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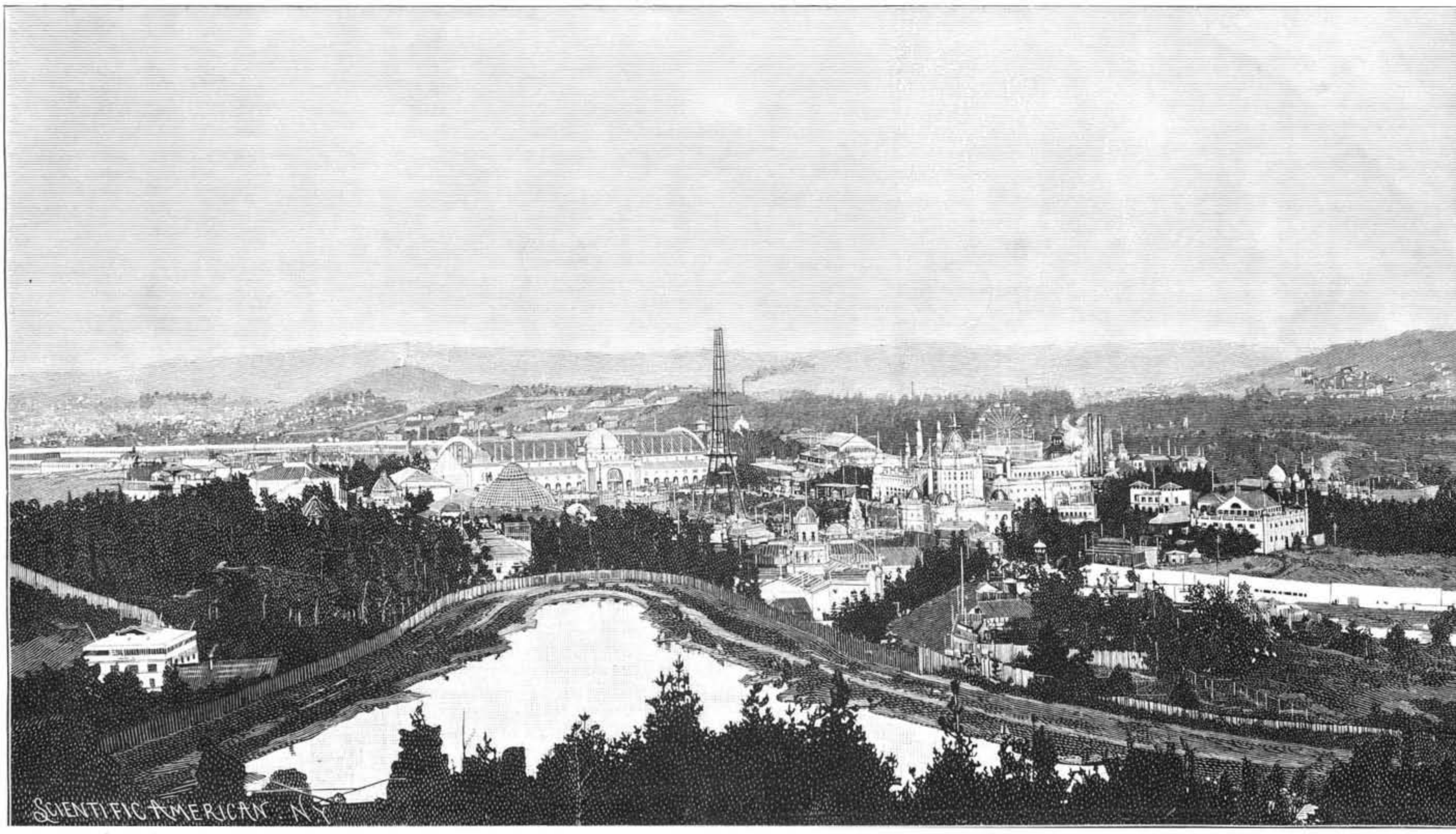

THE CALIFORNIA MIDWINTER FAIR—A BIRD'S EYE VIEW.

THE CALIFORNIA MIDWINTER FAIR—THE MECHANIC ARTS BUILDING.—[See page 232.]

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NEW YORK, SATURDAY, APRIL 14, 1894.

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 954.

For the Week Ending April 14, 1894.

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INVENTORS AND THE GOVERNMENT.

The treatment of inventors by the United States government, as exemplified in its courts, in the War and Navy departments, and in the Patent Office, has of late been the subject of very varied comments. A reporter's interview with a typical American inventor, now and for some years resident abroad (Mr. Hiram Maxim), has been somewhat extensively circulated, in which he states that he has received much better treatment abroad than at home. He claims that a disposition exists in this country to rob the inventor of his rights. When an invention is made, the first effort, he says, is to push forward some alleged improvement on it, or some variation which will afford a ground for escaping from the original patent. He accuses the government of not awarding him his just rights; or at least of not giving due consideration to his work—work, it should be stated, entirely in the direction of munitions of war. England, according to him, is a better field for the inventor, and the government there seems to have treated him as he desired, and as he feels is just. The United States government, through its officers, has, he claims, a way of taking out patents on top of his, and of so appropriating his inventions.

It is, however, in its character of purchaser of patented things that our inventor complains of the government. It is very true that until recently inventors of improved arms and munitions of war had but little chance to deal with the Federal authorities. There was little or nothing needed. The country drifted along very peacefully without an extensive navy, and with but the skeleton of an army. But now a change has come. The navy is being built up as quickly as possible, and we soon may be a participant in the race of the great powers for naval supremacy. The army, while not increased in numbers, is being supplied with new arms—arms due unfortunately not to an American inventor—and of small caliber, in sequence with approved European practice. Harveyized steel, American made projectiles and American machine guns are now freely purchased, simply because our country has a navy on which to employ these products.

It would appear therefore that as a purchaser of patents the government is not so very much to blame. The authorities have to exercise care in such matters, and their fate is to be besieged by patentees desirous of having their inventions adopted. The absence of a large standing army, and our fortunate exemption from imminent danger of war, have operated to cut off one of the largest markets for inventions.

The subject of the inventor and of how he should be treated by the public is a very wide one, on which different opinions may be consistently or at least honestly held. But the enlightened opinion can be but the one. The inventor should be encouraged. He is one of the few definitely provided for in the constitution, and the patent statutes are built directly on the provisions of that instrument. The administration of the Patent Office should be conducted for his good, the very establishment of the office being based on the theory that the inventor is a public benefactor. If an application is made for a patent, the examiners of the case should strive to discern the invention which may be in it, and not endeavor to reject it for want of this indefinable quality. The highest courts have their principal difficulty in patent cases in deciding as to invention, its presence or absence. It seems absurd, therefore, at the outset of the career of a patent application that this most difficult question should be adjudicated by the first official dealing with it.

Many lawyers have felt that a more liberal treatment should be awarded patents by the courts. The virtual abolishment of the right of reissue has done away with what should have constituted an effectual remedy for inadequacy of claims. The Patent Office should therefore not err on the side of severity; it should be the inventor's friend and critic, not his enemy, and should not constitute itself a court of first resort.

The Deadly Passenger Car.

We are all going to be poisoned now by the deadly passenger car. In the laboratory of the Imperial Board of Health of Germany experiments were made between January, 1891, and July, 1892, by which the seeds of consumption were found in abundance in the dust collected, not only on the floors, but on the walls and seats, of cars. Samples of dust were taken from 45 compartments of 21 different passenger cars and 117 animals were inoculated with them. Part of these died very soon thereafter of various contagious diseases before they had time to develop consumption; of the rest, killed four to six weeks after inoculation, three had tubercles. These three, however, were inoculated with sleeping car dust, taken, not from the floor, but from the walls, cushions and ceilings. Bacteria at the rate of 78,800 per square inch were found on the floor of a fourth class car, and 34,400, 27,200, and 16,500 per square inch on the floors of the third, second and first class cars. Thus, even in the latter, the average passenger, who usually has at least half a compartment to himself, say 3,000 sq. in. of floor, has an army of 49,500,000 deadly enemies aiming at his vitals on the floor alone, to say nothing of other millions in front and rear, on both flanks and overhead. It would seem impossible to escape; but the board of health is said to have reported measures for removing or reducing the danger, which the railroads are considering.—*Railroad Gazette.*

The Tehuantepec Isthmus Railway.

The March number of the *Engineering Magazine* contains an interesting article on this subject by Senor Romero, the Mexican minister at Washington, from which we take the following:

The Mexican Congress, by an act of June 2, 1879, gave a charter to Edward Learned, a citizen of the United States, or the company that he might organize, to build the Tehuantepec road within three years and four months from the date of the charter, and offered a subsidy of $7,500 for each kilometer of road built by the company and actual land opened. Mr. Learned organized a company in New York which held the grant for several years and built, in a provisional way, a few miles of road from the mouth of the Coatzacoalcos River toward the south.

After long experience in ineffectual efforts had shown that it was not possible to secure this road even under the liberal concessions made by the Mexican government, it was suggested that the government should undertake the work on its own account. Congress, therefore, authorized the executive, on May 30, 1882, on account of the state, to build the Tehuantepec Railway or to contract for its construction with a company.

By virtue of this authorization the Mexican government signed, on October 15, 1888, a contract for the construction of the road with Edward McMurdo, the representative of Salvador Malo, authorizing a loan of £2,700,000 for the expenses of the same, which was raised at London, Berlin, and Amsterdam by the sale of five per cent bonds at about seventy per cent. This contract was approved by an act of the Mexican Congress of December 19, 1888, and was modified by another contract signed on October 15, 1889, also subsequently approved by Congress.

To carry out this purpose it was necessary first to terminate the contract still pending with the Learned company. This company agreed to give up the contract, receiving a compensation for expense and damages of $1,500,000 in United States gold, which I paid in New York on behalf of the Mexican government.

As the proceeds of the loan of £2,700,000 were not sufficient to finish the road, part of another loan of £3,000,000, recently contracted at the city of Mexico, has been applied to that work. On December 6, 1893, a contract was signed at that city for the construction of the fifty-nine kilometers of road unbuilt, and it is provided in the same that the line shall be finished on September 6 of this year, with an additional expense of over $1,000,000.

The Tehuantepec road is now practically completed, and Mexico offers the result of all this work of many years to the commercial interests of the world.

The comparative advantages of the Tehuantepec interoceanic route over the Panama route, in reference to geographical and commercial features, are great. Any map showing the two routes will prove in a general way the geographical advantages of the Tehuantepec route in reference to the coastwise commerce of the United States, and, in a measure, its advantages in relation to the business of western Europe.

The shortest sail or steamer route from eastern Asia to any point on the Pacific coast of the American isthmus passes in close proximity to the shore line of Tehuantepec; in fact, the shortest great circle from Panama to Hong Kong will pass through Tehuantepec, east of San Francisco, and nearly up to the Aleutian Islands. Even the shortest route from Panama to the Sandwich Islands will pass close to Tehuantepec.

It is only a little over 810 miles from the mouth of the Mississippi River to the eastern terminal of the Tehuantepec Railroad. The total distance by rail and water from Chicago to the Pacific Ocean via Tehuantepec is only 1,875 miles.

The nautical conditions for sailing vessels are much more favorable at Tehuantepec than at Panama.

The interoceanic route established at Tehuantepec will connect, at the best possible location, the eastern and western coasts of the United States and Mexico, and will develop a coastwise business of great magnitude and of vast importance to these two countries, if controlled and managed by United States interests.

Eighty Miles in Forty-five Minutes.

M. Latruffe, who went up in a balloon recently, at Courbevoie, outside Paris, and who was supposed to be lost, succeeded in safely reaching firm earth. His ascent (says the Paris correspondent of the *Daily Telegraph*) was to have been a short one, but he had no sooner reached the upper air than he was carried away in a northwesterly direction. He descended with much difficulty at a little place called Beauvarde, between Chateau-Thierry and Epernay, in the Champagne district. He had thus traveled eighty miles in three-quarters of an hour.

How to Distinguish Textile Fibers.

It is customary, says *Textile Industries*, to mix, spin, and weave fibers in various proportions, and as it is important to know the quantities of different fibers contained in goods to be imitated, researches have established a number of tests for this purpose, with which every manufacturer and manager should be thoroughly conversant.

In a fabric composed of linen and cotton, a strong potash solution will color the linen fiber a deep yellow, while the cotton will be only slightly tinged with the color; a mixed yarn or fabric will, therefore, assume a spotted or striped appearance in the liquid. If a sample of the linen to be tested is dipped into olive or rapeseed oil, the fabric will quickly absorb it. When the excess of oil has been removed and the fabric appears striped, it is not pure linen, but mixed, and, further, the linen thread becomes transparent and the cotton thread opaque; while, if the linen saturated with oil is laid upon a dark substance, the linen threads will appear much darker than the cotton on account of this transparency. In order to destroy or dissolve cotton by a process similar to carbonization, the fabric to be tested is laid in a mixture of three parts sulphuric acid and two parts saltpeter for eight or ten minutes, then washed, dried, and, finally, treated with ether containing alcohol. The woolen and linen fibers have remained uninjured, while the cotton has been dissolved.

In order to distinguish animal from vegetable fibers, they may be boiled in caustic potash lye. Both wool and silk will be dissolved thereby, but not linen and cotton. If a sample of woolen goods is to be examined to see if it contains cotton, place it in a concentrated sulphide of sodium solution; by this, the wool is dissolved and can be entirely washed out in hot water. The residue will be vegetable fiber, and, if the sample was at first weighed exactly, the actual percentage of wool can be ascertained by weighing the remaining vegetable fibers. Such a fabric can be analyzed with still greater facility in an undyed condition. Wool and silk, when plunged into picric acid, are dyed a fairly fast yellow, while both linen and cotton remain white.

A silken thread, when exposed to a flame, ignites, evolving a smell of burning feathers, but continues to burn only as long as it remains in contact with the flame, and is extinguished when taken away, the burnt end forming a black, charred substance, thicker than the thread. Wool behaves similarly, but the odor is more repugnant.

