he traces the career of the *Coccus pe-la* of Westwood from its cradle, through its busy and interesting life, to its dishonored grave. The chief object of Mr. Hosie's journey was to procure for Sir Joseph Hooker specimens of the foliage of the flowers, and trees, on which the insects are propagated, specimens of the living incrusted wax, samples of the latter as it appears in commerce, and Chinese candles made from it.

The Chien-chang valley, which is about 5,000 feet above the level of the sea, is the great breeding ground of the wax insect. One very prominent tree there is known to the Chinese as the insect tree. It is an evergreen, with the leaves springing in pairs from the branches, very thick, dark green, glossy, ovated and pointed. In May and June the tree bears clusters of white flowers, which are succeeded by fruit of a dark purple color. The Kew authorities have come to the conclusion that it is *Ligustrum lucidum,* or large-leaved privet.

In March, when Mr. Hosie saw the trees, he found attached to the bark of the boughs and twigs numerous brown pea-shaped excrescences. The larger of these were readily detachable, and, when opened, presented either a whity brown pulpy mass, or a crowd of minute animals like flour, whose movements were just perceptible to the naked eye. From two to three months later these had developed in each case into a swarm of brown creatures each provided with six legs and a pair of antennæ. Each of these was a wax insect. Many of the excrescences also contained either a small white bag or cocoon covering a pupa, or a perfect image in the shape of a small black beetle. This beetle is a species of *Brachytarsus.* If left undisturbed, the beetle, which is called by the Chinese the "buffalo," will, heedless of the *Cocci,* continue to burrow in the inner lining of the scale, which seems to be its food; the beetle is, in fact, parasitic on the *Coccus.* When a scale is plucked from the tree, the *Cocci* escape by the orifice which is made. Two hundred miles to the northeast of the Chien-chang valley, and separated from it by a series of mountain ranges, is the town of Chia-ting, in which insect wax as an article of commerce is produced. The scales are gathered in the Chien-chang valley, and are made up in paper packets each weighing about 16 ounces. Sixty of these packets make a load, and are conveyed by porters from Chien-chang to Chia-ting (in former years there are said to have been as many as ten thousand of these porters). They travel only during the night, in order to avoid the high temperature of the day, which would tend to the rapid development of the insects and their escape from the scales.

At the stopping places the packets are opened out in cool places, but in spite of this each packet is found to have lost on an average an ounce in transit. A pound of scales laid down in Chia-ting costs, in years of plenty, about half a crown, in bad years the price is doubled. [Compare with this the consular note in the *Chemist and Druggist,* April 27, 1889.] In favorable years a pound of scales will produce four to five pounds of wax. In the plain around Chia-ting the plots of ground are thickly edged with stumps varying from 3 or 4 to 12 feet high, with numerous sprouts rising from their gnarled heads, and resembling at a distance our own pollard willows. The leaves spring in pairs from the branches, and are light green, ovate, pointed, serrated, and deciduous. The tree is said in all probability to be the *Fraxinus chinensis,* a species of ash.

On the arrival of the scales from Chien-chang about the beginning of May, they are made up in small packets of from twenty to thirty scales, which are inclosed in a leaf of the wood oil tree. The edges of the leaf are tied together with a rice staw, by which the packet is suspended close under the branches of this ash, or white wax tree as the Chinese call it. A few rough holes are drilled in the leaf with a blunt needle, so that the insects may find their way through them to the branches. On emerging from the scales, the insects creep rapidly up to the leaves, among which they nestle for a period of thirteen days. They then descend to the branches and twigs, on which they take up their position, the females doubtless to provide for a continuation of the race by developing scales in which to deposit their eggs, and the males to excrete the substance known as white wax. This first appears as an undercoating on the sides of the boughs and twigs, and resembles sulphate of quinine, or a covering of snow. It gradually spreads over the whole branch, and attains, after three months, a thickness of about a quarter of an inch.

After the lapse of a hundred days the deposit is complete, the branches are lopped off, and as much of the wax as possible is removed by hand. This is placed in an iron pot of boiling water, and the wax, on rising to the surface, is skimmed off and placed in a round mould, whence it emerges as the Chinese insect wax of commerce. Where it is found impossible to remove the wax by hand, the twigs and branches are thrown into the pot, so that this wax is darker and inferior. The insects, which have sunk to the bottom of the pot, are placed in a bag and squeezed of the last drop of wax, and are then thrown to the pigs. The wax is used for coating the exterior of animal and vegetable tallow candles, and to give greater consistency to the tallow. It is also said to be used as a sizing for paper and cotton goods, for imparting a gloss to silk, and as a furniture polish.

Removing the Epidermis.

A few days since, says the Boston *Herald,* at the Massachusetts General Hospital, a little instrument, invented by Dr. Mixter, wonderful in its simplicity, constructed so as to separate quite large portions of epidermis from the subcutaneous tissue, was used for the first time.

The patient had been etherized, and had undergone operation for the removal of a cancerous growth from the left breast, and the wound thus made was quite an extensive one. The instrument was applied to the anterior portion of the right thigh, and three strips, about an inch wide by six inches long, were taken off and transplanted to the exposed surface of the breast. The operation of removing the skin and transplanting it to its new quarters did not occupy more than about six minutes. A very few days suffice to restore the denuded surface of the thigh to its normal condition, leaving few traces of the reparative process to which it has contributed, and, other things being equal, the surface from which the cancerous tumor has been excised will heal over by first intention, thus saving the patient from a prolonged and painful period of convalescence. Of course, every precaution is taken, by the use of sterilizing processes and antiseptic solutions, to render the operation thoroughly aseptic, so that the chances of inflammatory disturbances from bacterial sources are reduced to the lowest minimum.

The thickness of these delicate human plasters probably does not exceed one-sixtieth of an inch, and the resulting hemorrhage is not more than what one sees on a slight abrasion of the skin, or it may be compared to the sanguineous oozing one gets from too earnest tonsorial attention. The advantages of the new over the old method of epidermic detachment are obvious. It is expeditious, the sections of shaved cuticle are much larger and of a more uniform thickness than can be obtained by the most dexterous manipulator, and the chances of successful grafting are enhanced by the fact that the skin is transplanted while the cellular elements are in their full vital activity.

Water.

Elaborate work has been done by E. W. Morley relating to the volumetric composition of water. In his summary he says: For the present we may believe that water, when the gases are measured under ordinary temperatures and pressures, is composed of 2·0002 volumes of hydrogen to 1 volume of oxygen; or that under ordinary conditions the number of molecules in a given volume of oxygen is one nine-thousandth part greater than the number of molecules in an equal volume of hydrogen.

Whitewashing Nero.

According to Signor Lanciani, the learned Italian writer in *Iron*, the Emperor Nero has been libeled. Instead of being the cruel tyrant he is generally represented to have been, he was a benefactor of mankind and a well-intentioned sanitary reformer. It has for centuries been commonly understood that Rome was set on fire and burned by Nero, in the year 64, either through brutal malice or drunken incapacity and indifference. Signor Lanciani's investigations put a very different interpretation upon the matter. Nero desired to make many changes in the streets of Rome by increasing their width and making many of them more direct, and also to introduce many improvements by reconstructing public buildings. His efforts in this direction were met by an opposition from property owners—it is a strange thing that property owners have not changed since Nero's time—and were also embarrassed by the fact that the city abounded in temples, altars, and shrines which were inviolate. While he probably made light of the property interest, religious sentiment the Emperor knew ought to be respected under all conditions and at all times, and he acted accordingly.

He directed two architects, Severus and Celar, to prepare plans for the rearrangement of streets in certain parts of the city, making them as near to straight lines and right angles as the hilly configuration would render feasible. Numerous public squares were laid out, and a system of sewers was planned. Regulations for buildings were prepared, in which it was provided that the height of houses should not exceed double the width of the street, that each house should be completely cut off from the adjoining buildings, that each house should have a portico in front, and that wood ceilings should be excluded from the first stories of buildings. Tents and booths were secretly prepared, and vessels were sent to various Mediterranean ports after grain, with orders to meet at the mouth of the Tiber on a certain date.

In accordance with Nero's plan, the city was fired in numerous places, and, of the fourteen wards, three were entirely destroyed, and seven were burned in great part. The crowds driven out of their homes found the booths in the outskirts of the city ready for them. The grain-laden vessels appeared in time, and the townspeople were fed and housed during the rebuilding, the whole plan having been carried into effect without exposure, famine, or loss of life, although the population of the city at the time was very large.

The Hair Worm.

The common hair worm of Europe is technically called the *Gordius aquaticus*, and the allied or representative American species is *Gordius varius* of Dr. Leidy, but we also have *G. longilobatus*, *G. robustus*, and *G. subspiralis*. In a volume now before us, entitled "Naturalist's Miscellany," published by Shaw & Nodder, London, 1791, we find an interesting illustrated article on *Gordius aquaticus*, from which nearly as much information may be obtained about the development of the Gordians as may be obtained from works on the subject published at the present day; for it seems that after the exclusion of the animal from the egg, very little about its subsequent development has been learned, between that period and its mature condition, when it looms up before us a perfectly formed and wriggled "hair worm." It was demonstrated more than a hundred years ago that the animal was not a vivified or animated horse hair, but that it was a distinct living animal, that had been developed through the media of *bona fide* eggs. Indeed, more than fifty years ago, after an experience of more than six months, it became manifest to us that a horse hair would never be transformed into a *Gordius*. We have taken them from water puddles, cabbage heads, moist earth, grasshoppers, ground beetles, and apple seed cavities—dark and light brown, red, pink, nearly black, pale and white, alive and squirming.—*S. S. R., in American Notes and Queries.*

Shading Greenhouses.

There is some difficulty in choosing a shading for greenhouses, as some materials wash off too quickly, and others not readily enough, as in the case of the common limewash. A correspondent in the *Gardener's Monthly* says he has tried many materials, but all have proved unsatisfactory. He found the following, however, very useful for many other purposes besides shading: Take one pound common whiting, one ounce of the best glue, and a quarter of an ounce of bichromate of potash, called also red alum. Soak the glue the day before using, melting in a common glue pot, and then dissolve the bichromate in warm water. Mix the materials together, and thin them down to the consistency required. These, after being exposed to the light, are almost as adherent as oil paint. Of course, by reduing the proportion of bichromate, the material can be made less retentive, but a coat of this wash on the greenhouse will last the whole summer, and even be troublesome to wash off, not to such a degree, however, as limewash It should be constantly stirred up while being used.

Power of Water in Motion.

About two months ago there was a dinner party at General Schofield's house in Washington. Among the guests were President Harrison, Chief Justice Fuller, the late Secretary Windom, Speaker Reed, Senator Sherman, and Senator Stanford, and Mr. Justice Stephen J. Field.

During the dinner the conversation turned upon mining operations in California, and Judge Field, whose knowledge of all matters relating to the Pacific coast is as extensive as his powers of narrative are entertaining, astonished the distinguished company by some of his assertions in regard to the force of the jets of water employed in hydraulic mining. He described the wonderful manner in which the streams from the hose cut to pieces and tear down the hills that hold the precious metal. Judge Field cited the Hon. James G. Fair as his authority for the statement that under a vertical pressure of 100 or 200 feet the force of the stream is sometimes so great as to hurl away or hold bowlders weighing a thousand pounds; and that it would be no more possible to cut through such a stream with a crowbar or an ax, where it issued from the nozzle, than to sever eight inches of solid iron with a penknife.

As Judge Field afterward informed Senator Fair, in a letter asking for expert testimony about the power of water applied by hydraulic machinery, these assertions were received by some of General Schofield's guests with smiles of polite incredulity. The eminent jurist felt that his position, for the moment, was somewhat like that of the Englishman who informed the King of Siam that in England water ofter became so hard that people could walk on it. It is not at all surprising that the facts gravely alleged by Justice Field should stagger even an imagination like the Chief Justice's, or strain the faith of so profound a believer in dynamics as the Hon. Thomas B. Reed.

In consequence of this incident, and for the vindication of his own reputation for veracity, Justice Field has collected from several of the highest authorities on practical hydraulics evidence and opinions that are of great interest.

Ex-Senator Fair tells Justice Field that at the Spring Valley gold mine in Cherokee, Cal., the water used in the hydraulic mining operations was brought in pipes and ditches from a distance of nearly 100 miles, and that the volume of water used on every working day in that mine amounted to three times the number of gallons consumed daily by the entire city of San Francisco.

Mr. Louis Glass, for 16 years the superintendent of the Spring Valley mine, assures Justice Field that he has seen an 8 inch stream, under 311 feet of vertical pressure, move in a sluggish way a two-ton bowlder at a distance of 20 feet from the nozzle; and that the same stream striking a rock of 500 pounds would throw it as a man would throw a 20 pound weight. "No man that ever lived," adds Mr. Louis Glass, "could strike a bar through one of these streams within 20 feet of discharge; and a human being struck by such a stream would be killed—pounded into a shapeless mass."

Mr. Augustus J. Bowie, of San Francisco, the author of a standard book on hydraulic mining, estimates that the stream from a six-inch nozzle, under 450 feet vertical pressure, delivers a blow of 588,735 foot pounds every second, equivalent to 1,070 horse power. "It is absolutely impossible," says Mr. Bowie, "to cut such a stream with an ax, or to make an impression on it with any other implement." Mr. Bowie adds that although never to his knowledge has a man been struck by such a stream as it comes from the pipe, several accidents have occurred where miners were killed by very much smaller streams at distances of 150 or 200 feet from the nozzle.

After an elaborate series of computations, Prof. Samuel B. Christy, of the University of California, an eminent authority on mining and metallurgy, reports to Justice Field that if a nozzle of from 6 to 9 inches diameter were specially arranged to throw a stream vertically upward against a spherical bowlder of quartz weighing 1,000 pounds, the vertical head being anywhere from 100 to 500 feet, the bowlder would be forced up until the diminished velocity of the stream established an equilibrium of pressures. There would be a point at which the upward pressure of the stream would exactly balance the gravity pressure of the bowlder, holding it, the half ton rock, there suspended. In practice, of course, the bowlder could not be balanced accurately upon the axis of the stream, but would fall to one side or the other. But if a large conical basket of iron bars were arranged about the nozzle so as to catch the bowlder whenever it should be deflected from the stream, and return it to the nozzle, the 1,000 pounds of quartz would be kept in play like a ball in a fountain. As to cutting these streams, Prof. Christy says that he has often tried to drive a crowbar into one of them. The stream felt as solid as a bar of iron, and, although he could feel the point of the crowbar enter the water for perhaps half an inch, the bar was thrown forward with such force that it was almost impossible to retain it in the grasp. An ax swung by the most powerful man alive could not penetrate the stream; yet it might be cut by the finger of a child, if the child were seated on a railway train moving parallel with the stream in the same direction and with the same velocity. That velocity would be considerably more than a mile a minute.

Justice Bradley, of the Supreme Court, has also tried his intellect upon the mathematics of the problem submitted by Judge Field. He delivers this opinion: "I can well believe all you say with regard to the tremendous force of streams issuing from the pipes of the miners under a large head of water. Of course, they would produce instant death if directed against a man standing near, and would probably cut his body in two."

The statements here presented in summary will not astonish engineering experts or members of the New York Fire Department. The average citizen, however, is accustomed to regard water as the least destructive liquid that can be put in motion, and he is familiar with no stronger manifestation of its power than the velvety touch of the stream from the Croton faucet.

We should say that the distinguished Californian upon the bench of the Supreme Court had amply vindicated his right to be heard with respect and perfect confidence by any dinner party on the subject of hydraulic pressure. Does it occur to General Schofield that in these facts there is the suggestion of a novel and most terrible engine of military defense against assaults at short range?—*New York Sun.*

Sale of Professor Koch's Lymph.

The following official rescript appeared in the German *Medical Gazette* of March 13, and a translation has been transmitted to the *Lancet* (London) for publication from the Foreign Office.

Professor Dr. Koch has published in the German *Medical Gazette* of January 15th last a description of the manner in which the lymph, discovered by him for the cure of tuberculosis, is prepared, and according to this description it appears that this remedy comes within the provisions of Section 1 of the Imperial Ordinance of January 27 of last year, and can therefore, with the exception of wholesale trade, only be sold by licensed chemists (apothecaries).

Chemists can at present obtain the lymph, prepared under the personal supervision of the inventor, only through his authorized representative, Dr. Libbertz, 28 Luneburgerstrasse, Berlin, N. W. It is supplied to them in special bottles of a capacity of 1 or 5 cubic centimeters. These bottles have glass stoppers covered with bladder and secured by a leaden seal bearing the letter "L." On one side they bear the name "Tuberculinum Kochii" in white letters on a black ground, on the other side a white label with the signature of Dr. Libbertz, and a note giving the date on which the lymph was prepared. Each bottle is accompanied by a printed paper containing instructions for its use.

With regard to the preservation and sale of the remedy in chemists' shops, the following regulations must be observed:

1. The "Tuberculinum Kochii" must be kept in the poison cupboard, and in the division reserved for alkaloids.

2. It can only be sold in the original bottles, and only upon the written order of an approved physician, and delivered to such physician himself or to a person authorized by him.

3. A record of the purchase and sale of the remedy must be kept in a special book, in which each bottle must be entered. The contents of the bottle, the date of preparation, of purchase, and of sale, the name of the physician to whom it has been sold, or eventually the removal of the unsold bottle from the shop, must all be noted.

4. If a bottle has not been sold within six months of the date of preparation marked upon it, it can no longer be sold or otherwise disposed of, but must be removed from the shop. Such bottles will be exchanged by Dr. Libbertz for others containing freshly prepared lymph free of charge.

5. The price of the "Tuberculinum Kochii" is hereby fixed (exclusive of the cost of packing) at 6 marks for a bottle containing 1 cubic centimeter and at 25 marks for one containing 5 cubic centimeters.

I have the honor to request you to cause the above regulations to be communicated to the chemists in your district for their guidance, and also to take steps to insure their due observance.

(Signed) DR. VON GOSSLER.

Berlin, March 1, 1891.

To the Governors of Provinces and the President of Police in Berlin.

The Doctor who Succeeds.

A physician who understands human nature, who plays with the baby, makes friends with the children, and listens to the woes of the good wife and mother, says a medical journal, is the fellow to whom the master of the house most cheerfully pays the largest bills. It isn't the medicine that's bottled up, but it's the comfort and consolation that are unbottled that mark the broad line between an unsuccessful and a popular physician.

U. S. COAST LINE OF BATTLE SHIPS.

(Continued from first page.)

The complement of twelve boats and one balsa are stowed well above the flash of the guns, and are handled by means of powerful cranes.

ARMAMENT.

Four 13-inch breech-loading rifles.
Eight 8-inch breech-loading rifles.
Four 6-inch breech-loading rifles.
Twenty 6-pounder rapid-fire guns.
Six 1-pound rapid-fire guns.
Two Gatling guns.
Six torpedo tubes.

The four 13-inch and the eight 8-inch guns are mounted in pairs within six Hichborn turrets, two of which are erected upon the main deck and the remaining four upon superstructure deck; the former containing the larger and the latter the lesser guns. These turrets are of a type which has been generally adopted by the Navy Department, similar protection to the guns having already been placed upon the monitors Monterey, Puritan, Monadnock, and Amphitrite, and also upon cruisers Nos. 2 and 6.

The 6-inch guns have local protection in addition to splinter bulkheads, shields, and automatic shutters. The turrets are all mounted in redoubts. The 13-inch guns are about 18 feet above the water, and have an arc of fire sweeping across the deck and 45 degrees on both sides back toward the center or body of the ship, making a total arc of fire of 270 degrees for the guns in each of these turrets.

This, as can be seen, gives a converging fire, *i. e.*, the power of training the guns from both ends toward a common point, directly opposite the middle of the ship, and of concentrating the shot within fifty feet in a straight line from the ship's side, in a broadside action.

The 8 inch guns are about 25 feet above the water, and are high enough to fire above the 13 inch gun turret, having an arc of action of 164 deg., being able to fire across the center line of the ship, the projectile crossing the same before reaching the ends of the vessel. The 6 inch guns have a train of 145 deg., and can cross the center line of the ship, extending beyond the hull, within 170 feet from either end of the vessel, showing that the main battery can train within a distance of about 700 feet on either side of the vessel.

The rapid-fire guns are so arranged that a radiating fire of shot around the vessel will destroy any venturesome torpedo boat or other light craft coming within range, and will be particularly effective in forming a destructive fire against the endeavors of the enemy to work such of their larger guns as are only partially protected in action, and whose effectiveness depends very largely upon gaining the initiative.