The surest and best test, however, is the microscope, which gives unerringly the component fibers of the fabric under examination. For this purpose, several threads must be drawn out of the fabric in question (an operation best performed under water) and subjected to an examination with a power of from 200 to 300 diameters.

The linen fibers appear as cylindrical formations, with nodular swellings, the former sometimes split into thinner fibers, especially in the case of linen which has been used.

Cotton fibers, however, will show themselves as flat ribbons, and are very thin as seen where the edge is shown. With mixtures of linen and cotton, the examination of the fibers can be conducted with still greater facility, by opening a small strip of the material to be investigated, introducing it into a dilute alcoholic solution of aniline red (fuchsine), but only for a very short time, after which it is well washed, and then immersed in caustic ammonia for two hours. In this operation the linen fibers are dyed rose red, while the cotton fibers take no trace of color, and their examination is thereby rendered much more easy.

The fibers of wool appear under the microscope as cylinders covered with scales, and their delicate structure is rendered still more visible by treatment with sulphuric acid, which dissolves the yolk that fastens these scales to the fibers; but the different qualities can also be comparatively tested to ascertain the uniformity, firmness, or strength. The microscope is a means of distinguishing the relative value of the different wools better than is possible by any other mode. For this purpose, a "wool gauge" has been constructed, consisting of a brass frame screwed to the stage of the microscope, into which the wool fiber is fastened in such a manner that it is first loose, but is gradually tightened with a screw for that purpose, when the diameter can be measured with a micrometer and an exact measurement of the fiber obtained. But as all the fibers are not equally thick, it is necessary, of course, to measure several, to obtain the average. To measure the elasticity and strength of the fiber, it is first drawn tight, the index placed upon zero, and the tension increased by the gradual drawing with the screw mentioned until the fiber breaks. The index will show on the scale how many millimeters a fiber may be stretched before it breaks. It is evident that this experiment must be repeated with several fibers, and that the same apparatus can naturally be used for this purpose for all kinds of fibers.

Other animal hair used for textile fibers, goat hair, horse hair, etc., can also be recognized and distinguished by the microscope. As for silk, it presents no peculiarities, but is simply a homogeneous cylinder without the scale layer, marrow, and bark substance of hair. The optical difference of all these fibers is aided by the micro-chemical investigation. Iodine and sulphuric acid may be used as reagents, whereby the vegetable fibers, consisting of cellulose, are always colored blue, which is not the case with animal fibers. Silk differs from the latter in that it is dissolved in concentrated muriatic acid.

Aluminum for the Preparation of Phosphorus.

The applications of aluminum in the arts multiply with much the same rapidity as do those of electricity. The *Berichte* describes a new method of preparing phosphorus by its use as a reducing agent. The process is so simple that it can easily be illustrated on the lecture table. Hydrogen ammonium sodium phosphate is fused in a porcelain crucible until it is changed into sodium metaphosphate; aluminum turnings are then dropped into the liquid, and the freed phosphorus bursts into flame. Now if the experiment is tried with a glass tube, instead of a crucible, a slow current of dry hydrogen being passed over the mixture of the salt and aluminum, the phosphorus distills into the cooler part of the tube without the formation of any phosphureted hydrogen. The residue consists of alumina, sodium aluminate and a phosphide of alumina—Al^3P^5.

By these steps in the process only 30 per cent of the phosphorus in the mineral used can be obtained; but the phosphide is decomposed entirely by heating with silica, and this may be added at the beginning of the experiment and the reaction proceeds without difficulty and without loss.

It is advised that for the lecture table a combustion tube a yard long be used; two and a half parts of aluminum, six parts of sodium metaphosphate (obtained from heating previously the hydrogen ammonium sodium phosphate) and two parts of finely pulverized silica are placed in the tube, a slow current of hydrogen is passed through, and heat is applied until the reaction begins. This is shown by sudden incandescence, and phosphorus is seen to condense in globules on the cooler part of the tube, at the end where the hydrogen escapes.

Instead of this phosphate, any ordinary phosphate may be used, but experimenters are warned not to use the superphosphates containing calcium sulphate mixed with them, such as are used for fertilizing purposes, because the sulphate is suddenly decomposed by the aluminum with an explosion when a certain temperature is reached.

Business Law in Daily Use.

Herewith are the most important laws, succinctly stated, that touch the needs of the average business man. An observance of them will enable one to avoid many mistakes that may be serious, and steer the innocent from many pitfalls that may be calamitous. They contain, in few words, the essence of a large amount of legal verbiage not always very intelligible.

Each individual in a partnership is responsible for the *whole* amount of the debts of the firm, except in cases of "special" partnerships.

Contracts made on Sunday cannot be enforced.

A contract made with a minor is void.

A contract made with a lunatic (or with one who has a general reputation for weak-mindedness) is void. (The latter case must, however, be *clearly* established.)

The acts of one partner bind all the other partners.

It is a fraud to *conceal* a fraud.

No consideration is sufficient in law if it be illegal in its nature. (Many "failures" are upset because of this law.)

A receipt for money is not alway *conclusive.*

An agreement without consideration is void.

The law compels no one to do impossibilities. (This must be liberally construed.)

Ignorance of the law excuses no one.

Note especially the following, as affecting the giving and taking of checks and notes:

A note made on Sunday is void.

A note made by a minor is void.

A note obtained by fraud, or from a person in a state of intoxication, cannot be collected. (This is a corollary to the law governing contracts with the weak-minded.)

Notes bear interest only when so stated.

If a note is lost or stolen, it does not release the maker; he must pay it if the consideration for which it was given, and the amount, can be proved.

Signatures made with a lead pencil are good in law.

A note indorsed *in blank* is transferable by delivery, the same as if made payable to bearer.

The maker of an "accommodation" note (one for which he has received no consideration, having lent his name and credit for the accommodation of the holder) is not bound to the person accommodated, *but is bound to all other parties*, precisely as if there was a good consideration.

If the maker of a check or draft has changed his residence, the holder must use "due diligence" to find him.

Checks or drafts *must* be presented for payment "without unreasonable delay."

Ignorance or oversight of or willful inattention to these fundamental injunctions is the frequent source of annoying and expensive litigation.—*The Keystone.*

DECISION RELATING TO PATENTS.

MARKING OF PATENTED GOODS.

Supreme Court of the United States.

DUNLAP ET AL. V. SCHOFIELD ET AL.

Decided March 5, 1894.

Appeal from the Circuit Court of the United States for the Eastern District of Pennsylvania.

This was a bill in equity, filed May 7, 1889, for the infringement of letters patent issued April 2, 1889, for the term of three and a half years, by the United States to Julius Stroheim for a design for rugs.

The plaintiffs asked for an injunction and for damages in the sum of $250 as penalty and damages under the act of February 4, 1887, chapter 105, and waived all right to any further damages, or to an account of profits. The court, on May 13, 1890, entered a decree for the plaintiffs accordingly, and the defendants appealed to this court.

Mr. Justice Gray (after stating the case) delivered the opinion of the court.

By section 4,900 of the Revised Statutes of United States (which, by virtue of section 4,933, applies to patents for designs), it is made the duty of every patentee or his assigns, and of all persons making or vending any patented article for or under them, to give sufficient notice to the public that it is patented, by putting the word "Patented" upon it, or upon the package inclosing it, "and in any suit for infringement, by the party failing so to mark, no damages shall be recovered by the plaintiff, except on proof that the defendant was duly notified of the infringement, and continued, after such notice, to make, use or vend the article so patented."

The clear meaning of this section is that the patentee or his assignee, if he makes or sells the article patented, cannot recover damages against infringers of the patent, unless he has given notice of his right, either to the whole public by marking his article "Patented" or to the particular defendants by informing them of his patent and of their infringement of it.

One of these two things, marking the articles or notice to the infringers, is made by the statute a prerequisite to the patentee's right to recover damages against them. Each is an affirmative fact, and is something to be done by him. Whether his patented articles have been duly marked or not is a matter peculiarly within his own knowledge; and if they are not duly marked, the statute expressly puts upon him the burden of proving the notice to the infringers, before he can charge them in damages. By the elementary principles of pleading, therefore, the duty of alleging and the burden of proving either of these facts is upon the plaintiff.

In the present case, although the plaintiffs had manufactured and sold goods with the patented design upon them, they made no allegation or proof that the goods were marked as the statute required. They did allege in their bill that they notified the defendants of the patent and of their infringement; but this allegation was distinctly denied in the defendants' answer, and the plaintiffs offered no proof in support of it. They could not, therefore, recover, even if this were a suit for damages within section 4,900 of the Revised Statutes of the United States.

But these plaintiffs, waiving all right to an account of profits, or to other damages, sought and were allowed to recover the fixed sum of $250, in the nature of a penalty, imposed by the act of February 4, 1887 (ch. 105), upon any person who, during the term of a patent for a design, and without the license of the owner, applies the design secured by the patent, "or any colorable imitation thereof," to any article of manufacture for the purpose of sale, or sells or exposes for sale any article of manufacture to which "such design or colorable imitation" has been applied, "knowing that the same has been so applied." (24 Stat., 387.) This statute, according to its clear intent and effect, requires that, in order to charge either a manufacturer or a seller of articles to which has been applied a patented design, or any colorable imitation thereof, he must have been "knowing that the same has been so applied," which is equivalent to saying "with a knowledge of the patent and of his infringement." The reasons for holding the patentee to allege and prove either such knowledge, or else a notice to the public orto the defendant, from which such knowledge must necessarily be inferred, are even stronger, in a suit for such a penalty, than in a suit to recover ordinary damages only

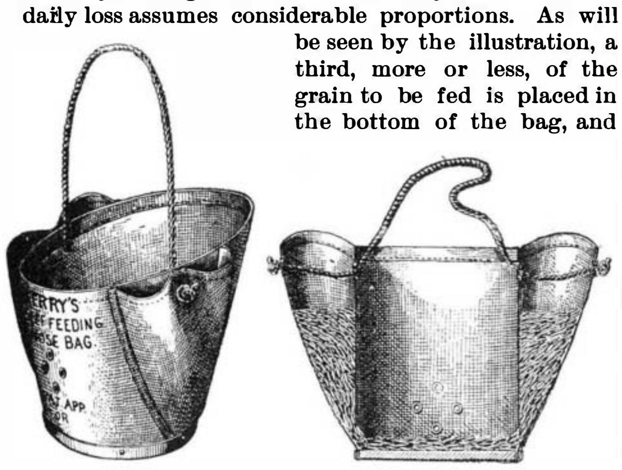
In none of the cases on which plaintiffs rely, and by which the court below considered its judgment as controlled, was there any adjudication inconsistent with this conclusion.

Decree reversed and bill dismissed.

TERRY'S FEED BAG.

The accompanying illustrations show an article which embodies in itself a notable improvement on the horse feed bag in common use. This bag is designed to prevent the waste of horses' feed so prevalent where the common bag is now used.

Whoever may have noticed how oats are scattered about at midday in the streets of the metropolis has also probably been impressed with the thought that not only the yearly but also the daily loss of grain in the city of New York alone must be something enormous. It is safe to say that where the common nose bag is employed nearly one pint of grain is lost at every feeding. In a stable of only ten horses this daily loss assumes considerable proportions. As will be seen by the illustration, a third, more or less, of the grain to be fed is placed in the bottom of the bag, and the balance in the two side pockets, in the lower end of each of which is a small aperture through which the grain passes automatically into the bag as fast as its contents are consumed. When in position on the animal's head, his lips are always within reaching distance of the bottom of the bag. So long as the bottom is covered to the depth of an inch or more, the grain in the side pockets cannot flow in. There are no springs, chains, metal tubes, etc., used in the construction of this bag, and it can be trampled on by the horse with impunity without suffering injury.



TERRY'S FEED BAG.

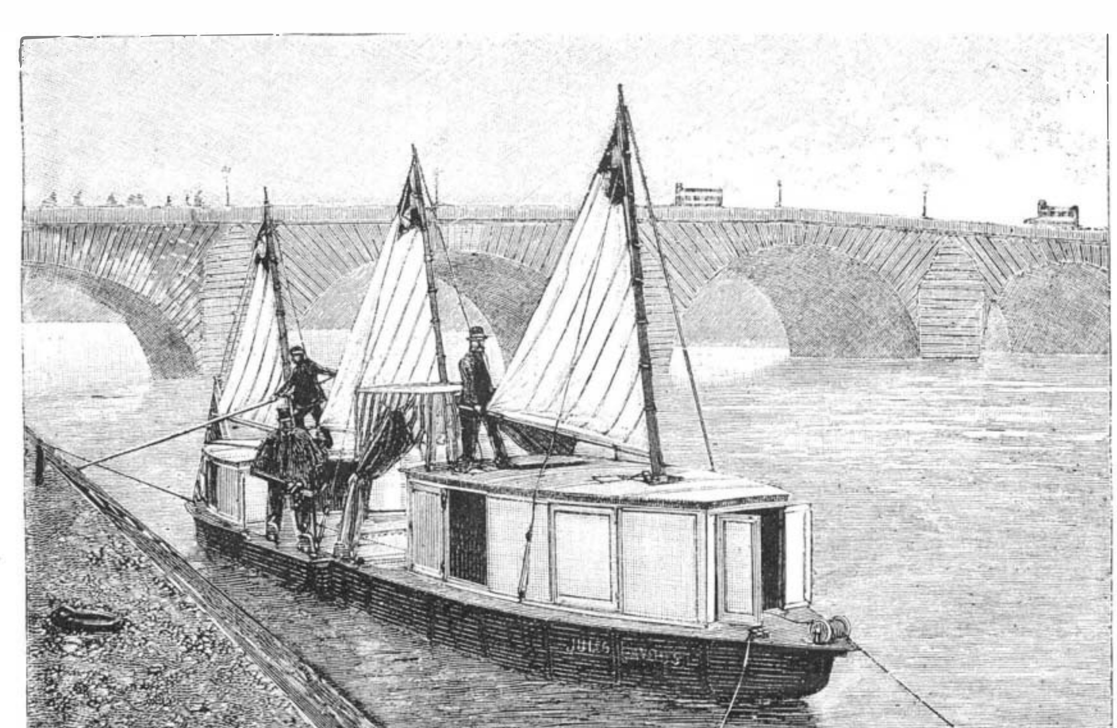
The automatic method of closure prevents the grain from being tossed out by the shaking of the animal's head.