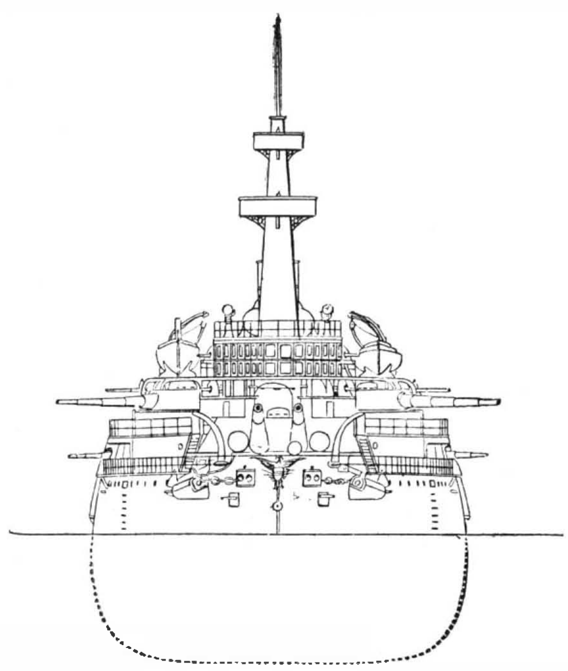
Torpedo nets are to be carried which will completely incase the vessel, thus precluding the possible effect of torpedo fire from the enemy.

The facilities for handling the ammunition are of the best. Passages connecting with all magazines run the length of the armored inclosure, along which, and near to the armored tubes and passing scuttles, are distributed auxiliary magazines to obviate delay in transmitting ammunition during an engagement.

ARMOR.

Thickness of side belt armor	18 in.
" " end diagonal belt	14 "
" " 13 in. B. L. R. redoubts	17 "
" " " " " turrets	17 "
Thickness of 8 in. B. L. R. redoubts	8 in. and 10 in. resp.
" " " " " turrets	6 " and 8½ " "
" " conning tower	10 "
" " " " tube	7 "
" " casemate	5 "
" " 6 in. B. L. R. local protection	5 "
" " 20 pdr. local protection	2 "
" " armor deck	2·75 in. and 3 in.

The side belt armor is 7 feet 6 inches wide, 3 feet above and 4 feet 6 inches below the water, extending along the sides for 148 feet, then taking a diagonal course inboard at an angle of 45° for a longitudinal distance of 24 feet at each end (making a total broadside armor of 196 feet), passing around and supporting the armor for the 13 inch gun turrets. On top of this side armor is placed a steel deck 2¾ inches thick, under which are the magazines and machinery. Above this belt of side armor is placed the casemate with a backing of ten feet of coal. Forward and abaft the redoubts are 3 inch protective decks of steel, which turn down to 4½ feet below the water line, and on top of these decks there is a belt 7 feet high by 6 feet wide, filled with water excluding material similar to "woodite." The steering gear is below this deck protection.



FRONT VIEW OF LINE OF BATTLE SHIP.

Provision has been made to protect the hull from the blast of the guns by thickening with heavy steel plates where contact necessitates this precaution, and across the decks under the muzzles of the thirteen inch guns, circular flash plates have been provided to prevent the blast from splintering the planking. The hatch coamings, skylights, etc., coming near the blast of the guns are removed in action, and heavy battle plates sunk flush with the deck are substituted to afford the necessary protection.

The side belt, diagonal belt, redoubts and turrets have behind the armor a backing of wood and thick plates backed up again by heavy channel bars.

The machinery is inside of and protected by the armor inclosure, also by 12 feet of coal bunker back of the side armor, and a reserve coal bunker above and under the armor deck; the engines and magazines are also protected by coal, besides which, there are four thicknesses of skin "penetration" before reaching the engines and fire rooms.

The engines are of the twin-screw, vertical, triple-expansion, inverted cylinder type; diameter of cylinders as follows: High pressure, 34.5″; intermediate, 48″; low pressure, 75″; stroke, 42″. There are four double-ended boilers, 18′ × 15′ in diameter, and two single-ended boilers (donkey), 8½′ × 10′ in diameter. Each boiler and engine is in a separate water-tight compartment, in order to localize possible injury.

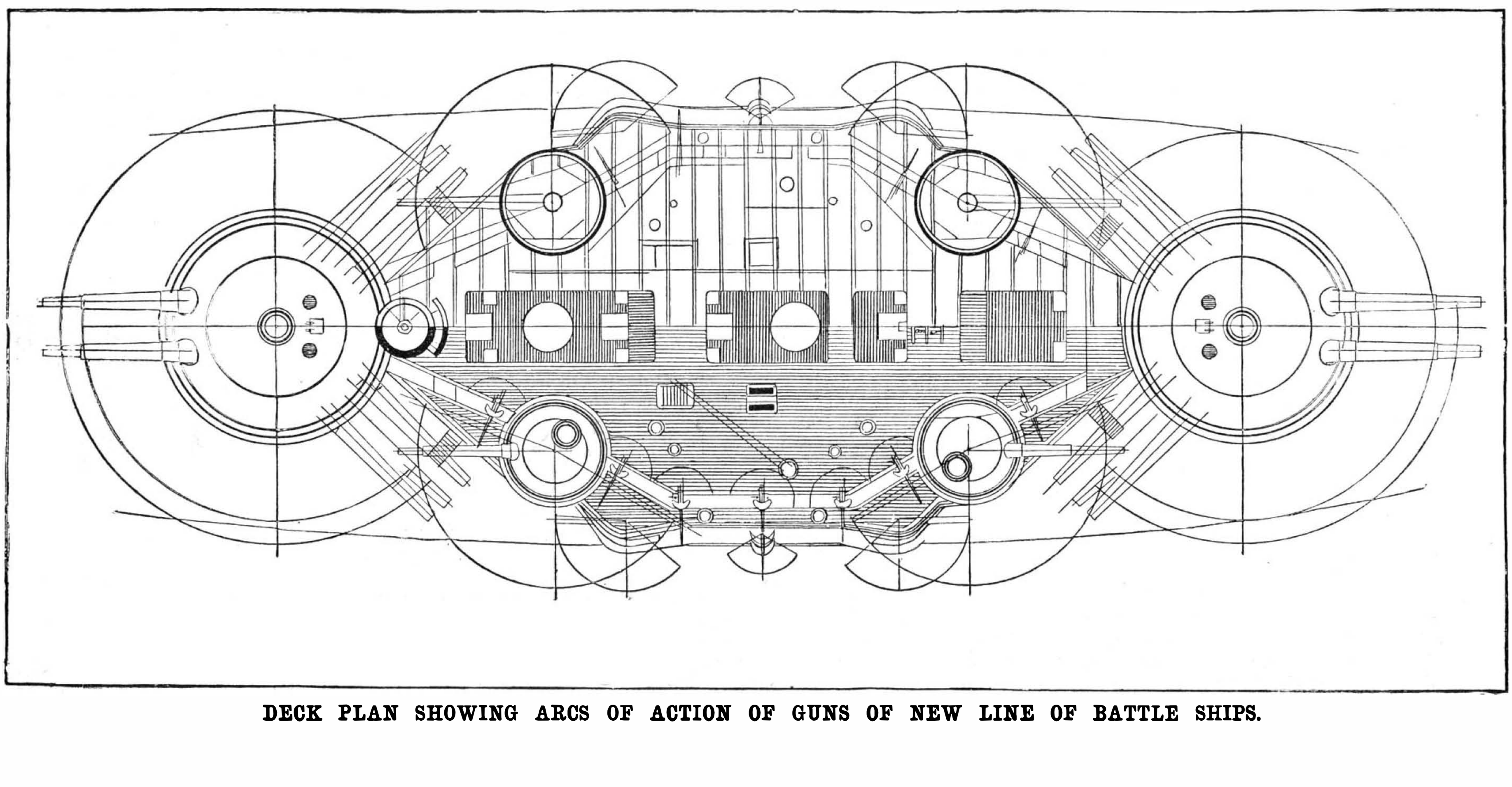
The normal coal supply is 400 tons, but a coal bunker capacity of 1,800 tons is provided. With the bunkers full she can steam at full speed (16 knots) for 10 days, or a radius of action of about 4,000 knots; and going at 10 knot speed this endurance is increased to 60 days, or a radius of action of 15,000 knots.

The vessel is very much "cut up" forward to facilitate maneuvering by offering as little resistance to the water at that point as possible; the ram, accordingly, being at the water line.

The complement consists of 460 persons, officers and men combined. Good quarters and accommodations have been provided, and all the latest sanitary improvements are to be installed to insure efficiency and thoroughness in lighting, ventilating and drainage.

Electric Ship Log.

There have been many attempts to produce a ship's log the recording apparatus of which should be operated by means of electricity. In the opinion of the London *Times*, however, these attempts have all failed in practice, in consequence of the inability to overcome three main difficulties. These are the necessity of having a perfectly water-tight chamber in the log itself, that of having a battery, and of preserving perfect insulation in the connecting towline. These difficulties have been overcome in a very simple and ingenious manner in Granville's electric log, recently shown at Messrs. Elliott Bros., 101 St. Martin's Lane, London. Although it is essentially an electric log, it has no battery whatever, the log, the iron hull of the ship, and the ocean together forming the battery. A portion of the log is made of zinc, which provides one element, while the iron plates of the ship form the other, the sea water constituting the exciting solution. The log is of very simple construction, and has only two moving parts, a revolving head and a small internal worm wheel. The head is connected with the worm wheel gearing, and every sixth revolution of the former is communicated, by means of a spring contact, through the towline to an indicator placed on the bridge or in the chart house of the ship. When the log is in use the sea water has free access to all the working parts, and serves to keep them clean and lubricated. The towline, which is very pliable, is made of a braided tanned netting twine, inside which a number of copper wires are wound spirally and joined together at each end. This line can be handled and coiled by a sailor in the same way as any other line and is readily connected with, or disconnected from, the log. The indicator consists of a small metal circular box, with the necessary internal mechanism and external dials and pointers. The apparatus, after many months' trial at all speeds, has shown itself to be an efficient means of accurately indicating, at any part of the ship where an indicator is fixed, the total distance run, and also, at any time, the rate of speed per hour. One of these logs has been fixed on board the Orontes, and it is also in use in the Argentine navy.

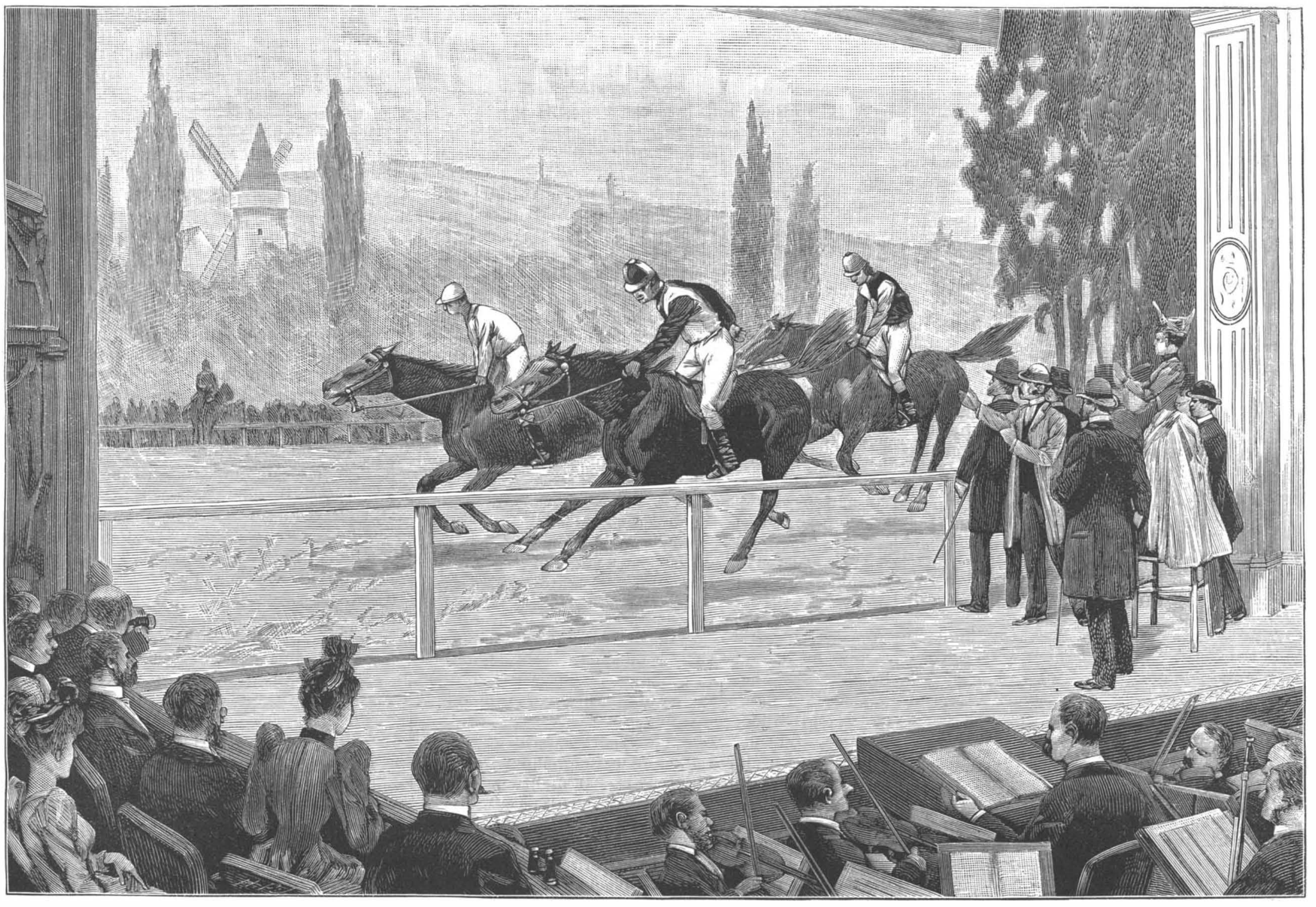


DECK PLAN SHOWING ARCS OF ACTION OF GUNS OF NEW LINE OF BATTLE SHIPS.

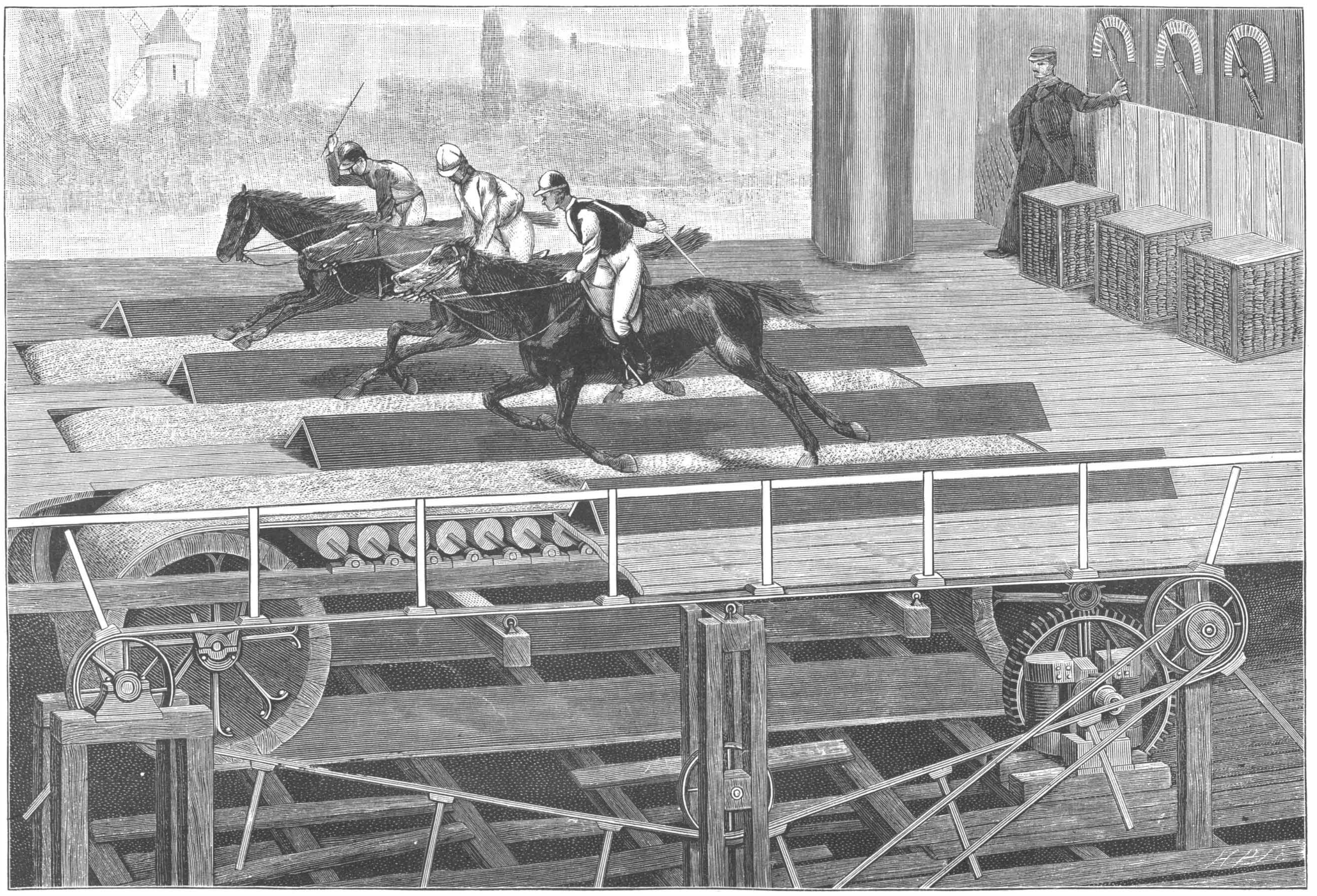
THE HORSE RACE ON THE STAGE.

One of the "hits" of Messrs. Montreal and Blondeau's "Paris Port de Mer," played at the Varieties Theater, is a horse race. Three genuine horses, ridden by three genuine jockeys, start off at full speed, and make the circuit of the hippodrome of Longchamps. We have here a real effect plus an effect of illusion. The horses are free from all restraint, and really gallop, but the ground disappears under their feet in moving in a direction opposite that of their running, and the landscape as well as the fences also fly in a direction contrary to the forward motion of the horses. Our readers have before their eyes the very simple arrangement by means of which this remarkable theatrical illusion is operated. The three horses run upon three tracks independent of each other, but arranged side by side. Our engraving represents, in section, one of these tracks, formed of an endless matting of cocoanut fiber analogous to the mats that serve for wiping the feet, but of thicker and closer texture. This belt, which is three feet in width, runs over two drums placed on each side of the stage, and is tautened by a third cylinder on a level with the stage floor. It is supported by a series of wooden rollers, which are placed very close together and revolve on pivots. The drum mounted to the left is capable of being set in rapid motion by an electromotor, which receives the current from a battery of accumulators placed on Feydeau Street, in the vicinity of the theater. The starting and the velocity of the machines are controlled through commutators maneuvered by handles.

At the moment of the race each horse appears upon one of the tracks. The electric current is sent into



RACING HORSES ON THE STAGE—EFFECT FROM THE AUDIENCE.



RACING HORSES ON THE STAGE—MACHINERY UNDER THE STAGE FOR DRIVING ENDLESS BELT.

the motors, and the belt begins to move. The horses, feeling the ground sliding and carrying them backward, first begin to move their feet in order to maintain their position; and then, on the one hand, the motion of the track becoming swifter, and, on the other, the jockeys exciting them with voice and spur, they begin a gallop which is so much the more marked in proportion as the motion of the belt under their feet is more rapid. Yet, despite the speed, the courses always occupy the center of the tableau circumscribed by the frame of the stage, and the background of which is formed of a panorama of Longchamps. The immobility of the horses in space results, then, from the double effect of their projection forward under the impulsion of the jockeys and of their carriage backward by the flight of the ground. If the belt should happen to come suddenly to a standstill, the horse and his jockey would be dashed against the wall; in the opposite case they would fall head over heels backward.

An equilibrium is maintained between the two impulsions by very careful attention to the commutators that regulate the running of the motors, and consequently that of the drums and belt. The illusion is completed by the unwinding of a canvas in the rear, 95 yards in length, representing the panorama of the country as seen from the stands of Longchamps. This canvas, which is first wound around a vertical cylinder on the right hand side of the theater, unwinds therefrom and afterward winds around a duplicate cylinder on the left hand side of the theater. The two cylinders are set in motion by a windlass maneuvered by manual power. Finally, the fence whose pickets are seen flying in the foreground, in the same direction as the panorama, is mounted upon an endless belt running around two drums actuated by a Popp air motor. The panorama unwinds in a minute and a quarter, and, during this time, the endless belt moves at a velocity of 3,200 feet per minute, or, in other words, at the rate of 12 or 15 leagues per hour. The authors of this truly curious illusion are Mr. L. Brader, who constructed the tracks, Mr. Solignac, who installed the electric motors, and Mr. Justin.

The apparatus used in this race is very similar to that used in the American play "County Fair," which has been running so long in this city. The effect is very real, and the interest of the spectators is kept up throughout the race. We believe that the idea was adapted from the American play. We are indebted to *L'Illustration* for the engraving and article.