A patent to cover this improvement has been applied for by Mr. T. Philip Terry, of No. 7 Bowling Green, New York City.

ALUMINUM BOAT—THE JULES DAVOUST.

Lieut. Hourst, of the French navy, and his mate, Ensign Baudry, in charge of the Niger hydrographic mission, left Bordeaux at the beginning of January carrying with them the Jules Davoust, a boat capable of being taken apart, and of extreme lightness, owing to its hull being constructed of an alloy of aluminum. This little boat, of which we give a view reproduced from a photograph taken near the Royal Bridge, at Paris, where it was exhibited before its departure, weighs 4,840 pounds, and has a capacity of 11 tons with a full load and a maximum draught of but 1·38 feet. The hull is formed of sixteen half sections assembled in pairs in the longitudinal direction upon a strong keel of hard steel that runs the entire length of the boat. In the transvere direction, each half section is connected with the following by bolts, and tightness is assured by the interposition of a strip of rubber between the flanges. The general aspect is that of a barge slightly depressed in front. This part is occupied by a wooden cabin for the captain and his mate. A second chamber, formed by the hold, is to receive the stores and the goods for trading purposes. At the rear there is a cabin for the crew. The three chambers thus formed are separated by tight bulkheads. The steering wheel is situated behind the captain's cabin. A movable tent arranged at this point is designed to protect the captain and his assistants during the hydrographic observations, and serves likewise to shelter the pilot.

The boat is provided with three masts, with easily handled lateen sails. These masts are light and are placed at nearly equal distances from each other. The boat may likewise be propelled with oars. Two sponsons near the center of the boat support two Hotchkiss rapid-fire guns.


ALUMINUM BOAT, THE JULES DAVOUST.

The following are the principal dimensions and weights of the various parts:

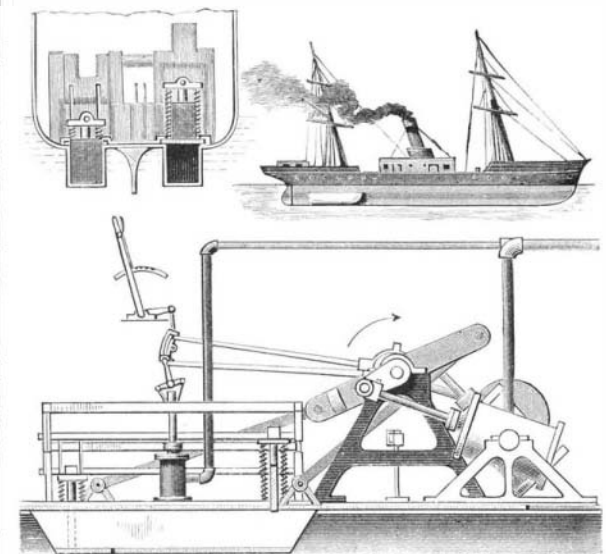
Total length	42	feet.
Breadth	9	"
Depth	2·6	"
Breadth outside of wales	10·5	"
Length of captain's cabin	13	"
Mean width	6·8	"
Length of rear cabin	10·8	"
" " central chamber	16	"
Light weight	4,840	pounds.
Total displacement	24,640	"
Corresponding draught	1·38	feet.
Mean weight of a section	82·5	pounds.

These sections are, therefore, easily transportable, and it is thus taken apart that the Jules Davoust is to reach the Niger, in the first place by sea, then by the Senegal River, and finally by the route by land from Kayes to Bamakou.

The use of aluminum in the form of an alloy, tough, yet soft enough to undergo forging (for pure aluminum is slightly brittle), constitutes a very important progress for the preparation of the carrying *materiel* that is to be used in the colonies, either for the construction of launches capable of being taken apart or for that of light vehicles adapted for following everywhere the movements of forwarding columns. The Jules Davoust was constructed at the works of Mr. Lefebvre, of Paris, who has already furnished the Monteil mission with a barge of the same nature, and has made a specialty of colonial war *materiel*, especially of light wagons, capable of being taken apart, that our troops have made use of several times in the Soudan and Tonkin expeditions.—*La Nature.*

MEANS FOR PROPELLING VESSELS.

The illustration represents an apparatus for the propulsion of vessels in which pistons are operated in open-ended pipes extending longitudinally beneath the vessel, the impact of the pistons on the water being designed to act with great efficiency in moving the vessel ahead, and the piston and tube being designed to handle with much better effect the same quantity of water that the screw of a vessel of the same kind would handle. The improvement has been patented by Mr. William H. Witte, of No. 253 Flushing Avenue, Astoria, L. I., N. Y. On opposite sides of the keel are parallel rectangular, open-ended pipes, as shown in the transverse sectional view, these pipes being closed on their upper or inner sides by slide plates moving in suitable slideways, and reciprocated by pitmen pivotally connected with cranks on a transverse crank shaft, at whose ends are driving cranks pivoted to piston rods whose pistons work in the common form of oscillating steam cylinders, whose trunnions are journaled in suitable supports, as shown in the longitudinal sectional view. The cranks extend from opposite sides of the crank shaft, so that the two slides are moved simultaneously in opposite directions. Each slide carries a vertical piston moving through a slot in the slide plate, each piston having a longitudinal movement backward through the pipe, and ejecting the water therefrom in a solid stream. An upwardly extending shank of each piston has a crosshead sliding on vertical guide posts around which are spiral springs normally raising the piston, and each crosshead slides longitudinally on a guide rod forming part of a frame moving with the pistons, the top beam of each frame having a lateral arm attached to the piston rod of a steam cylinder, two such cylinders being arranged vertically side by side and having a common steam chest between them. The valve stems extend upward from the steam chest to a walking beam, an arm from which is pivoted in a link pivotally supported on a rod suspended from an arm moved by a hand lever, the latter being held in the usual manner by a quadrant. The opposite ends of the link connect by rods with eccentrics on the main crank shaft, so that by means of the hand lever the strokes of the pistons in the steam cylinders may be reversed without stopping the machinery. In operation, as the revolution of the crank shaft causes the slides to be reciprocated


WITTE'S APPARATUS FOR THE PROPULSION OF VESSELS.

by the pitmen, the piston moves downward at the end of each forward movement of the slide, the slide then moving backward and carrying the piston with it, the piston being raised as it reaches the end of its stroke, and the alternate raising and depressing of the pistons in the slide being effected by the pair of vertically arranged steam cylinders. Instead of the steam mechanism for effecting the vertical movement of the pistons, a very complete system is provided by means of which this operation may be automatically effected by electricity. The inventor differentiates his system widely from the ordinary methods of jet propulsion, in which comparatively small quantities of water are ejected at high speed, but proposes to expel the water with about the same velocity given to it by the screw propeller, the water being expelled at about the plane of the ship's bottom, and thus exerting great power.

Her Majesty's Ships at Sea.

The Chief Constructor of the British Navy recently read an important and reassuring paper at the Institute of Naval Architects on the subject of the qualities and performances of first-class battleships of the Royal Sovereign and Resolution class. There was but little said about that bugbear of some writers on naval subjects, the metacenter, but a great deal about the *periods* of the rolling motion of the ships and the *periods* of the waves being isochronous. "I venture to illustrate this point by the simile of a boy in a swing and a man swinging him. If the latter exerts his force concurrently with the movement of the swing and the boy in it, as he increases his efforts the higher the swing goes, and as he uses less strength so will it tend to bring the swing to a state of rest. The ship's period is that of the boy in the swing; the wave's period that of the efforts of the man. The difficulty I find in the matter of the Resolution is that, taking the chief constructor's views as correct, and that there was "no danger whatever, only discomfort," why did not she continue her voyage instead of returning to Queenstown, when a small craft like the Gleaner pursued her way in safety? Of course, the talk about the foreturret lifting some inches was 'twaddle,' though a large quantity of water was shipped and went below. This was due, as I heard at the time on excellent authority, to the tarpaulin cover not fitting the lower part of the turret, or the right cover being mislaid, and to a large ventilator on deck not being unshipped and the dead-light screwed down, as it ought to have been."—*Westminster Gazette.*

IN the eleventh century both English and French dandies covered their arms with bracelets.

THE BAHAMA EXPEDITION OF THE STATE UNIVERSITY OF IOWA.

BY B. M. WILSON, A.M.

During the last summer a most unusual move in educational circles was made by the State University of Iowa.

It is well known among scientists that nowhere in the world, possibly, do the waters of the sea throb with a more varied and wonderful marine flora and fauna than around the Bahamas and Florida keys. The "gardens of the sea" are there! With the water-glass (a common wooden bucket with a glass bottom) one looks down through brilliantly hued waters upon scenes of wonder and exquisite beauty.

There are great jagged caves of coral, with curious sponges growing about their walls; long, slender sponges of lilac and ocher, and some of scarlet and others of brown and black, and still others coarse and clumsy, looking like lumps of yellow mud or clay. There the slender gorgonians, ranging through all the shades of browns and tans, lift their delicate fingers teeming with polyp life. Yonder one sees a cavern carpeted with gorgeous "sea anemones," their tentacles glowing with bright green and scarlet and maroon and flesh color. These are Neptune's sea flowers! Here those treasures of the mermaids—the "sea fans"—gracefully wave their red and yellow lace-work, and the "sea feathers" toss their nodding plumes. On this jutting coral crag a "sea urchin" bristles in long, slender black spines, and a little further on one of its relations glistens in a spiny armor as white as ivory. In and out among these caves flash the tropic fishes, on which the sea god has lavished the most vivid colors of his palette—intense blue and silvery white and gold, and turquoise; and some of these dwellers in his secret halls even gleam like mother-of-pearl, with all the colors of the rainbow.

But useless would it be to attempt to appropriately picture forth the wealth and beauty of these hidden wonders.

A few years ago the student got his knowledge of these marine forms from musty textbooks bristling with names often as meaningless as unpronounceable. Later he had the advantage of dried and alcoholic specimens. But it was not until very recently that an effort was made to give him an opportunity to study these most beautiful and wonderful forms of life in their native homes.

Prof. C. C. Nutting, of the chair of systematic zoology at Iowa State University, had twice before crossed the rich zoological waters around the Bahamas, and it was then that occurred to him the plan which the summer of 1893 finally saw realized.

The Emily E. Johnson, a two-masted schooner, 96 feet long, tonnage 115 tons, was chartered of its owner, Captain C. C. Paul, of Baltimore, for three months for the use of the "Bahama Expedition of the State University of Iowa," which had for its object the "careful and systematic investigation of the marine fauna and flora around the Florida keys and Bahamas." The schooner was rapidly transformed into a dwelling vessel and floating laboratory.

A huge skylighted hatch was cut in the hold, and the hold itself fitted up to serve at once as sleeping apartments for the gentlemen of the party, as dining room, and as laboratory.

A double tier of extemporized bunks lined either wall, long oilcloth-covered tables and camp-chairs occupied the center space, and a complete scientific library and laboratory supplies, including microscopes, chemicals, dissecting apparatus, etc., occupied shelves at one end. Provisions were stored in the fore part of the hold.

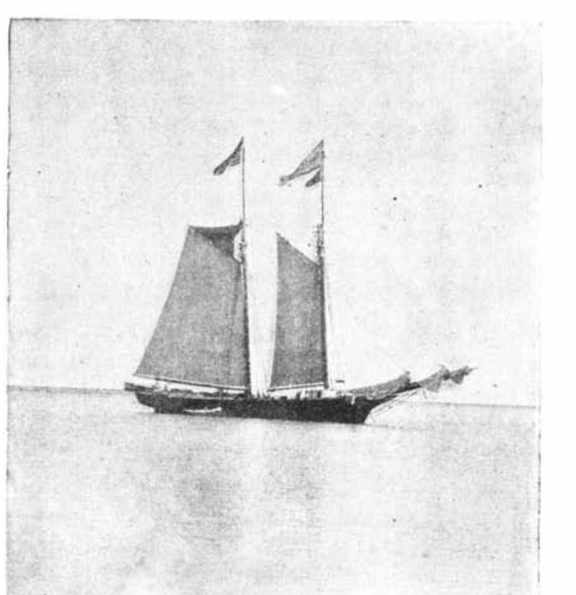
On deck was placed the hoisting apparatus, which was worked by hand and provided with 300 fathoms of wire rope. There was no steam aboard. The vessel had been chosen for its fitness to ride the shallow waters about the keys and islands.

Charles Flowers, of Baltimore, was engaged as captain and George Merrill was mate. Three sailors, a cook (all as black as the ace of spades), and a saffron-hued mulatto waiting boy comprised the crew.

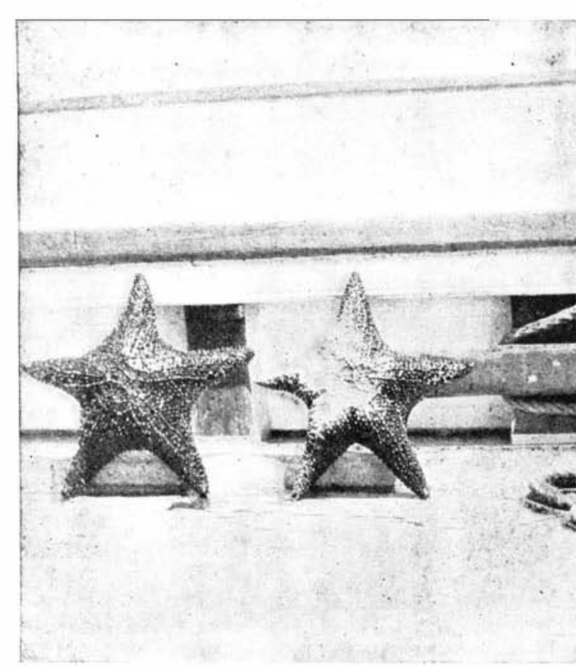
The party itself was composed of twenty-one members (of which seven were ladies), and included professors, instructors, alumni, and students of Iowa State University, Professor Nutting being the leader. Gilbert L. Honser, instructor in biology, was the photographer, and many beautiful pictures were taken, of which our space only permits us to present a few.