Bleach and Caustic Soda from Salt.

The process by which bleaching powder and caustic soda is manufactured from common salt is quite simple, as well as economical. The salt is introduced into a still constructed of stone and provided with suitable tubes for heating, and a sufficient amount of nitric acid is added to transform it into nitrate of soda. Upon applying a gentle heat, the decomposition begins, and the nitrate of soda is rapidly formed. As the nitrate of soda is extremely soluble in a hot solution, the operation is so conducted that the solution of nitrate of soda in the still is saturated at the boiling temperature. The solution is then run out from the still and cooled. Owing to the great difference in the solubility of nitrate of soda in hot and cold solutions, a great mass of the salt is deposited on cooling. Over half of the quantity of nitrate of soda in solution at one hundred and ten degrees to one hundred and twenty degrees Centigrade is deposited on cooling the solution down to twenty degrees Centigrade. The crystals obtained by this cooling are separated from the mother liquor, which, together with more salt and nitric acid, is again sent to a still, and the operations repeated.

The gases resulting from the reaction in the still, composed principally of nitrosyl chloride and chlorine, pass into a vessel containing nitric acid and manganese dioxide in suspension, where nitrate of manganese is formed and chlorine is given off. The chlorine evolved passes through a washer, and then into a bleaching powder apparatus.

In this process all of the chlorine combined with the sodium in salt is obtained in the form of bleaching powder, and the gas passing to the bleaching powder chamber is pure chlorine gas, thus avoiding the weak and impure chlorine obtained in all magnesia processes, and avoiding the loss of two-thirds of the chlorine which is incurred in the Weldon process.

The crystals of nitrate of soda obtained by cooling the nitrate of soda solution coming from the still are mixed with two or three times their own weight of oxide of iron. The mixture is then heated to a red heat in a current of air in a cylindrical furnace. The nitrate of soda is completely decomposed and the gases evolved with an excess of air are passed over an oxidizing substance, such as manganese dioxide, a manganite, a manganate, or a permanganate of the alkalies or of the alkaline earths.

The nitrate of manganese liquor is heated and evaporated to a plastic consistency by the hot gases coming from decomposition of the nitrate of soda. The nitrous gases coming from the decomposition of nitrate of soda and nitrate of manganese finally pass, after treatment with air and steam, into the usual apparatus for condensation of nitric acid. Nitrate of manganese evaporated to the plastic condition mentioned contains about ninety per cent MnO—2. It will thus be seen that both the nitric acid and manganese are recovered. The mixture of iron oxide and soda is taken from the furnace and lixiviated. If the heat has not been carried too high, the mixture is in good condition for lixiviation. If lixiviated with hot water, a caustic liquor of thirty to forty degrees Baume may be obained practically free from carbonate of soda, so that when this liquor is evaporated and mad into caustic soda, an extremely high test of causti soda may be obtained. —*Ameri an Paper Trade.*

How to Make a Blackboard.

Select seasoned pine lumber of the first quality and good width. Plane it well, joint nicely, and glue a sufficient number of boards together to make the required blackboard four feet in breadth. For end pieces use scantling which will dress two by three inches; saw them a few inches longer than the proposed width of the board; cut a slot through the pieces on the flat side, so as to admit the ends of the board, with an inch t spare at the top; into this spare space insert a key, and drive home. To hold the end pieces in position the board may be dovetailed at its lower edge. Form a chalk trough by nailing a strip of half inch stuff, five inches wide, to the lower edge of the board, and nailing to this strip, on its outer edge, a similar one two and one-half inches wide. Bevel or round off the inn r edges of the end pieces in a workmanlike manner, and smooth the surface of the board with fine sandpaper before painting. The board may be supported by leath r straps attached to the top. No nails or screws ar used, because they compel the forming of cracks whenever th re is shrinkage, by holding the several boards apart; by l aving the whole free to slide in the slot, and following up all shrinkage with a key, occasionally tightened, a perfect surface is secured.

DIRECTIONS AND RECIPES FOR PAINTING.

No paint in which there is oil should be used. Holbrook's, Sherwood's, "Alpha," and "Eureka" liquid slatings are first class paints. They come in pint, quart, and gallon cans, and are ready to use at any moment, and can be kept for years if tightly corked. One gallon will paint 250 square feet, and costs $6 to $8. Any school furnishing house will fill orders.

The following is taken from Wickersham's "School Economy:"

"T make one gallon of paint take 10 ounces pulverized pumice stone, six ounces pulverized rotten stone, three-quarters pound of lamp black, and mix with alcohol enough to make a thick paste. Grind the mixture thoroughly, and then dissolve 14 ounces of shellac in the remainder of the gallon of alcohol. Stir the whole together and th paint is ready for use."

The composition named below has been tried upon old boards and new with xcellent success. Dissolve gum shellac in alcohol, and mix with it lamp black and flour of emery. No more lamp black and flour of emery should be used than is necessary to give the required black and abrading surface, and sufficient gum to hold the materials together, and confine the composition to the board. The thinner the mixture, the better. The lamp black should first be ground with a small quantity of alcohol to free it from lumps. Apply with a common painter's brush, and when dry smooth with pumice stone.

A still cheaper preparation, though hardly as durable, may be made and applied by any school teacher before nine o'clock on a summer morning, and used in a half hour thereafter. For fifty square feet of board take four ounces of common glue, three ounces flour of emery, and just lamp black enough to give an inky color to the preparation. Dissolve the glue in three-quarters of a quart of warm water, put in the lamp black and em ry, and stir until there are no lumps, then apply t the board with a woolen rag smoothly roll d. Put on two or three coats, evenly, and you have a nice surface at a cost of about thirty cents for material. You may call this the "Poor District's Paint."

Caution. No pupil should be allowed to erase with his hand, or a wet eraser, from this or any other board.

Quoting again from Wickersham: A cheap and serviceable black surface may be made by the following recipe: Four pecks of white finish or white coating; four pecks of fine sharp sand, four pecks of ground plaster; four pounds of lamp black; four gallons of alcohol or good whisky. This quantity will make a mixture sufficient to cover twenty square yards. A little flour of emery will prevent the mixture from "setting" immediately, thus giving time to put it on the wall with the necessary are. If emery be not used, only a small quantity of the mixture can be put on at a time, and this is, perhaps, the better way.

The wall which is intended to be covered with the black surface should be plastered like the rest of the room, with the exception that the black mixture takes the place of the white coating, and is put on in the same manner. After the black surface is on the wall, it must be carefully dampened and rubbed in order to fill up the pores, and make the surface hard and smooth. If the old surface be well moistened, a new surface, composed of the same mixture, may be applied. It must be remembered that the black surface requires much more working with the smoothing trowel than the white finish.

PLASTER BLACK WALL.

Nearly or quite all black walls in this portion of the State, made within wooden buildings, have failed to stand. The mortar seems of poor quality, and the lath, constantly springing beneath the pressure of the hand while marking, causes the plastering to crack and fall in a very short time. To prevent this the room should be sheeted inside the studding, furred and lathed on that, and the first coat of plastering pressed in against the sheeting with great care. A very firm wall is thus secured. The black belt should be four feet wide, and come within two and one-half feet of the floor. It should surround the room. A chalk trough should extend its entire length, and it should be bounded at its upper edge by a simple moulding.

PAPER BLACK SURFACE.

When care has been taken to secure a good wall, strong manila paper, which is manufactured for the purpose, may be smoothly pasted on "hard finish," and then painted with liquid slating. It has proved durable in some instances, its durability depending, however, very largely on a smooth surface beneath.—*Minn. Teacher.*

Cradina.

In 1880, in a communication to the French Academy of Science, M. Bouchut reported that he had found the juice collected from the common fig tree (*Ficus carica*) to contain a powerful ferment capable of digesting albuminoid substances, thus confirming a belief of the ancients that the juice possesses digestive properties (*Pharm. Jour.* [3], xi., 250). This ferment is now the subject of a paper by Dr. Mussi, in which he reports its isolation and describes its properties (*L'Orosi*, Nov., p. 364). Juice collected from the fruit and branches of the fig was filtered to remove the serous portion from the insoluble, the latter repeatedly washed with water and the washings added to the filtrate. This liquid, which after repeated filtration was obtained limpid was distinctly acid in reaction, and when placed in contact with moist fibrin digested it completely. It was evaporated to a small volume, again filtered, and treated with absolute alcohol, which threw down a plentiful white precipitate that dried, when exposed to the air, to a dark yellow amorphous mass. This, when treated with water, swelled up and imparted a milky appearance to the liquid, but a clear filtrate from it, though it gave the reactions of vegetable albumen, had no digestive power. The residue, insoluble in water, dissolved readily upon the addition of a trace of acid or alkali, and the solution, placed in contact with moist fibrin, effected complete and true digestion. To the ferment thus isolated Dr. Mussi gives the name "cradina," from *krade*, the name given by the Greeks to the part of the fig with which they specially associated the digestive property. It contains nitrogen, and in the dry state it forms a friable, semi-transparent, dark yellow, amorphous mass, yielding an amber-yellow powder. In water it swells, but does not dissolv, though upon being shaken it imparts to the liquid a milky appearance. When dissolved by the aid of alkali or acid a concentrated solution is dark yellow, but becomes colorless upon being diluted. Cradina differs from pepsin in maintaining its digestive power in an alkaline liquor, and from papain or papayotin in being insoluble in water, not precipitated from solution by alcohol or lead acetate, and in its activity not being diminished in the presence of hydrochloric acid. In a neutral liquid it is devoid of digestive power and it has no reaction upon starch.—*Pharm. Journal.*

AT a recent meeting of the Engineers' Club of Philadelphia, Mr. Rudolph Hering continued reading a paper on the corrosion of iron and steel, and referred to galvanic action as a principal cause. He gave the results of experiments on this subject, and principally of those made by Mr. Thomas Andrews, of England. Wrought iron was placed in connection with numerous steels and cast iron, and exposed to sea water for about 300 days. From these it was found that metals corroded much faster wh n in galvanic connection than otherwise. The wrought iron (Wortley best scrap) resisted corrosion better than ith r steel or cast iron. The electro-chemical position of the steel changed frequently with reference to wrought iron, indicating that corr sion took place alternately in the wrought iron and steel. The position was almost constant, however, when connecting wrought and cast iron, indicating corrosion to take place almost entirely in the latter. Gravimetrical results were also given, which showed the amount of corrosion in grains per square f ot, per annum, under the conditions assumed in the xperiments.

APPARATUS FOR SCOURING WATER-WAYS.