All were interested in science and each was supposed to be especially interested in some particular branch of science. All had applied voluntarily for membership in the party. The university furnished all appliances for dredging, for preserving materials, and for study. In addition, each member paid two hundred dollars, which covered all expenses incurred by the party *collectively*, including car fare from Iowa City to Baltimore and return, with "stop-offs" at Washington and the World's Fair, in addition to our life aboard the vessel for three months. It is estimated that we traveled by land and sea some six thousand miles.

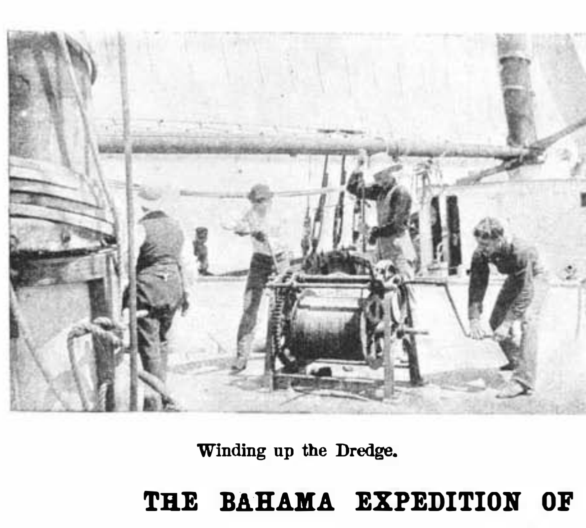
Prof. C. C. Nutting.



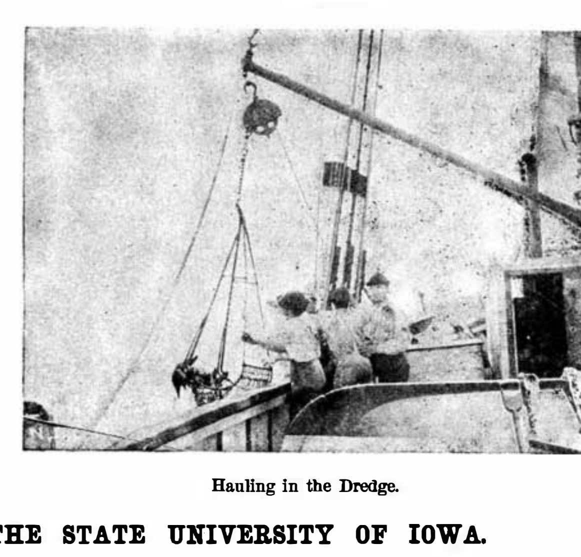
The Schooner E. E. Johnson.



Giant Star Fishes.



Winding up the Dredge.



Hauling in the Dredge.

THE BAHAMA EXPEDITION OF THE STATE UNIVERSITY OF IOWA.

On May 5, 1893, we left Baltimore in our floating summer home and laboratory.

Seven days later we anchored in the harbor of Egg Island, Bahamas. Here we made a marvelous collection in the shallow waters and on land. Our deck was strewn with sea-fans and gorgonians. There were great tubs of rattling crabs and star fish and sea urchins, and buckets of mollusks. One of our illustrations shows the giant star fishes captured, which measured about two feet across. The ornithologist and entomologist had captured strange birds and "bugs," the first prize of the latter being that curious luminous beetle worn by the Cuban ladies as a glowing ornament for the hair or to catch the lace of their mantillas. The botanists had their cans full and running over with tropic vegetation, from the passion flower to our own familiar shepherd's purse and *sand burr;* and there were pans full of floating algae, "sea mosses." But it would take volumes to give an adequate idea of the spoils.

From here we sailed for Havana, spent a few days exploring the city, and just outside the harbor dredged for that exceedingly rare animal form until lately supposed to be extinct, viz., the *crinoid*, genus *Pentacrinus*. We found fully 150 beautiful and perfect specimens.

Bahia Honda, thirty miles further along the western coast of Cuba, next claimed our attention The Spanish authorities, however, took us for a filibustering expedition, and forbade us to go more than thirty feet from the water line. The mosquitoes also waged war against us, and we turned toward Key West.

Here, too, however, we were forbidden to land, as a vessel clearing from a Cuban port during the quarantine season must either lie fifteen days at sea or go to the Dry Tortugas and be fumigated.

Accordingly we chose the Dry Tortugas, and made many valuable collections, both by dredging and in shallow waters around the keys. Here we procured our first shark and investigated the coral reefs.

Returning to Key West, we dredged in the vicinity some three weeks. In deep sea dredging we used a common oyster dredge, a trawl, and a tangle bar. This last was especially useful in procuring the finer materials. It was merely a horizontal bar of iron, with great masses of raveled manila hemp rope tied to it, and in its meshes were caught a tangle of basket fish, crabs, sea urchins, deep-sea algae, and so on.

Clearing from Key West, we sailed for Harbor Island, Spanish Wells, and Eleuthera, Bahamas, and after a hasty run to Little San Salvador, or Cat Island, we had to turn northward, as we were due at Baltimore August 1.

The whole summer had been one delightful round of novelty and surprises. To one scientifically inclined it was an opportunity for careful study and investigation, such as has heretofore been enjoyed only by specialists in government employ. The knowledge gained in actually seeing and studying these curious life forms in their native element was of more practical value than the perusal of whole libraries of monographs, or years of study of museum specimens.

Then the trip offered, as well, glimpses of the customs and peoples of strange countries under the rule of three different powers. Cuba is Spanish, Key West and the keys are Uncle Sam's southernmost possessions, and the Bahamas are English. It was a study in comparative sociology. The trip has opened new avenues to educators; new possibilities to students, and to scientists, we feel safe in saying, it will offer many new life forms, dredged from the "unknown depths."

As the favoring breeze swelled our sails homeward bound and the foam curled, a silvery plume behind our prow, studded at night with glowing phosphorescence, our little group sat silent on the deck, awed, subdued by the splendor of the tropic sunset, the swift-following night, or the indescribable beauty of the moonlight on the sea.

As we sat dumb, in trying to comprehend the infinite expanse of ever-restless water around, the infinite expanse of burnished sky above, the infinite *silence* over all, and as memory wandered back over the revelations of the summer, one and all were humbled with the consciousness of the insignificance of man and the goodness of the Incomprehensible in granting us these glimpses of this wonderful glory!

State University of Iowa, April, 1894.

Highly Sensitive Collodion Emulsion.

The publication of Dr. Hill Norris' process for the production of a highly sensitive collodion emulsion induced Dr. David, of Paris, to test the three methods described in the patent. He could not obtain a satisfactory result, but by making some alterations he has succeeded in preparing a bromide of silver collodion emulsion, the sensitiveness of which increases gradually to 22 or 23 degrees Warnerke.

The method adopted is as follows: Upon a horizontally adjusted glass plate, size 18×24 cm., are poured 25 c.c. of collodion, which contains per liter 18 grammes of silver nitrate and 7 to 8 grammes of pyroxyline. After the film has coagulated sufficiently, it is changed to a bromide of silver film by treatment with the following bath:

Potassium bromide	80 to 120 grammes
Potassium iodide	0·01 gramme
Gelatine	2 grammes
Distilled water	1,000 c.c.

A completely opaque film must be obtained. It is sensitized by leaving the plate for a longer or shorter time in the following:

Potassium bromide	18 to 25 grammes
Gelatine	1 gramme
Distilled water	1,000 c.c.

The sensitiveness increases with the duration of action and the temperature of this bath. At a temperature of 70° to 75° Cent., the time of action must be about two hours; at 90° to 95°, about one hour.

Upon looking through the film, it will be observed that the grain becomes gradually larger until the granularity is distinctly visible to the eye. Accompanying this increase in the size of the grain is an increase in the sensitiveness of the film.

After the plate has reached the desired stage, it is washed and dried. Contrary to what might be expected, the collodion film does not exhibit the slightest tendency to leave the plate at a temperature of 100° Cent., provided that the surface of the plate has been thoroughly cleansed.

Plates prepared in this way can be developed very quickly, washed and fixed. The negative is ready for printing in ten minutes. Varnishing is unnecessary, as the collodion film is very hard.—*Photographisches Archiv.*

The United States Navy vs. the British Navy in 1812.

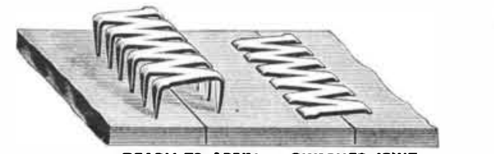
The following, from the New York *Sun*, occurs in the course of an able review of the first volume of "A History of the United States Navy from 1775 to 1893," recently published by the Appletons. The narrative is by Mr. Edgar Stanton Maclay, and the technical revision of the text by Lieut. Roy C. Smith, U.S.N. The book sets forth our naval annals from the outbreak of the revolutionary war up to the beginning of the last year of the war of 1812, the continuation of the history down to the present day being reserved for a second volume.

"It was pre-eminently in the war of 1812 that the pride of England in her navy was brought low. To appreciate the outcome of this contest, one must keep in view a comparison of the two navies, which will be found on page 319 of the book before us. At the outset of the war Great Britain had 1,048 ships, possessing an aggregate capacity of 860,990 tons, and carrying 27,800 guns, with 151,572 men and officers. At the same juncture the United States had but 17 ships, with a total tonnage of 15,300, and carrying only 442 guns, and but 5,025 officers and men. Yet, at the end of the struggle, which lasted but about two and a half years, the little American navy, assisted by privateers, had for the time practically swept the British mercantile marine from the high seas and captured over fifteen hundred vessels, on board of which were more than twenty thousand British seamen. It was not so much, however, the number of merchant vessels lost, great as this was, which affected the British public mind. It was the fact that in duels between warships of nearly equal force the English were generally beaten. In eighteen engagements with the Americans the British navy sustained fifteen defeats, and this just after England had successfully matched her sea power against the combined strength of all the other great maritime nations of the world. At the beginning of the war of 1812 the British navy had reached the apex of renown. Mr. Maclay points out that in two hundred actions between single ships it had been defeated but five times, and on those occasions the English ship was admitted to have been of inferior force. The complete reversal of results which followed a trial of strength and skill with the Americans produced in Englishmen a kind of stupor. The London *Times*, when it heard of the capture of the first English ship of war, said: 'The loss of a single frigate by us, it is true, is but a small one; when viewed as a part of the British navy it is almost nothing; yet under all the circumstances of the two countries to which the vessels belonged, we know not any calamity of twenty times its proportions that might have been attended with more serious consequences to the worsted party.' When the report of the loss of a second British frigate reached the *Times*, it exclaimed: 'In the name of God, what was done with this immense superiority of force? Oh, what a charm is hereby dissolved! The land spell of the French is broken [at Moscow], and so is our sea spell!' Mr. Maclay sums up the effect of the disasters suffered in the war of 1812 upon intelligent Englishmen in the well-founded assertion that in those defeats they foresaw the eventual subversion of their naval supremacy, and they well knew that, if that were lost, nothing could avert the reduction of Great Britain to one of the least important of European powers."

THE BRISTOL CO.'S PATENT STEEL BELT LACING.

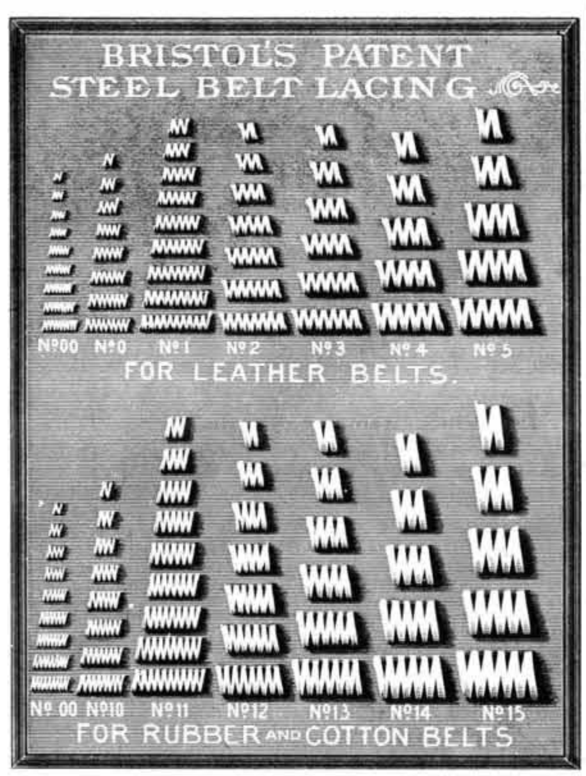
Five years ago the Bristol Company, of Waterbury, Conn., began the manufacture of their patent steel belt lacing, illustrated herewith.

At that time only one size, for ordinary single leather



READY TO APPLY FINISHED JOINT

belts, was produced, but encouraged by the success attained, which is principally attributed to the genuine merits of the steel lacing itself, the company have developed their machinery and improved their methods of manufacture, so that now they are able to announce



a complete line of one hundred different sizes (as shown in the larger view), suited to all kinds, widths and thicknesses of belting. As a result of improved processes of manufacture, prices have also been reduced. The lacing is made of the toughest cold-rolled steel, cut into a continuous zigzag form, and so proportioned as to give maximum strength with a minimum amount of material. The wedge-shaped points, when driven through the belt, force the fibers aside so as not to cut them; hence the ends of the belt are not weakened as when holes are punched. The lacing makes a smooth and elastic joint and is easily and quickly applied without any special tools, the spurs being driven through upon a piece of soft wood, after the ends of the belt to be joined have been brought evenly together. The belt is then turned over upon the pulley or any convenient piece of iron and the spurs clinched, bending them toward the joint. The lacings are furnished in lengths varying from one to three inches (No. 1 by quarter inches), it being always possible from a box of assorted lengths to find two or more pieces of lacing which, together, may be used for a belt wider than three inches. For rubber, cotton, and woven belts the space between the spurs is a trifle greater than in the corresponding sizes designed for leather belts. Thus a better grip is obtained on the fibrous ends of such belts. The lacing was exhibited at the World's Columbian Exhibition by the Bristol Company, and was awarded medal and diploma.

Effect of Yellow Light on Diamonds.

Some diamond merchants on Maiden Lane, New York, have complained to the owner of a building opposite to them because he has painted it bright yellow, and when the sun shines yellow is reflected into their store. They say the yellow light falling upon their show windows spoils their trade by making the diamonds look yellow, and therefore cheap; whereas the stones are in reality pure white, of the highest grade. The owner refuses to have the color of his building changed although the diamond merchants have offered to do it at their own expense. We suggest that the effect of the reflected yellow rays could be neutralized by placing the diamonds in glass cases slightly tinted with blue; or by a thin varnish of a blue tint, applied to the show windows.

Official Trial of H. M. S. Hornet.

On the 19th of March the official trial of H. M. S. torpedo catcher Hornet took place in the Estuary of the Thames, with the following admirable results. The propellers are 6 feet 4 inches in diameter. There was calm weather and high water. Steam is supplied by Yarrow water tube boilers; the power exerted was approximately 4,000 horse power. The Havock has locomotive boilers and gives 3,500 horse power; the difference in power is very nearly in direct proportion to the cubes of the speed of the two boats, but the air pressure for the Havock was 3 inches; for the Hornet, 1½ inches.

Time of day.	Revol. Star.	Revol. Port.	Time.	Speed.	Means.	2d Means.	
10·28	395·9	395·4	2m. 17·6s.	26·163	27·322		
10·34	384·4	386·8	2m. 6·4s.	28·481	27·418	27·370	
10·43	384·7	392·2	2m. 16·6s.	26·355	27·373	27·395	27·313
10·52	391·3	392·7	2m. 6·8s.	28·391	27·239	27·306	
11·02	380·0	381·7	2m. 18·0s.	26·087	27·128	27·183	
11·10	394·3	394·3	2m. 7·8s.	28·169			

Steam in boiler vacuum 26 inches.

The three hours' trial commenced at the "Chapman" lighthouse and ended below the "Sunk" lightship. The average speed for the whole time was found to be 27·628 knots per hour, or 31·8 miles an hour. After this circles at full speed were turned to starboard and port, and generally all the usual tests of machinery and ship, all of which were found to be perfectly satisfactory. At full speed and at slower speeds practically no vibration was felt. There was no heating of any parts of the engines, and the boilers made ample steam with a mean air pressure of 1·5 inch.

The Admiralty authorities expressed themselves as highly pleased with the result in every respect.

Embossing Wood.

Carving wood is too costly a process for this age and country. People like it and want it on their furniture and inside finish, but most of them are not willing to pay for it what it costs. It requires a natural turn and a long practice to make a skillful wood carver, and consequently many devices have been resorted to to secure the same appearance by cheaper methods. The most common of these is to press the figures into the grain of the wood with a hot metal die. One of the latest machines for doing this kind of embossed "carving" was on exhibition in Machinery Hall annex of the World's Fair, and is an ingenious machine and does rapid work. Patterns are cut on a hollow brass cylinder which is heated by gas jets from the inside and the wood passed under it under a pressure of several thousand pounds to the inch in width. At first the work appears very pretty, but it will not stand the test of time. In the course of time the part of wood pressed into the grain will rise to nearly or quite its original position and, in large figured patterns, unevenly, making a very rough and rotten looking figure, that is more of a blemish than a thing of beauty. Another plan is to dress the board down to a level with the embossed figure and then by steaming to raise the pressed parts to their original height to imitate relievo carving. None of these processes are "carving," nor will the work retain its form like hand carving. However, it may suit people who must have their furniture and house finish carved and are not able or willing to pay for the genuine article, but it would be better taste, perhaps, to take it plain rather than to have alleged carving that will not last long and look well all the time.—*Tradesman.*

The Fourth Dimension.

In an address before the New York Mathematical Society on "Modern Mathematical Thought," Professor Simon Newcomb is reported as saying: "As in space of two dimensions one line can be drawn perpendicular to another at a given point, and by adding another dimension to space a third line can be drawn perpendicular to these two; so in a fourth dimension we can draw a line which shall be perpendicular to all three. True, we cannot imagine how the line would look, or where it would be placed, but this merely because of the limitations of our faculties. As a surface describes a solid by continually leaving the space in which it lies at the moment, so a four-dimensional solid will be generated by a three-dimensional one by a continuous motion which shall constantly be directed outside of this three-dimensional space in which our universe appears to exist. As the man confined in a circle can evade it by stepping over it, so the mathematician, if placed inside a sphere, in four-dimensional space, would simply step over it as easily as we should over a circle drawn on the floor."

The Founder of the First Scientific Journal.

BY M. JACQUES BOYER.

When recently the statue of Theophrast Renaudot, the founder of French political journalism, was unveiled, the literary and scientific journals were alike full of praises of him and his work; but none of them recollected another pioneer in his field, the modest and profoundly erudite Denis de Sallo, the founder of the *Journal des Scavants*, who did for letters and science what Renaudot so successfully accomplished for politics.

Without undertaking a full sketch of the history of the French scientific press, I desire only to show here how new in 1665 was that idea, which seems so simple and natural now, of the creation of a scientific journal; how many impediments were raised against its creator by the commonplace authors whom the new tribunal condemned without appeal; what patience, what erudition, what a prodigious sum of labor were required from its founders to surmount all the obstacles, avoid all the perils they met every day, and give their work a vitality strong enough to permit it, rising repeatedly from its ashes, to perpetuate itself till our time.

Denis de Sallo, Seigneur de la Coudray, was born in Paris in 1626, of an old noble family of Poitou. His lessons in early childhood were not brilliant; but after he entered the courses of rhetoric at the College des Grassins he obtained all the prizes of his class; became in the next year a distinguished pupil in philosophy, and having sustained in public remarkable theses in Latin and Greek, gave himself up with ardor to the study of law. His advance was so rapid that he was able, in 1652, to succeed his father, Jacques de Sallo, in his office as counselor at the Parliament of Paris. Three years later he married Elizabeth Menardeau, daughter of a counselor in the Grand Chamber, by whom he had one son and four daughters. He died on the 14th of May, 1669, of apoplexy. His death, according to Vigneuil Marville, was caused by the loss of all his fortune in gambling in 1665; but, besides that this story has little probability in view of the character of De Sallo, who was industrious through all his life, it is controverted by a letter of Guy Patin's of the 13th of November, 1665, which proves that at that time De Sallo had no thought of dying, and by the testimony of Pere Honore de Sainte Marie, who agrees with Moreri in placing his death in 1669 and not in 1665.

Having given an outline of the principal events of De Sallo's life, which was otherwise quiet enough, we pass to the study of his character and work. "He read all sorts of books," says Moreri, "with incredible care, and kept secretaries continually employed to write down his reflections and the passages which he marked, so that by this plan of studying he fitted himself to compose treatises on every kind of subject, as he showed on several occasions."

It was probably the considerable quantity of material that he collected in this way that suggested to him the thought of giving the public those extracts the utility of which he had recognized in his experiences. He associated with himself in the execution of this work, which was colossal for that time, a number of men of science and letters: De Bourzeis, a distinguished theologian; De Gemberville, chaplain, the famous author of La Pucelle; and the Abbe Gaulois, who, according to Fontenelle, seemed "born for that work;" but De Sallo revised all the articles—not very numerous—which his colaborers furnished, and himself wrote the largest number.

The authorization having been obtained, the support of Colbert assured and the plan and periods of publication fixed, the *Journal des Scavants* appeared on Monday, January 3, 1665, in a sheet and a half quarto, under the pen signature of Hedouville;* and it continued to appear every Monday till the 30th of March of the same year, when the authorization was withdrawn. Although its criticisms were always moderate and just, it had made many enemies among men of letters, and among the Jesuits, then all-powerful, "who were not pleased to see a literary and philosophical tribunal that was not set up by them, and who, moreover, detested De Sallo and his friends as Parliamentarians and Gallicans suspected of Jansenism; these added their complaints to the cries of wounded self-love. They secured the aid of the papal nuncio, and he obtained a prohibition against De Sallo's continuing the publication." The pretext alleged for this act was a passage in the *Journal* in which De Sallo criticised a decree of the Inquisitors, "whose delicate ears required so great circumspection."

Colbert, however, still retained a friendship for his client, recompensed him for the suppression of his journal with an office in the treasury, and, realizing the full value of De Sallo's work, commissioned the Abbe Gaulois to continue it. The *Journal* reappeared on the 4th of January, 1666, and was henceforth illustrated;† but Abbe Gaulois, who held the direction of the paper for nine years, published it very irregularly; thus there was only one number in 1670 and none in 1673.

In 1675 the *Journal* passed into the hands of Abbe La Roque, who exhibited in his work a punctuality worthy of praise, but was far from knowing as much of science as his predecessor; then in 1686 Chancellor Boucherat, who declared himself its protector, intrusted its direction to President Cousin. Finally in 1701 the *Journal* was acquired for the state by Chancellor De Pontchartrain, who gave the preparation of the numbers no longer to one man, but to a company of students, consisting of Dupin, Rassicad, Andry, Fontenelle, and Vertot, with Julien Pouchard as director. Thus renewed, supported by Abbe Bignon, nephew of the chancellor, the *Journal des Scavants* appeared again on the 2d day of January, 1702, and its history till 1792, when political events compelled its suspension again, offered the single noteworthy feature that its period of publication was changed in 1764, and from a weekly it became a monthly, with supplements every six months.*

Sylvestre de Sacy tried to resuscitate the *Journal* in 1796; but his attempt was abandoned after the publication of twelve numbers, from the 16th of nivose to the 30th of prairial of the year V. It was re-established September 1, 1816, on the proposition of Barbe Marbois, Keeper of the Seals, and Dambray, Chancellor, on a report of the historian Guizot, then general secretary to the Minister of Justice, and has not been suspended since. The presidency of the editorial committee appertained to the Keeper of the Seals from that time till the imperial decree of May 4, 1857, by which it was transferred to the Minister of Public Instruction, under whose auspices the *Journal* is still published.

Such has been the checkered career of the first French scientific journal—a career that demonstrates, better than any eulogy can, that the work of De Sallo possessed the qualities of merit and utility which make intellectual work fruitful and durable.

The detailed history of the *Journal des Scavants* may be found in Hatin, "Histoire politique et litteraire de la presse en France," 1859, vol. ii., p. 151, and those following; and in the "Memoire historique sur le Journal des Scavans," in the table of the *Journal*, by the Abbe de Claustre, 1764, vol. x., 595 and following pages.—*Popular Science Monthly; Revue Scientifique.*

* The name of one of his servants.

† As a specimen of the illustrations, we mention a superb engraving representing a louse as seen under the microscope; it measures not less than forty or fifty centimeters (year 1666, page 292 of the reprint of 1729). This reprint is a nearly textual reproduction of the original edition, which is now very rare. It is well to remark here that the *Journal des Scavants*, like all similar journals of the seventeenth and eighteenth centuries that were successful, was reprinted as the numbers were exhausted; thus in the set that I have consulted at the library of the Arsenal, the year 1665 is of 1733, and the year 1666 of 1729, while the year 1676 was reprinted in 1717. Hence it is almost impossible to find two collections of the sets exactly alike. If we add to this that the publisher has sometimes intercalated notes in the reprints without indicating that they were not in the original edition, and that some of the series have been counterfeited in Holland, one may have some idea of the difficulty of the investigation and of the lamentable differences of the editions.

* There were also supplementary volumes for each of the years 1707, 1708, and 1709, and in 1773 only the five numbers of the first five months were published.

Longevity of Life.

Longevity of life will always be an interesting subject upon which to think and write. When we read of a "hale, hearty old man" taking a European trip in his 89th year, there are very few of us who would not go far out of our way to learn the secret of living to such an age, and at the same time of retaining possession of every faculty. Who can but admire William E. Gladstone managing the political affairs of one of the greatest nations of the earth at his great age—over 80—and David Dudley Field, who is enjoying his tour in Italy with all the enthusiasm of a young traveler, in his 89th year? Of course these men are exceptions to the general rule, but we all are anxious to gain every idea pertaining to the lengthening of one's life. At a recent meeting of the New York Academy of Medicine, some of the specific and relative values of the important factors of longevity were discussed. In the last issue of the *Medical Review* are two paragraphs that are interesting and touch particularly on this point:

MANNER OF LIVING.

"The man who was careful, considerate, and moderate in the exercise of all his faculties, whether animal or intellectual, was one who would last longer than the man who over-indulged in any one of the numerous things which go to make up life. The men who broke down and died prematurely were usually those who had not lived temperately. It was often said that men worked themselves to death, yet the more he observed people, the more did he become convinced of the correctness of the Western editor's assertion that men do not die of overwork, but rather of what they take between work. He thought it would be found that what killed men was not work, but what they did outside of their work; yet he did not believe in total abstinence in any sense. There was no law, with regard to eating and drinking and manner of living, which could be laid down as applicable to all individuals. Each person must find out the law which applied to himself and obey it. Each person could usually discover what agreed and what disagreed with him, and if longevity was sought after, he would have to avoid the things which evidently disagreed with him and seek the things which did agree with him."

EXTERNAL INDICATIONS.

"There are certain external indications which would give a fair idea of long and short life. It was not in one trait, but in the entire make-up of the individual who stood before the examiner. There were the color, the motions, the measurements, including size of head, which was one of the most certain indications of long or short life, for in the brain lay the great center of power. A person with a head whose diameter at the thin portion of the temporal bones measured five and a half to six inches was almost sure to give a longevity on the father's side of seventy to ninety years or over. If the head measured in front from the external auditory canal to the naso-frontal suture as much as four and three-fourths or five inches, we might be almost sure of long life on the maternal side. A beard which was darker or redder than the hair indicated inheritance from the paternal side; if it were lighter than the hair, the inheritance was probably from the maternal side. The length of the chest, its proportion to the circumference, to the height of the individual, and other measurements, were important."