In works like increasing the depth of rivers, channels, and harbors, it is the highest grade of engineering to devise methods of supplementing nature by means of mechanical devices in such a manner as to cause the work to be done mainly by natural forces.

Mr. Holden, the inventor of the system of scouring the water-way, illustrated by our engraving, has grasped this idea and has patented an effective device, by means of which sand on river and harbor bottoms may be loosened and floated so that the natural eddies and currents may carry it away.

According to this invention, two sets of pumps are mounted upon the deck of a suitable boat, preferably a heavy tug boat, and connected with two sets of pipes extending from the deck of the boat upon platforms supported by stays from a mast. From these two sets of pipes hang flexible pipes provided at their lower ends with nozzles, the nozzles of the water pipe alternating in position with the nozzles of the air pipes. The pipes are further stayed by guy ropes from the sides of the tug, and the nozzles are furnished with transverse arms, as shown in Fig. 2, from which are suspended heavy weights for holding the flexible pipes in a vertical position. Water is driven with great force through the water pipes, thereby stirring up the sand and other material at the bottom, and the air forced through the air nozzles, in bubbling up through the water, tends to float away the particles dislodged by the water jets, so that the natural current of the water will carry the sand or other material to a much greater distance than it would if the water jets alone were used. Although this apparatus will generally be carried by a vessel or float of some kind, it may be operated from a dock or temporary structure.

We understand that this invention is very effective in its operation, and bids fair to play an important part in engineering works of this class.

We are informed that arrangements have been made with the Aransas Harbor Company, of Aransas Harbor, Texas, whereby this invention is to be applied at once for dredging Aransas Harbor and the bay, up to Aransas Harbor. It is expected that the depth of the water can be increased thirty feet in less than sixty days by the use of this apparatus.

Further information regarding this invention may be obtained by addressing Mr. E. G. Holden, Fulton, Texas.

The Smoke Nuisance can be Easily Abated.

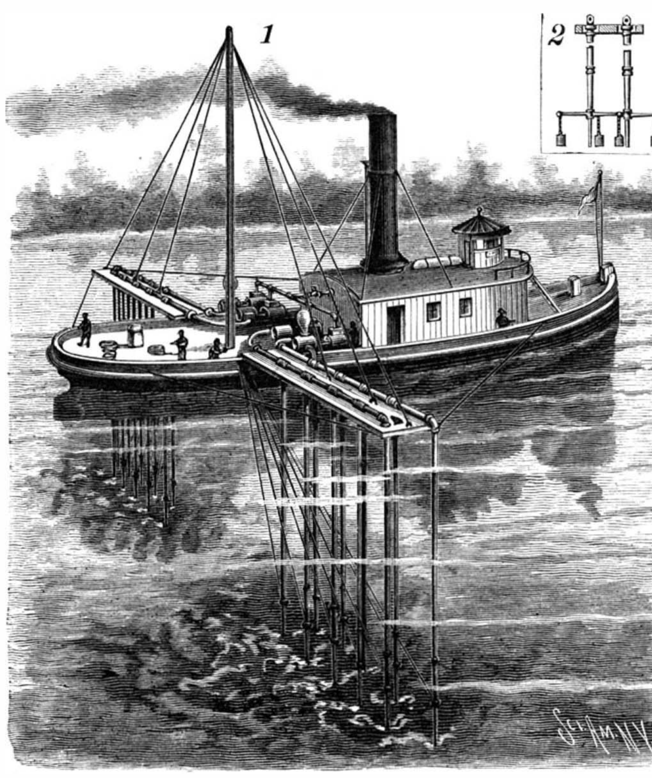
Something over a year ago the municipal authorities of Chicago began to move in dead earnest against the owners of steam-making plants, manufacturers, railroads, hotels, etc., for their constant violations of the ordinance which declared the emission of volumes of black smoke from chimneys, smoke stacks, etc., to be a nuisance. Hundreds of prosecutions were instituted and fines to a very large aggregate amount were levied. The result has been, says the *Railway Master Mechanic*, that the nuisance has been to a large extent abated. This has been accomplished very largely by the use of devices which force jets of air in sufficient quantities into the furnace to secure complete combustion. This method has proved satisfactory on both locomotives and stationary engines, and has helped largely to clear the atmosphere of Chicago from the black smoke which soft coal produces.

The Chicago & Northwestern has abated the nuisance on 64 locomotives and on 166 stationary boilers, in its depots, office building and shops; the Pittsburg, Chicago & St. Louis on 18 locomotives, one boiler in its shop, and has contracted to equip all other engines running into Chicago; the Pittsburg, Fort Wayne & Chicago has ten locomotives equipped; the Chicago & Northern Pacific is engaged in equipping all its locomotives running into Chicago; the Lake Shore & Michigan Southern has equipped 68, and that number comprises all the locomotives running into the city, including passenger, freight and switch engines; the Chicago, Rock Island & Pacific has equipped 24 locomotives with new devices and repaired 36 old ones, some of them having been in use for the past six years, and has equipped the boilers at its elevators A and B; the New York, Chicago & St. Louis has equipped 8 locomotives and contracted for ten more, which will cover all the engines this road has running into the city; the Chicago & Erie has equipped 18, and has assured the department that it will continue the good work until all the engines running into the city stop their smoke; the Chicago & Grand, Trunk is now engaged in equipping all its engines running into the city, it has seven equipped and has promised to finish them all before summer; the Belt Road has equipped three locomotives and the boilers at the Dearborn station; the Chicago & Eastern Illinois has equipped nine new and repaired 16, that had been in use several years; the Baltimore & Ohio has all its engines equipped running into the city, 35 in number, and reports being highly pleased with the result; the Illinois Central has succeeded in stopping the smoke on 12 of its engines and promises a complete abatement of the smoke nuisance in the near future; the Michigan Central is engaged upon 39 of its engines running into the city, and has 13 of them already working satisfactorily. These results are very satisfactory, and establish beyond a question that it is practical to abate the smoke nuisance. Many of the other roads running into the city have made experiments during the past year, but have reported little progress and a good many failures. The department has decided that sufficient time has been given to those who have not yet complied with the ordinance and a vigorous prosecution will be commenced against those who have neglected or refused to comply. Much more has been accomplished in abating the nuisance in factories, hotels and office buildings.

Pump or Injector.

We know of an engineer who had the question asked him by his employer if it would not be better to have an injector for his boiler than the power pump he was using, "because all the heat went right back into the boiler again, and heating the feed water." This is the way he figured it out to see what he had better do:

If 1,000 pounds of water is to be pumped into the boiler by an injector, raising the temperature of the water in doing so 70°, as one heat unit will be required to raise one pound one degree, 1,000 × 70 = 70,000 heat units are required to raise 1,000 pounds 70°. Taking the total heat of steam from 62° as representing 1,145 units of heat, this work will require 70,000 ÷ 1,145 = 61 pounds of steam, to make which, assuming an evaporation of 8 pounds per pound of coal will require 61 ÷



HOLDEN'S APPARATUS FOR DEEPENING CHANNELS.

8 = 7⅝ pounds of coal to do the work with the injector.

Taking 1,000 pounds pumped by the power pump run by a belt driven primarily by a Corliss engine, against a pressure of 60 pounds, equal to a height of 120 feet would require 120 × 1,000 = 120,000 foot pounds of work to be performed, or nearly 4 horse power, for a minute. The engine would use 30 pounds of steam at the outside per horse power per hour, or one-half a pound per horse power per minute. The 4 horse power therefore would need 4 × ½ = 2 pounds of steam. This two pounds of steam, on the same evaporation as with the injector, would require one-quarter of a pound of coal to do the work.

Another method he tried was to take a pump duty of 70,000,000 foot pounds per 100 pounds of coal as a basis, a low duty. Therefore one pound of coal would do a duty of 700,000 foot pounds, but as the work he was to do was but 120,000 foot pounds, it would require but its proportion of the pound of coal, or about one-fifth. From this figuring he reasoned that the injector was not going to be so economical as his pump, especially when he would not consider the raising the temperature of the feed water in the matter, because he used a feed water heater and he considered he was getting that heat for nothing, since otherwise he would throw it away.—*Boston Jour. Commerce.*

A Sky Rocket Boiler.

At Pittsburg, April 4, the boiler of the West End Gas Company exploded. The boiler was an upright one and it went straight up through the roof over Foley's livery stable, which is three stories high, and then over a row of frame buildings, in the rear of the stable, and up into a lot on Steuben Street, a distance of about 500 feet. No one was in the building when the explosion occurred and its cause is not known.

Where Does Light Go?

The question put where a transparent surface has has been made translucent, as in the case of a cut, frosted or ground surface given to glass, is applicable to light generally. Where does light go? What becomes of the darting, shooting, piercing ray? These questions are equally to the point, whether we accept the theory of emission or of undulation, but particularly as to the latter.

To obtain as full a comprehension of the simple object as possible, let us, for the moment, consider that the expression of movement of light is in a right line—a right line only. This is an effect on the senses which we may say we know practically. Undisturbed, so far as we can calculate, the movement will go on indefinitely and forever; but when disturbed, we call the manifestation deflection (bent as to course), refraction (broken as to course, or a violent deflection), and reflection (doubled back as to course, or the most violent action to which light is susceptible).

Now, if we imagine light to be a solid bar, we will observe, on the basis of what is here advanced, that it might perform all the movements that we are ascribing to a single ray of light, and, if properly projected, as light is, it might go on indefinitely, bending, coiling and twisting through all creation. But we always conceive the idea of light by multiples—we speak of a ray when we really mean a whole bundle of rays, how many it is ever impossible to enumerate. So, continuing the figure of the bar, let us fill our horizon with an infinite quantity of bars, projected from an ever-lasting and ever-moving force, as they go on bending, coiling and twisting, until the sphere of our surrounding is filled and bar meets bar, each with the projection of the other, derived from the same imperial source, and propelled by the same majestic energy. Where do the bars go? On the light principle they cease to be bars, as light ceases to be light when motion becomes rest. With no means of progress or continuance except upon each other, we have come to the inevitable halt of the senses over the conception of an irresistible force and an indestructible body, for bar thus circumstanced cannot displace bar, and with the cessation of action the bars are no more on the principle of light. It is the Greek of nature meeting Greek with the natural product of nihilism after action. In this way light is said to be decomposed.

The same analogy may be carried into our conception of sound, where two identical vibrations neutralize each other and produce silence, and the same with air—the same with water.

Then may we not account for the loss of light as exhibited by the photometer in transmission, through a mass of prisms and reflecting surfaces, of the ground glass or the frosted globe, as perfectly natural? For, in the passage, ray has met ray and become extinct. This warfare is eternal—it is going on everywhere. Otherwise the universe would be all light, and primal sources would in no way be needed to combat the everlasting tendency to what is darkness to the senses.

Thus then we may reasonably conclude that the loss which we experience in transmission of light is simply a constant tendency of one ray to kill another as nothing else can, and as the prisms and surfaces are multiplied the loss is increased, and *vice versa*. Such at least appears to be the law of the elements that are inherent in matter and of a primary character.—*J. A. Price, Amer. Gas Light Jour.*

Sanitary Qualities of Watercress and Onions.

The watercress is a plant containing very sanitary qualities. A curious characteristic of it is that, if grown in a ferruginous stream, it absorbs into itself five times the amount of iron that any other plant does For all anæmic constitutions it is, therefore, specially of value. But it also contains proportions of garlic and sulphur, of iodine and phosphates, and is a blood purifier, while abroad it is thought a most wholesome condiment with meat, roast or grilled. The cultivated plant is rather more easy of digestion than the wild one. Botanically the onion belongs to the lily family. The odor of the vegetable, which is what makes it so unpleasant, is due to a volatile oil, which is the same as that in garlic, though in the onion it is milder and naturally does not last so long. There are, besides, easy ways of removing at once all unpleasantness from the breath. A little parsley or a few grains of coffee, or even a swallow or two of milk, if taken after eating, proves an effective remedy. Boiled onions are the least objectionable in regard to odor, and are as easily digested as any. The oil in the onion passes off in the water in which the vegetables are boiled, and if the kettle be kept closely covered and the water changed after they have boiled five minutes, and then again ten minutes later, there will be no odor through the house, and the onions will be white instead of gray, as they so often are. Besides being rich in flesh-forming elements, raw onions are especially good in breaking up a heavy cold, they are also stimulating to fatigued persons and are otherwise beneficial.

The Teredo.

In the office of General Manager C. J. Smith, of the Oregon Improvement Company, are a number of cans of some poisonous compound intended to prevent the terror of Puget Sound, the teredo, from destroying piles or other timbers placed in the water. The stuff is to be sent over to the sound to be tested. A number of things have been tried to protect piles from the teredo, such as creosote, asbestos, coal tar, castor oil, strychnine, etc., but the only perfectly sure method for preventing the teredo from eating up piles is to make them of iron. Covering wooden piles with copper will protect them as long as there is no place in the joints of the copper where a teredo can poke his nose through, but if once the copper gets torn it is goodby, John, to the pile. So far the poisonous compounds used on piles seem to have pleased the teredo much, seeming to act as a condiment on what must be rather a monotonous bill of fare, and assisting in its digestion. The man who finds out the poison which will act as an antidote to the teredo will have a good thing. It may be that if the piles were washed with whale oil soap every day it might keep away the teredo, or if the piles were greased with tallow, perhaps the long, slimy, wriggling pest might not be able to get its teeth into the pile, as they would slip off. The people on the sound can rejoice that the teredo does not go ashore and hunt for tall timber, as if it did the lumber output of that section would soon be *nil*. It might be that if the sawmills on the sound would throw their sawdust into the sound the teredo would learn to like it, and would prefer "cut feed" to cutting up the piles themselves, and thus some good might be accomplished.—*Portland Oregonian.*

Wealth of the Northwest says: Not only sawmill owners, but all who build docks, booms, or log in the salt waters of this coast find in the teredo an enemy who works in the dark and one that is as uncertain in its movements as it is certain to be felt in some way not profitable sooner or later. Certain localities whose waters are salt and tributary to the Pacific Ocean are reported as free from the ravages of this pest. Mr. J. S. Mundy, of the Bellingham Bay Milling Company, at Fairhaven, Washington, is on record as saying that he has recently inspected piles at that point—under a dock—that have been in use for six years, and did not find a pile entirely destroyed by teredoes, though some were so badly eaten that it was necessary to replace them. Cedar posts under the mill were found in a condition that did not require that any of them should be replaced. On Gray's Harbor the statement is made that the teredo has never done any damage. There may be some local causes in both these places for this healthy condition, so to speak. It is thought by some that rough water caused by continuous winds prevents this worm from getting in its work. In other localities swift currents from tides may be a preventive. At any rate certain points seem more exposed to their destructive work than others. It may be that these worms haunt certain localities—as fish do—and avoid others, without any cause known to man. At Tacoma, Seattle, Victoria, and other points on the sound the teredo has cut docks down in a year's time, causing heavy damage, and in some instances loss of life. By some it is thought that after six months a pile is unsafe, but this is an extreme opinion. However, in the case of a dock that was cut down by these worms at Seattle within a year after it was built, this opinion is not very much out of the way.

The *Commercial News*, of California, says on this subject that "the teredo is a nuisance and expense here, but the great Northwest coast, which tries in many ways to prove its superiority over California, in one respect at least carries off the palm, and that is in teredoes. Captain Gibson, of the bark J. D. Peters, has presented this office with the section of a pile which was in a raft waiting to be used in the building of a wharf at Seattle. The pile had been in the water only thirty days, and when hauled out on the beach it was noticed the teredo had got in its deadly work, and the stick was, before it had ever been used, rendered worthless by this pest. The section referred to is about a foot in diameter, and contains, by actual count, 212 holes bored by this industrious woodworker. When this log was on the beach, it is said the little pests kept up boring, so that placing the ear near the pile it sounded as if a sawmill was in active operation. With such an illustration of the futility of using wood for wharves, why is it that here and at the north some plan is not devised by city or State authorities to make permanent improvements on the water front of each city? Docks built of stone, though the first cost is greater, would in a very short time be cheaper than wooden wharves constantly needing renewal, and this section of a pile, which is on exhibition at this office, is an object lesson which merchants, taxpayers, and particularly officials having charge of the wharves in this and other Pacific coast cities should study."

In the year 1884 it is said that one of the large sawmill companies of Puget Sound lost 50,000,000 feet of logs that were allowed to lie in the water until the teredo had ruined them.

So far nothing has been found to protect these piles that is not too expensive for general use. Some one will one day solve the problem and realize a fortune.

Treatment of Diphtheria.

Dr. Guntz, of Dresden, has had great success in the treatment of diphtheria with bichromate of potash in water containing carbonic acid, which he has found by numerous experiments on animals, as well as in the course of extensive clinical observation, to be entirely harmless. For an adult 600 grammes (about a pint) are ordered per diem, in which are dissolved three centigrammes (about half a grain) of potassium bichromate. The whole quantity is directed to be taken in about half a dozen doses, regarding which it is important to observe that they must not be taken on an empty stomach; a little milk or gruel should therefore be swallowed before each dose. Children, of course, take smaller quantities, according to age. They can be given the medicine in a tumbler mixed with some fruit sirup, and they do not generally object to it. At the commencement of the disease Dr. Guntz washes the mouth out with a 1 per cent solution of permanganate of potash containing 0·1 per cent of thymol, or with a corrosive sublimate solution of the strength of 1 in 3,000, taking care, in the latter case, that none is swallowed, and that the mouth is well rinsed with water afterward. In the case of young children the pharynx must be brushed out with the solution. Sometimes iodoform is employed, being applied on the tip of the finger to the affected spots. Dr. Guntz specially remarks that potassium bichromate, though harmless in the way described, is by no means so when in pills, powders, or in solution in non-carbonated water.—*The Lancet.*

RECENTLY PATENTED INVENTIONS.

Engineering.

SMOKE CONDUCTOR. — An improved smoke conductor, patented by Mr. James R. Johnson, of Charleston, S. C., is designed to adjust itself automatically where it is coupled to the cars of a train, and to retain its connection whether the train is on a curved or a straight track, the whole being arranged so that it may be regulated from the cab of the locomotive. A section of the conductor is mounted upon each car, and one is provided for the locomotive and another for the tender. The forward end of the conductor enters the smoke stack, and a valve is provided for directing the steam and products of combustion from the locomotive smoke stack through the rearwardly extending conductor. In front of the smoke stack is arranged a flaring mouthpiece opening into the stack opposite the conductor, the mouthpiece serving to gather air as the train moves forward, and assist in propelling the sparks, gas and steam through the conductor.

ASH PAN FOR ORE ROASTING FURNACES.—Mr. Simon B. Dexter, of Glendale, Montana, has recently patented an ash pan for ore roasting furnaces, especially those described in a former patent by the same inventor. The ash pan is provided with a water discharge pipe and arranged in connection with the water grate so as to receive the cooling water discharged by the grate and convey it, together with the ashes, to the discharge pipe leading away from the furnace.

PORTABLE SELF-RAISING LADDER.—Mr. Benjamin H. Burling, of Fort Ann, N. Y., has recently patented a portable self-raising ladder, which is readily placed in position for use. It is provided with an auxiliary ladder at the upper end, which may be used as an extension of the main ladder, or as a platform or fire escape, which may be projected horizontally into the windows of the upper stories of a building. The lower portions of the side pieces of the main ladder are thickened and provided with tubes, two on either side of the ladder, for conveying hot or cold water or steam for extinguishing fires. The ladder is supported upon a vehicle furnished with a tongue at either end, so that it may be drawn in either direction without the necessity of turning it around.

Railway Appliances.

AUTOMATIC RAILWAY SIGNAL.—Calvin W. Wilhelm, Mauch Chunk, Pa. This signal is set and locked by means of a lever depressed by the wheels of a train and actuating a series of locking levers and latches, the semaphore being released by the closing of an electric circuit as the train proceeds. The electrical parts are so arranged that one battery at each station operates two magnets; and a train may be signaled a block and a half to the rear.

SAFETY ATTACHMENT FOR RAILWAY CARS.—Robert M. Smith, Cherokee, Iowa. This is a support or platform adapted for attachment to the end of a car adjacent to the coupling device, whereby the cars may be coupled or uncoupled by a trainman without exposing himself to injury. A further safeguard is also provided to prevent the train hand from being jolted from the platform.

Mechanical.

A MACHINE FOR LAYING AND SPOOLING WIRE, patented by Messrs. G. B. Johnson and J. O. Hill, of Princeton, Kan., is designed for use with any variety of wire, or other material usually wound in coils, but it is especially adapted to be used in handling barbed wire fencing, the machine being constructed so that the wire may be laid and stretched at one operation. The frame carrying the wire-winding mechanism is mounted on wheels; a shaft journaled in the frame carries a spool containing the wire, and a rod pivoted to the rear end of the frame carries at its free end a guide roll to guide the wire to the spool. The machine has all the necessary adjustments to adapt it to the use for which it is intended.