There is a common belief, when any organ of the human body becomes weakened or debilitated from any disturbance, that it required rest to regain its lost strength. In reading over an editorial in the New York *Medical Times* this popular idea is certainly overthrown in the present instance. It states that Sir Andrew Clark, that distinguished doctor, was given up to die from consumption, and yet, notwithstanding his hard work, his health became so firmly established that he outlived many of his contemporaries and gained a reputation exceeded by none in his profession. The *Times* states that the solution of this problem is simple, and should serve as an example to those who are constantly breaking down and have often to leave work for weeks or months to recuperate. In a clinical lecture in the London Hospital, Dr. Clark gives a very excellent prescription for health.

"Labor," he says, "is the life of life. And especially is it the life of life to the delicate. And when any organ is sick it is then truer than in health that even in sickness and delicacy it is better for the organ to do what work of its own it can, provided it can do it without injury. And from a considerable experience of tuberculous pulmonary disease, I can say with perfect confidence that those who have done the best have usually been those who have occupied themselves the most. I never knew my own parents. They both died of phthisis. At the age of twenty-one I myself went to Madeira to die of phthisis. But I did not die, and on coming back, I had the good luck to get into this great hospital, and in those days they were not very well pleased to have the Scotchmen coming to London to occupy such appointments. The members of the staff had heard that I had tubercle, and they wagered 100 to 1 that I would only have the appointment six months at most. The reason given for that was that I did not eat and worked too hard. I got the appointment. Thirty-eight or thirty-nine years have gone since that time, and all the other doctors are gone. Only I am left here on the staff—an old gentleman—not dead yet."

Labor is life, but "worry is killing. It is bad management that kills people. Nature will let no man overwork himself unless he plays her false—takes stimulants at irregular times, smokes too much, or takes opium. If he is regular and obeys the laws of health and walks in the way of physiological righteousness, nature will never allow him or any other person to work too much. I have never yet seen a case of breaking down from mere overwork alone; but I admit that it is necessary above all things to cultivate tranquillity of mind. Try to help your patients to exercise their wills in regard to this—for will counts for something in securing tranquillity—to accept things as they are, and not to bother about yesterday, which is gone forever; not to bother about to-morrow, which is not theirs; but to take the present day and make the best of it. Those affectionate women who will continually peer into what lies beyond never have any present life at all—they are always grizzling over the past or prying into the future, and this blessed to-day, which is all that we are sure of, they never have."—*Charlotte Medical Journal.*

Subterranean London.

It gives an impressive idea what subterranean London is fast becoming, says the *Daily News*, to learn that on emerging from the river the new City and Waterloo line will, in its passage up Queen Victoria Street, run for a part of the way underneath the low level main sewer, which in its turn runs along beneath the District Underground Railway. So that at this point in the City we shall have first a busy main thoroughfare, below that a steam railway, then a huge metropolitan sewer, then an electric railway, reaching its terminus at a depth of about 63 feet below the streets, and here it will communicate with another line—the **Central London—which will lie at a depth of 80 feet.**

THE CALIFORNIA MIDWINTER FAIR.

California is the wonderland of America, with its glorious climate, its remarkable fertility, its Yosemite Valley, and notable mountains. When the Eastern States are wrapped in snow the inhabitants of favored California are in the midst of a semi-tropical garden enjoying all the delights of spring and early summer. This attracts large numbers of people from all parts of the world, who visit California for health and pleasure. When Mr. M. H. De Young, vice-president of the Columbian Commission, proposed that a midwinter fair be held on the Pacific coast, the idea was everywhere received with enthusiasm. The subject was first broached at a meeting held in the California Club, of Chicago, on May 31, 1893. Notwithstanding the financial depression of the country, ground was broken on the 24th of August last, and five months afterward, on January 27, 1894, the fair was ready and opened to the public.

Golden Gate Park, San Francisco, is in reality a sea-girt garden, filled with the choicest blooms of all lands. This park possesses an individuality of its own which renders it unique among the pleasure grounds of the world. The park is laid out in a highly artistic manner, and the profusion of palms suggests Bordighera, Nice, or San Remo. The Midwinter Fair occupies about 160 acres of the park.

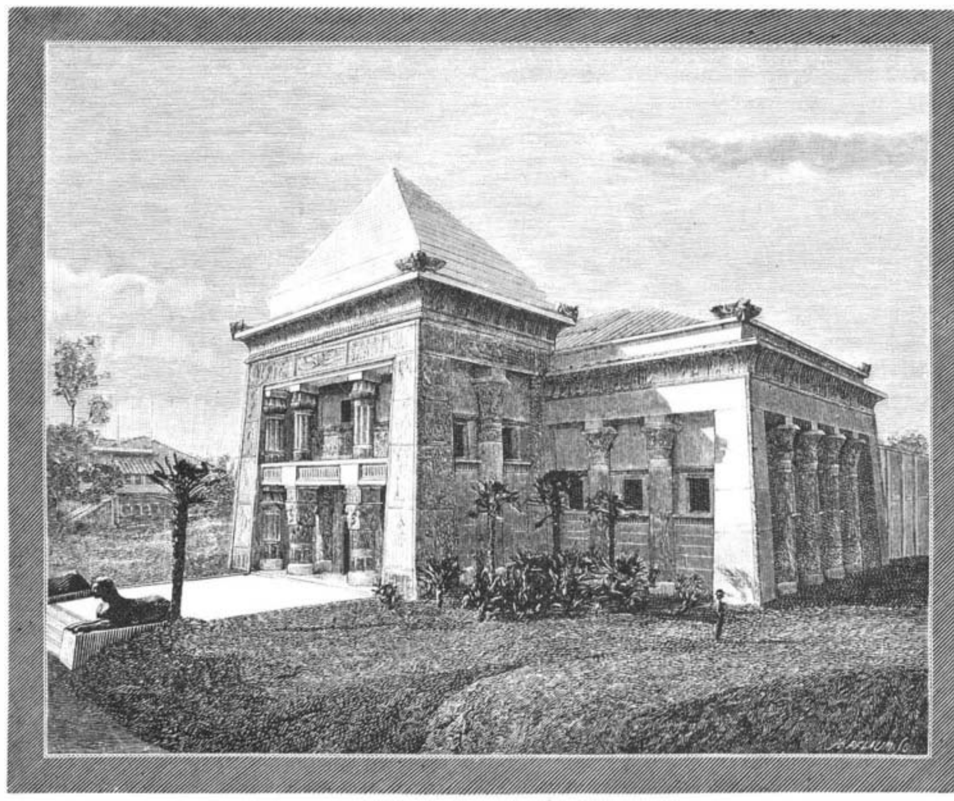
We present several views of the grounds and the buildings. In a subsequent issue we shall give a view of the Manufactures and Liberal Arts building.

Our bird's eye view shows the dome of the Horticultural and Agricultural building in front at the left; behind rises the Manufactures and Liberal Arts building, flanked by the electric tower, 250 feet in height. To the right rises the prominent collection of domes and minarets which covers the Administration building; at the rear of this is the Firth wheel and the Mechanic Arts building. The other buildings are the Fine and Decorative Arts building, Festival Hall, buildings for concessions, etc.

The Administration building is situated on the southern side of the Grand Court, and its oriental architecture and coloring comports admirably with the luxuriance of the surrounding vegetation. This building was designed by A. Page Brown, and the architectural style may be said to be a combination of central Indian and Siamese. The main structure rises from a terrace, and the leading feature of the building is the richly ornamented dome, which is 135 feet in height and 50 feet in diameter. The total floor area of the building is 16,800 feet. This dome is brilliantly illuminated at night.

The Art building was designed by Mr. C. C. McDougal. It is a modern adaptation of Egyptian architecture, and the coloring is subdued. Like all the other buildings, staff is freely used. The vestibule is very effective. It is 22 feet square and 63 feet high. The interior measurements show that the galleries are 58 feet long and 38 feet wide. Annexes give wall space, so that the available wall space is 2,000 running feet. The structure is fireproof. The approach is of artificial stone, 40 feet wide, flanked by immense sphinxes. The third edifice which we illustrate is the Mechanic Arts building, with allegorical fountain in the foreground. The building was designed by Mr. Edward R. Swain. It is built in the East Indian style. The length of the building is 330 feet and the width is 160 feet. The total floor space available for exhibitors is 37,041 square feet. It has also an annex measuring 249 by 45 feet, containing boilers and engines. In the central part of the main floor are two great tanks 30 feet long and 25 feet wide. Around them are gathered the exhibit of steam and other pumps. The exterior of the building is elaborately ornamented. The cresting of the main body of the building is 42 feet above the ground, and the pinnacles rise to the height of 120 feet.

The oriental style of architecture and brilliant coloring gives a suggestion of age which is very pleasing. The total expense of the buildings has been about $1,500,000.



THE CALIFORNIA MIDWINTER FAIR—THE FINE ARTS BUILDING.

The New Transandine Telegraph Lines.

The direct telegraph lines extending from Buenos Ayres (Argentina) to Valparaiso and Santiago (Chile), which have been established by the Pacific and European Telegraph Company, of which Sir John Pender is chairman, were opened for traffic recently. From the Atlantic coast to Uspallata on the spur of the Andes, a distance of about 697 miles, the line is aerial on iron poles, and is of the latest type of construction. Thence to Rio Blanco, in Chile, underground cables are laid in about 75 miles of trench through the highest and wildest part of the route, where heavy snow falls in winter would sweep away any telegraphs erected above ground. The lines from Rio Blanco to Valparaiso and the branch to Santiago, consisting together of about 160 miles, are aerial. The total length of the line, which extends from the Atlantic to the Pacific coast, is about 927 miles. Arrangements have been made by which the telegraph lines have been erected adjacent to the railway lines, and exceptional facilities are thus afforded for the efficient maintenance of the wires. There is only one station, which is at Mendoza, but Buenos Ayres and Valparaiso work direct with each other. The opening of this system is of great importance to the West Coast of America Telegraph Company, as it places their cables in direct connection with those of the Western and Brazilian, the Brazilian Submarine, and the Eastern Telegraph Companies, affording a continuous chain of telegraphs in British hands from England and the Continent to the Pacific coast of South America. The construction of this line was rendered necessary to enable the English Submarine Telegraph Companies to transmit with great rapidity the important traffic to and from the west coast of South America, where it is dealt with by the cable of the West Coast of America Company.

Dirt in Milk.

The author puts 1 liter of milk from each dealer into a flask closed with a plug of wadding. On its arrival in the laboratory it is transferred to a measuring glass, covered with a piece of filter paper and a glass plate, and allowed to stand for two hours. The milk is then carefully decanted off from the sediment down to about 30 c. c., the residue is made up to 1 liter with pure water, and again allowed to subside for one hour. It is then again drawn off, repeating this proceeding until all the dirt is left in pure water, which is then decanted off to about 100 or 150 c. c. The dirt is then collected in a tared filter, dried, and weighed. The dirt in the milk may be calculated as five times the dry residue. One liter of market milk was found to contain 3 m. grammes dirt at Wurzburg, 3·8 at Leipzig, 9 at Munich, 10·3 at Berlin, and 14·92 at Halle. The richness of the milk in microphytes was surprising. — *Leo. Schulz, Archiv fur Hygiene.*

THE CALIFORNIA MIDWINTER FAIR—THE ADMINISTRATION BUILDING.

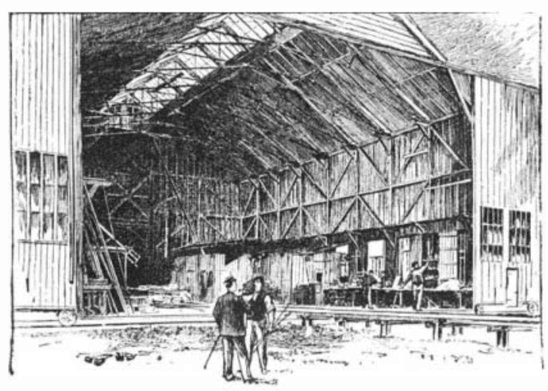
THE MAXIM AIR SHIP.*

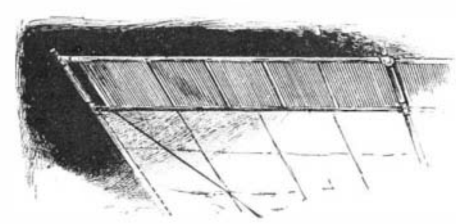
AN INTERVIEW WITH THE INVENTOR.

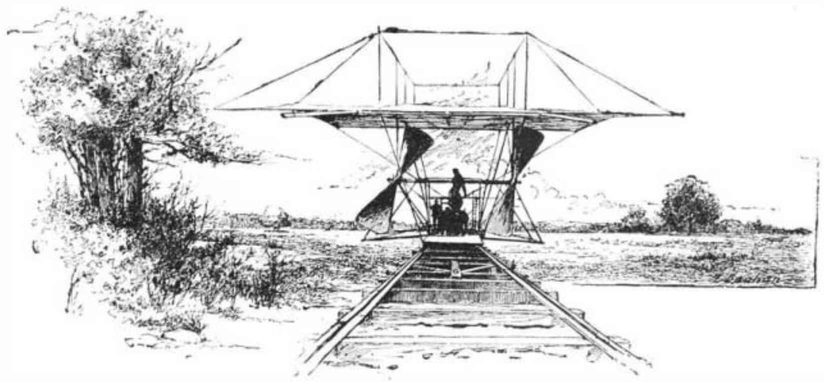
BY H. J. W. DAM, IN MC CLURE'S MAGAZINE.