DYEING MACHINE. — Mr. Joseph Hussong, of Camden, N. J., has recently patented a new dyeing machine. This machine is provided with a vat furnished with a cage supported by bell crank levers, the levers being connected by links and arranged to receive oscillatory motion from a rock shaft, the motion of the bell crank levers being made variable by placing the connecting rod in different notches of the arm of the rock shaft.

CHECK PUNCH.—Mr. George L. Banks, of Fall River, Kansas, has patented a check punch which will perforate a check with figures representing the amount of its face value. The device is provided with a series of figure punches mounted in a frame and capable of being brought to the same point before being operated, a registering and indicating device being provided for bringing the punches into the proper position for use. A pair of feed rollers is employed to move the check forward one space for each figure punched, the lower roller of the pair being mounted on a shaft operated by a pawl and ratchet connected with the punching key or lever.

AN IMPROVED GRINDING MILL for gradually reducing grain to different degrees of fineness for flour and feed has been patented by Mr. Le Grand D. Harding, of Colfax, Washington. In this mill one of the grinding rollers has in its periphery an annular recess to which is fitted the annular projecting portion of a second roller, the two rollers running in frictional contact with each other, or with the grain passing between them. The rollers are made hollow from the center to the ends, to receive spouts for conveying away any dust that may be discharged from the ends of the rollers. The grain is fed to the rollers by a feed roll working in a hopper located above the rolls. The rolls being made hollow in the manner described, afford a ready escape for any heat that may be generated in grinding, and by driving one roller by frictional contact with the other, an economy in power is secured.

Agricultural.

POTATO DIGGER.—Mr. John Franklyn Fowler, of Brooklyn, N. Y., has patented a potato digger, formed of a beam to which is attached a U-shaped hanger carrying a plow or point adapted to pass under the hill of potatoes, and provided along its rear edge with a series of divergent fingers or rods projecting upwardly and rearwardly, so that as the potatoes and the earth are raised together by the point as the implement is drawn forward, the potatoes are crowded over the rods or fingers, when the earth falls through and the potatoes are discharged over the rear extremities of the fingers upon the ground.

Miscellaneous.

WATER TROUGH.—Bernhard Koeppe, Kearney, Neb. This invention relates to an improved trough for watering stock, fowls, etc., and provides a device to be connected to the water supply to control the inflow of water, so that the desired height of water in the trough will be uniformly maintained by the automatic action of the controlling mechanism.

TRUSS PAD.—Joseph Garcia, Paterson, N. J. This invention provides a pad which may be conveniently filled with a liquid or with air as often as desired, while the interior of the pad may be effectually and thoroughly cleaned when necessary.

A NEW SERVICE AND CASH CHECK, patented by Mr. Geo. D. Smith, of New York City, is especially designed for use in restaurants where it is the rule for waiters to collect from the guests or patrons the value of the food served. His invention is designed to assure to the proprietor full returns for the value of the food served, and to prevent collusion between the employes and patrons, without offense to either, and to secure a more satisfactory service. The check is provided with a series of numerals indicating successively higher values of food served, and provided with a series of dots or marks opposite each of the numerals, so that like orders of the same value may be registered by punching out successively the dots or marks of the series opposite the corresponding numerals of the check.

NEW BOOKS AND PUBLICATIONS.

DIE DECORATIVE KUNST-STICKEREI. I. Aufnaeh Arbeit. By Frieda Lipperheide. Berlin. 1890. Franz Lipperheide.

The first part of "Artistic Embroidery" deals principally with cut-out figures or patterns attached by stitches or other means on the cloth. The handsomely illustrated book gives full instructions for making such artistic embroidery, and also gives description and illustrations of the tools necessary for the work. The book contains besides the text a number of colored plates and wood engravings illustrating beautiful designs of embroidered covers, curtains, chairs, etc., copied from original designs of the Spanish, German, Italian, and French schools of the fifteenth, sixteenth, and seventeenth centuries. The book, although primarily intended for the use of ladies doing handiwork, will no doubt be welcomed in many shops, factories, etc., requiring artistic designs for embellishing the goods manufactured.

The Charter Gas Engine Co., of Sterling, Ill., publishes a pamphlet giving a large number of letters of recent date, from users of their machines, testifying to their efficiency and economy. They are used for every variety of work, from printing presses to grain elevators, and are designed to be perfectly safe, compact and trustworthy, while working with great economy. The engine uses gasoline direct from a tank, and has an automatic governor whereby only as much gasoline is used as required to do the work.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(2976) A. C. asks: 1. Is an iron casting containing from 40 to 60 per cent of steel (or *vice versa*) of any commercial value as scrap? A. Yes. 2. Is it possible to decarbonize foundry irons by the Bessemer or any other process? If not, why? A. Yes; but they may not be well adapted for it, as not being pure enough, etc. 3. Why will steel scrap produce slag in a cupola and not in a covered crucible? A. In the cupola it is mixed with the ashes of the coal, which have to be slagged off, and it also needs slag to protect it from oxidation. In a covered crucible there is no impurity to be disposed of, and the steel is protected from oxidation. 4. In the manufacture of steel car wheels are the wheels cast from new steel, made in a converter? A. Casting direct from a converter has had very little success hitherto, on account of blowholes in the metal. 5. Is not the presence of blowholes in steel castings due more to the lack of pressure on the castings rather than to impurities in the metal? A. Blowholes are due to the low degree of fluidity of melted steel, and only to a limited extent to impurities. 6. What work is there on the manufacture of steel castings that you could recommend as being thoroughly up to the times? A. We highly recommend our SUPPLEMENT, No. 692, as well as many others to be found indexed in our new catalogue of SUPPLEMENTS. Also Howe's "Metallurgy of Steel," $10 by mail.

(2977) J. N. H. asks: 1. In what ratio is the time in which no current is passing to the time in which a current is passing in an alternating current? A. The time when no current is passing is almost zero. As the current rises and falls, and changing in direction rises again, the zero phase is indefinitely short in duration. The full discussion is quite complicated. 2. How can the lines of force about a certain magnet be calculated? A. By determining the adhesion of an armature, or by determining the E. M. F. produced by cutting the lines with a coil of given size, or by producing the lines and determining the E. M. F. produced in a coil of known size. 3. What is meant by the "torque" of an armature? A. The turning moment or couple, the product of the pull upon the armature by its effective radius tending to produce rotation. 4. What is a "cushion tire" on a bicycle? A. A hollow tire, giving greater extent of cushioning than the ordinary solid rubber tire.

(2978) C. H. asks: 1. What kind of battery would be most satisfactory and economical to run a motor to furnish ¼ horse power? A. Probably a Bunsen battery is the best for your purpose. You will find it a troublesome and expensive power. 2. How many cells would be required A. Enough to give 373 watts through zero external resistance, say 24 one quart cells. 3. How long would they furnish the required current at one charging? A. With ordinary use they will work for 50 or 60 hours with one full charge and an additional renewal of the bichromate solution. 4. What makes the bones of canned salmon so soft and brittle? A. The canning process, and action of the ingredients.

(2979) N. E. C. asks: What is the difference between air pressure at sea level and one, two, three, four and five thousand feet elevation respectively? And, what the difference in the volume of air at sea level and the above elevations? A. Taking the height at sea level as 30 inches, at 5,000 feet it is 24·773; at 10,000 feet, 20·459; at 15,000 feet, 16·896; at 3 miles, 16·361; at 6 miles, 8·923; at 9 miles, 4·866; at 15 miles, 1·448. As a rough approximation, allow one inch to one thousand feet. The volume of the air is in inverse ratio to the height of the barometer.

(2980) A. F. asks (1) if there is anything he can put on boots and shoes to make them waterproof? A. Beef tallow 4 ounces, resin 1 ounce, beeswax 1 ounce, melt together and add an equal quantity of neat's foot oil. Rub in while warming the shoe at a fire. 2. How can I take spots out of clothes, black worsted. It is a lightish spot, and I think it is grease. A. Use benzine, applying in a ring around the spot and finally to the spot itself. 3. How can I make cloth waterproof? A. Melt in paraffin wax with a hot iron. 4. I have a scar on my chin; how can I take it off? A. It is probably impossible to remove completely; consult a physician.

(2981) H. A. S. asks what the boiling point is for oils of spruce (*Abies nigra*) and tamarack (*Larix Americana*). A. The specific gravity of these oils varies from 0·850 to 0·880; they boil from 300° to 320° Fah., are very slightly soluble in water, sparingly in alcohol, readily in ether.

(2982) M. F. asks how to transfer lithographs to glass. A. Varnish the glass with dammar varnish or Canada balsam. When dry, soak the picture in water for some hours. When the glass is nearly dry, smoothly press the wet picture upon it, being careful to exclude all air bubbles. When all is dry, rub off the paper with the wet finger, dry, and revarnish.

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April 14, 1891.

AND EACH BEARING THAT DATE.

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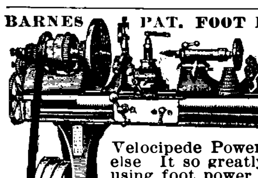

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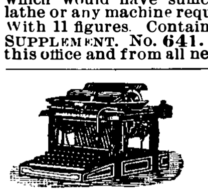

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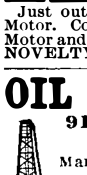

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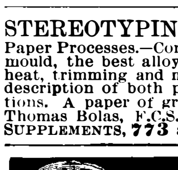

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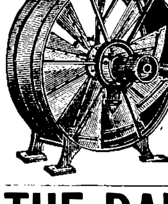

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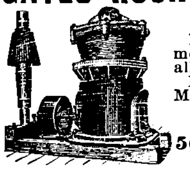

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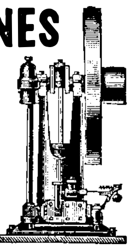

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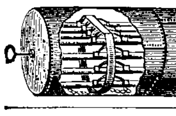

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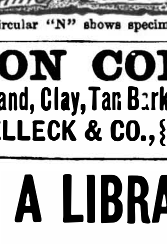

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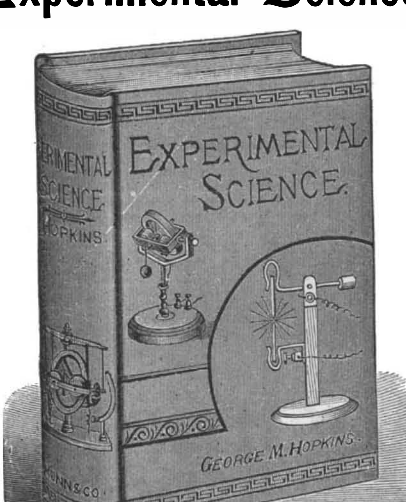

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