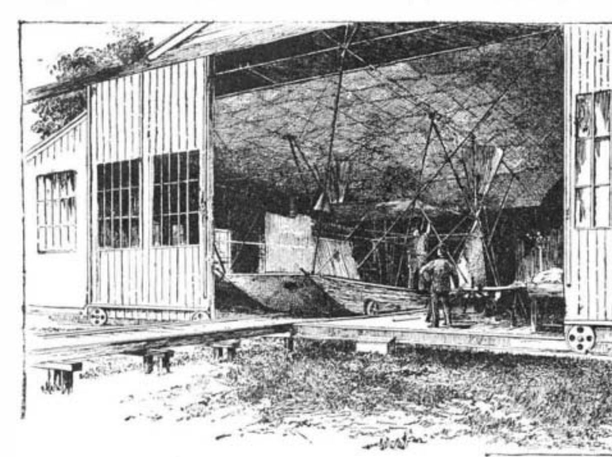
Very few people are aware of the advanced results which have already been attained, and a visit to Baldwyn's Park, near Bexley, England, would be to them a revelation which can only be described as startling. To see a great air ship, weighing three and a half tons, flying across a park, on wheels, and to know that its engineer could lift it into the air, in a moment, by a turn of his wrist, makes one doubt the evidence of his own senses. It comes upon him with a shock, as if he had just awakened from a long Rip Van Winkle slumber, during which the magic of the world's advancement had left him hopelessly behind. The big white machine is a practical, moving fact, however. It can propel and lift itself. And just as soon as those subordinate experiments, upon which depends the safety of aerial voyages, are completed, one of the greatest mechanical problems of the ages will have been finally and practically solved.

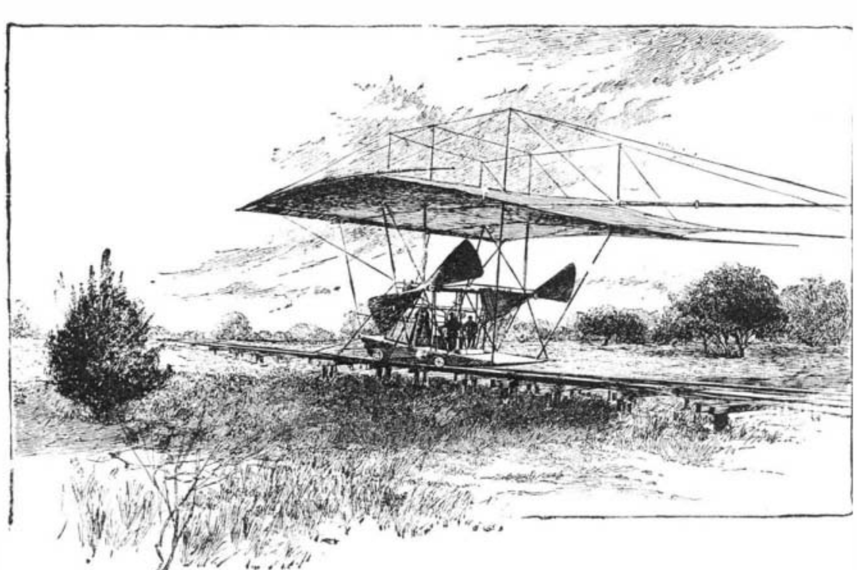
Among all the scientific men whose researches have contributed to this most important result, Mr. Hiram S. Maxim, the inventor of the air ship in question, stands foremost. As the inventor of the Maxim gun, and many other ingenious machines of less importance, he had won a worldwide fame before the navigation of the air became the chief object of his study and investigation. Beginning life fifty-three years ago, with a

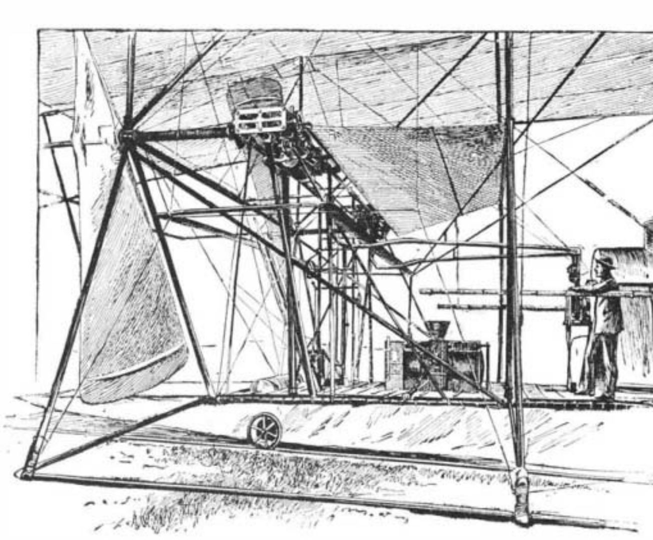

The Workshop.


Condensing Tubes on Edge of Aeroplane.


The Maxim Air Ship.


The Air Ship in the Workshop.


The Air Ship on the Track.


Details of Maxim Air Ship.

HIRAM MAXIM'S AIR SHIP.

common school education and a jack-knife, in Sangerville, Maine, he is now the proud possessor of a town house in London, and is lord of the manor at Baldwyn's Park, a stretching domain of hundreds of acres, which he leased five years ago as well adapted to his preliminary experiments. Mr. Maxim is a man of medium height and solid build, his weight being two hundred and ten pounds. His hair, mustache and beard are white, but his mental and physical energy are astonishing, and go far to explain the variety and extent of the results he has achieved. His voice and action show great physical strength, while his eyes, which are a deep brown, full and wide open, have continuously the semi-absorbed, preoccupied look of the student concentrated upon a problem. A courteous host, a jolly, even boisterous storyteller, and a wonderful mechanician, Mr. Maxim is, in his way, as unusual as his machine.

By way of introduction and explanation the inventor said :

"The principle I have worked on, generally speaking, is that of the kite. That large cloth frame at the top of the model is the aeroplane, or main kite surface. The lesser aeroplane above the platform, or car; the side aeroplanes, or wings; and the flat-pointed rudders, fore and aft, are designed to furnish additional kite surface. It is necessary to make it, however, so that we can run it in a calm, against the air, thus making our own wind, as it were; and for this purpose I have a railway track, and instead of cords to hold the kite against the wind, I employ a pair of powerful screw propellers driven by a steam engine. In this manner I can drive the machine exactly as I please, can ascertain exactly how much the push of the screws is, and at the same time find out exactly how much the machine lifts at different speeds. The machine is, in fact, a big kite. Should I fly it in the air with a cord during a strong gale and then run my engines, I should be able to find out how fast they would have to run in order to take all the pull off the cord. As soon as the cord became slack, the machine would be flying with its own engine power."

To more clearly illustrate his meaning, Mr. Maxim led the way to the workshop in the grounds—a large and substantial bird cage, sixty feet wide and fifty high, in which the mechanical bird had been constructed, and stood perched for one of its daily flights. A railway track, nine feet wide, ran outward from the closed doors, and stretched indefinitely, in a straight line, across the green level of the park to the line of a belt of woods two thousand feet distant. The front of the shop consisted of four large doors, "the largest in the world," their owner remarked; and when these were rolled back by a dozen workmen the air ship came into view. It was so novel, so unexpected, and so apparently complex at first sight, that it held the eye for a long, silent period; the beholder's sensation being one of wonder, if not awe, coupled with an indescribable mechanical confusion of ideas.

It took many minutes to grasp it; to form an intelligent idea of it. Then, as the sense of relation between the different parts developed, it became a framework of black steel rods of varying sizes, with a square frame of white cloth, fifty feet by fifty, at the top, and an inclined wooden platform, eight feet wide by forty long, resting on wheels upon the track below. On the platform, near the front end, was a small boiler house in the shape, roughly speaking, of a truncated pyramid, and ten feet behind it was a frame eleven feet high, on which were two sets of compound cylinders, and two big wooden screws above the two sides of the platform and eighteen feet apart. Outside of these fundamental accessories were a water tank, a naphtha tank, and an indefinite number of rods and very small wire ropes, to give strength and compactness to the whole. The many minor elements of the machinery did not at first catch the eye, but all appeared in interesting action when details were entered upon later on. It should be noted that the machine, as it stood and as it appears in the accompanying pictures, was without the side planes, and the big rudders of cloth on steel frames, which are mounted, fore and aft, on the main aeroplane. These are not used in the experimental trials, their utility having been established, as far as is possible without a practical test in the air.

Pushed by the workmen, the machine rolled slowly out of the house, and shortly stood upon the track in the park. It had completely filled the workshop from roof to floor; but here, with only the sky above it, seemed smaller and lighter. The steam was hissing in the boiler; the big screws had made one or two preliminary revolutions, and a flight along its track was imminent. "Jump on board," shouted its owner, who stood at the boiler, conning half a dozen different gauges; and, climbing over an outlying rod like the outrigger of a canoe, I mounted the platform, which was of the lightest matched boards, so thin that they seemed insufficient to bear a man's weight. Prior to the start, a rope running to a dynamometer and post was attached behind to measure the forward impulse, or "push," of the screw. Mr. Maxim turned on the steam and the screw on the port side began to revolve. It is seventeen feet eleven inches in length, five feet wide at the ends, and twenty-two inches at the waist. It is made of the lightest American yellow pine, and painted a pale blue, the paint having been sandpapered to perfect smoothness, reducing the skin friction to a point at which it became negligible. It revolved faster and faster as the steam power was increased, until it was whirling on its seemingly frail framework at a dizzying speed. Then steam was shut off; it came quickly to a standstill, and its fellow on the other side was tried. All working smoothly, both screws began to turn faster and faster and faster, until the eye began to lose the blades and retain only the sense of two whirling disks. The action of the screws at high speed caused remarkably little shaking of the whole machine. This is one of the surprises of the invention, the tremendous force exerted as compared with the lightness, steadiness, and compactness of the whole.

Behind the screws, forty feet away, two men were

* The illustrations for this article are from copyrighted photographs taken under the supervision of the author and Mr. Maxim, by Pradelle & Young, of Regent Street, London.

squatting over the dynamometer, and indicating the degree of "push" on a large index board for the engineer to read. The index marked four hundred, five hundred, six hundred, seven hundred, and, finally, twelve hundred pounds of "push." The pressure was then diminished below five hundred, and the commander yelled: "Let go." A rope was pulled, the machine shot forward like a railway train, and, with the big wheels whirling, the steam hissing, and the waste pipes puffing and gurgling, flew over the eighteen hundred feet of track in much less time than it takes to tell it. It was stopped by a couple of ropes stretched across the track, working on capstans fitted with revolving fans. The stoppage was gentle, and the passenger breathed freely again, looking now upon the machine with more friendly and less fearful eye, as if it were a dangerous bulldog with which amicable relations had been established and fear of injury was over. The machine was then pushed back over the track, it not being built, any more than a bird, to fly backward. In a quarter of an hour it is again at its starting place, and ready for another flight. Having seen it in action and had evidence of its power, the details were more than ever interesting, and were furnished by the inventor in succinct and practical terms.

The first question was its supporting power in the air. He said:

"The area of the main aeroplane is two thousand eight hundred and ninety-four square feet; of the small one, one hundred and twenty-six; and of the bottom of the car, one hundred and forty. With the rudders and wings added, the total area is about six thousand square feet. The wings are ten in number, and superposed, five on each side, and are each five feet wide and from twenty-five to thirty-five feet in length, according to their positions. The forward rudder, projecting in front from the main aeroplane, is eighteen feet wide and thirty feet long, and the aft one, eighteen by twenty-three. Rudders and wings, like all the other aeroplanes, are made of a specially woven cotton cloth, so fine that you cannot blow through it, and mounted on a framework of hollow steel tubes. All these aeroplanes are inclined at a small angle to the air, the angle which gives the most support combined with the least resistance to its forward motion."

"What speed is necessary to support the machine in air?"

"A minimum, under present conditions, of twenty-five miles an hour. At that speed with wings and rudders adjusted, it will leave the track. It lifted in one of the earlier trials, and caused us some trouble, as we were not ready."

"What will happen in the air if anything goes wrong, and the engine stops?"

"The machine will settle to the earth, and land with the same velocity as if it had fallen a distance of three feet."

"Only three feet?"

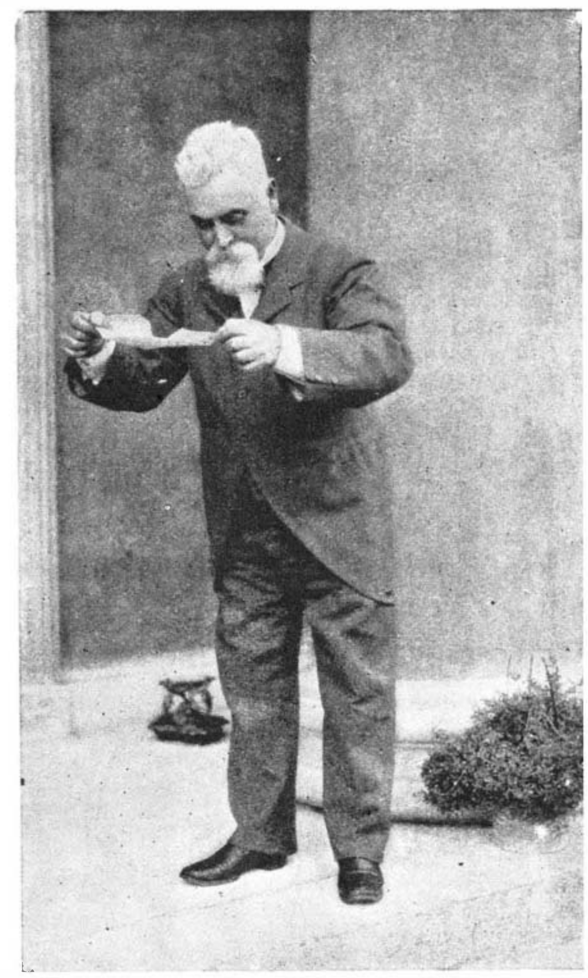
"Yes. When the propulsion ceases, the machine will fall three feet. At this point the resistance to the atmosphere afforded by the aeroplanes will become nearly equal to the force of gravity, and it will settle without any increase of velocity."

"How about its steadiness in the air? You know a kite sometimes indulges in extraordinary rolling, to say nothing of darts and dives."

The explanation of this point was given ocularly, and much more clearly than words would have made it. Mr. Maxim tore a sheet of paper from his note book, held it up, and let it fall to the ground. It darted, dived, and fell in irregular lines, shooting out behind him. He then took the same sheet of paper, tore a square out of each corner, and bent back the four sides from the corners of the squares at an angle of forty-five degrees. He then held this up and let it fall. It sank to the earth gently, without a tremor, its surface remaining perfectly even throughout. "That," said he, "is the principle of the wings. They are so adjusted that as any side is depressed it presents a greater lifting surface to the air below. There's no trouble keeping her on an even keel," he added with a smile.

"But can't it tip over in a wind?"

"No. It is quite possible to make a plane remain right side up in the air, even if the center of gravity is considerably above the center of lifting effort. Stability in the air depends very largely upon the shape of the aeroplane, but nevertheless with this machine the center of gravity is very much below the center of lift;



Mr. Maxim Illustrating the Principle of the Wings of the Air Ship.

and this, together with the form of the aeroplane, makes it quite impossible that the machine should tip over in the air. The center of gravity in this machine is here," and he held up his hand at an imaginary point about five feet back of the boiler and seven feet above the center of the platform. It may be here mentioned that the main aeroplane is twenty-five feet above the platform. The total height of the machine to the tops of the rods above the aeroplane is thirty-five feet, and its greatest length seventy feet.

"Are the cotton aeroplanes strong enough to bear the weight in falling, without fracture?"

"They are twenty-five times stronger than is necessary. The greatest weight which can bear on them is a little over a pound to the square foot, and they are tested for twenty-five pounds. The pressure on the cloth is practically the same at all speeds, whether the machine is falling to the earth or sailing through the air; the cloth in any case has to sustain the weight of the machine."

"How is it steered?"

"For steering to the right or left I expect to use the screws. If I have any difficulty I can easily use rudders. For steering upward or downward the fore and aft rudders will be used. The aft one is pivoted on the extension of the two center poles and the forward one hung on their ends. Both will be worked from the center of the platform, and will at first require a man to each, though I shall greatly simplify the working of them later on."

"What is your estimate of the speed?"

"I don't expect, with this machine, to get over thirty-five miles per hour. The next one, which will be smaller, and will be worked with a hundred horse power, will give me, I expect, from fifty to sixty miles per hour. The highest speed I look for, as the art is perfected, is ninety miles per hour. I believe that any speed which is attained by a railway train can be reached by a machine moving through the air."

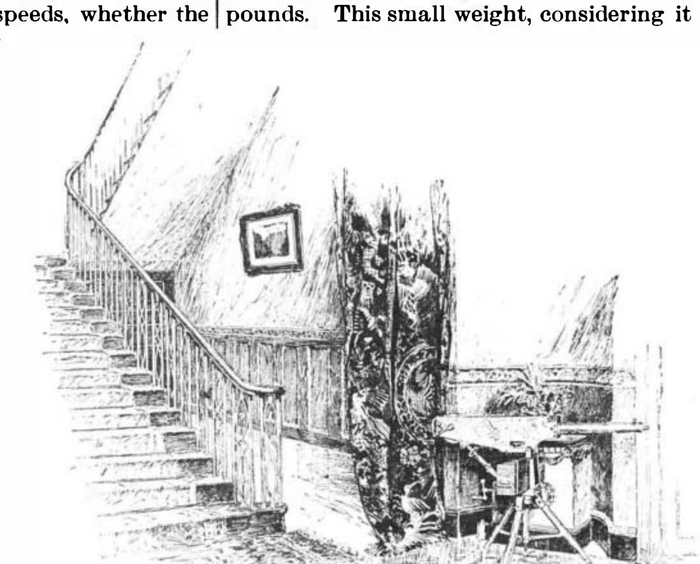
"How about the duration of the flight?"

"That is merely a matter of water and naphtha. The margin of weight carrying is so large that, once the machine is successful, any amount of time and distance within reason can be looked for."

As far as support and action in the air were concerned, there seemed nothing more to be said, and yet it was difficult to realize that the facts as stated were simply and undeniably true; to realize that the navigation of the air is the traversing of an entirely new medium, whose conditions are so foreign to those of water, for instance, that they are difficult to quickly conceive.

The next question was that of weight, and here came some object lessons in the weight of metal that were astonishing. "Lift that tube," said Mr. Maxim. The tube was of copper, four feet long, and elliptical in shape, its greatest diameter being one and a half inches. It looked heavy. Lifted up, its lightness was surprising. It weighed no more than thin paper, and actually seemed, for the moment, like paper colored in imitation of copper. "That is one of the condensing tubes," said Mr. Maxim. "There are five hundred of them up there." and he pointed to a section of what had appeared to be thin laths running across the entire front of the main aeroplane. "Of course," said he, "we can't waste any water up in the air, because we have no means of replenishing. The used steam runs up by those large pipes, and the water runs back through those small ones to the tank in the center of the platform. The framework is constructed," he continued, "not of rods, but tubes, and tubes of the least possible weight. They are all of steel, a steel with considerable carbon in it and not tempered, and they vary from one inch to three inches in diameter. I tried aluminum, but found that steel was stronger, weight for weight. In addition to this, steel tubes can be united with great facility, and the coefficient of the joint is fully ninety-five. There is no convenient way of uniting aluminum tubes, however, and if they were united the coefficient of the joint would be very low. The heaviest tubes in the machine are the shafts of the screws, which are five inches in diameter, five feet long, and an eighth of an inch thick. The next size, used in the car, are three inches in diameter, and one-twelfth of an inch thick. I have a few more, one-fourteenth of an inch thick, of the same size. I need not say that at every point I have used the lightest tube possible for the strain which comes upon it, perfect safety being at all times considered, as I purpose to take my first machine up into the air myself, and I don't intend to run any risks. The bulk of the machine is constructed of hard steel tubes one twenty-fifth of an inch in thickness. The total weight of the machine, with its full complement of water, naphtha, and three men, is something over seven thousand one hundred pounds Without the wings it is six thousand eight hundred and eighty. The boiler complete weighs one thousand pounds. This small weight, considering it gives me a force of three hundred horse power, is perhaps the most valuable portion of the work, since it has always been known that we could fly if we could get a motive power of adequate strength with sufficient lightness. I use a compound engine, the high pressure cylinders being five inches in diameter, with a twelve inch stroke, and the low pressure eight inches in diameter, with a twelve inch stroke. The piston speed is eight hundred feet per minute. Nearly everything connected with the machinery had to be newly designed, with a

Mr. Maxim's House at Baldwyn's Park.



The Hall in Mr. Maxim's House.

HIRAM MAXIM'S AIR SHIP.

special view to lightness, none of the known appliances being of use in this case. It was necessary, in the first place, to develop a system of making a very large quantity of carbureted air from naphtha, with very little weight." Pointing out a large hole where the air was drawn in, he said that, as the velocity with which the combined air and gases entered was at the rate of two miles a minute, he found it very difficult to deal with these gases at this high velocity, and had spent a great deal of time in devising a system by which the gas was equally spread out over the whole furnace, and not influenced by the inductive action of the incoming gas at this very high velocity. "I had," he resumed, "to devise a system for regulating the product of the gas; for pumping the liquid into the gas generator; a new kind of boiler and feed water heaters; a system for burning a very large quantity of carbureted air in a small space, without smoking or blowing out; a system for regulating the steam, and pumps for filling the boiler and regulating the supply. None of the existing types of engines seemed well fitted to the purpose. I had to design one expressly with a view to great lightness, and notwithstanding there were some hundreds of types of connecting rods already in existence, I found it necessary to design an absolutely new form of connecting rods. I had to invent a new dynamometer to meet the necessities, and new dynagraphs for measuring the lift of the machine at different speeds, as well as another to measure its rate of speed through the air." He paused, looking over at the machine which represented so many hours of concentrated brain work in a puzzled, absorbed way. "And there is more to do yet," he added impressively. "I don't call this an air ship or a flying machine or anything else. To me it is merely a machine for making experiments in aerial navigation. In my next one, I shall make a number of changes which it is not worth while to make in this. It is slow work, but there is no doubt of the result. Propulsion and lifting are solved problems, and it is merely a matter of time."

"How much time?"

"Well, if I had nothing else to occupy me, unlimited money, and plenty of space for experimenting, I should expect to be up in the air within eighteen months. I am very busy, however, have a very limited space here, and am proceeding as economically as possible. In my opinion, however, under the most unfavorable conditions, aerial navigation will be an accomplished fact inside of ten years."

This was a digression. We now came back to the most remarkable boiler that ever was seen. It was inclosed in a house eight feet long, five feet wide at the base, and about six feet high. The sides of the house were of thick cloth, woven from pure asbestos, and the frame and top of the thinnest iron. Within, viewed through a peephole, the entire floor was a mass of small flames from seven thousand six hundred gas burners. The boiler has about six hundred tubes which are eight feet long, and about one hundred which are four feet ten inches long. These tubes are about half an inch external diameter, and half a millimeter, or one-fiftieth of an inch, in thickness. They are curved and joined into a steam drum, ten inches in diameter and eight feet long, where the water and steam are separated, the water again passing through the boiler, and the steam passing to the engine. There are also some three or four hundred much smaller tubes, which are used for heating the water by the products of combustion before it enters the main boiler at all. In order to prevent the tubes from being injured by the great heat of the fire, a forced circulation of the water is employed. It is therefore possible to use a very small and thin tube and a very hot fire without any danger. A single spare boiler tube in the shop served to exhibit the peculiar lightness of the boiler, which is perhaps the most ingenious as well as the most important part of the machine. The tube, like the condensing tube before mentioned, was as light as so much paper. It was made of pure copper, any impurities, in view of the thinness of the tubes, causing them to become "hot short" and break. "With only a moderate fire," said Mr. Maxim, "I have been able to get a horse power out of four of these tubes; with a hotter fire I have got a horse power out of three of them. Their bursting pressure under steam is sixteen hundred and fifty pounds to the square inch. The boiler itself has been fired to give a steam pressure of four hundred and ten pounds to the square inch, but I have never run the engine above three hundred pounds, thereby developing three hundred brake horse power, which is all that I need for this weight, and which leaves a very wide margin of safety. To run the boiler the machine carries six hundred pounds of water, and two hundred pounds of seventy degree Baume naphtha. The consumption of naphtha is about one pound per horse power per hour."

Last of all, in the way of general description, came the questions of propulsion and lifting power. To give all the details under this heading, into which the inventor entered, would alone make an article quite as long as this, if not a small volume. Concerning specific results, however, he said:

"The lifting of an aeroplane by a screw or screws has been the subject of many series of experiments by myself and others. The number of pounds lifted by one pound of 'push' in the screw varies greatly with conditions. In my early experiments with a merry-go-round, or whirling table, I succeeded in lifting fourteen times the 'push' of the screw, or fourteen pounds of weight for every pound of 'push' forward. In this large machine, however, with a large number of wires and a good deal of framework, where the aeroplane is so large, where it is difficult to make it remain uniform or rigid when there is a pressure on it, and where I have an engine, boiler, platform, men, tanks, wires and tubes to force through the air, I have not been able to lift more than six pounds for each pound of 'push.' This, however, is much more than is absolutely necessary. The engine is able to give, and has often given, a 'push' of nineteen hundred and sixty pounds, which would mean a lifting power of nearly twelve thousand pounds. With a 'push' of one thousand pounds from the screws, using one hundred and twenty horse power, the lift, as shown by the dynagraphs, was over six thousand pounds. This left only a weight of one thousand pounds on the track, and this was not sufficient to keep us there. The speed along the track with this 'push' was twenty-seven miles per hour."

"When do you expect to take your first flight?"

A TWO SEATED TRICYCLE.

"I have not set any time, and shall not. Haste in an enterprise of this kind is the worst possible policy. At every trial of a machine which is mechanically new in so many particulars, weak points develop and require attention, while new improvements constantly suggest themselves. To-day it is a leaking valve, tomorrow something else. Rising into the air with a new machine, when all the experiments in the way of maneuvering, which can only take place in the air, are yet untried, would be unwise until everything which can be completely tested on the track has been so tested. The possibilities of accident must be as nearly as possible exhausted beforehand. More than this, I have not at Baldwyn's Park the necessary room and privileges. It may be that I shall not attempt to rise until I have more room, and I am now looking for a suitable location—something difficult to find in England. In fact," he added, with one of his ready New England comparisons, "I am like a boy with a pair of skates which he has never tried, and only a little piece of ice to try them on."

Tho foregoing was the substance of the "few safe particulars" which Mr. Maxim was willing to give. The improvements upon his first machine, which will appear in his second, and the eventualities and possibilities of aerial navigation, were subjects upon which he was not inclined to talk very much. He confessed, however, that an air voyage of three or four thousand miles seemed to him eventually probable. "I don't want to speak of things before I am ready to do them. I don't imagine that flying machines will be used very soon to carry bricks from Haverstraw to New York, or coals from Newcastle. The first machines are certain to be used for military purposes, whatever their cost or whatever the expense of running them, and the nation which first employs them will have every other at its mercy. I shall be quite content with my results when I can go a distance of twenty miles and back. That will suffice for all present purposes."

A Great Coal Vein in Tonquin.

The French are actively working a coal mine in Tonquin which promises to produce excellent coal in large quantities. The mine is situated about eight miles from Port Hongay, in the Bay d'Along, and a railway has been laid down for the whole of that distance. The offices and huts of the miners are all situated at Hongay, and the workpeople are conveyed to the mine every day by train. The mine itself is called Hatou. The length of the seam is given as 16 miles, and it is, according to the *Times*, nearly 200 feet thick. The supply is, therefore, practically inexhaustible. At present about 500 tons a day are extracted by the simple process of quarrying, the mass of coal having only a very thin layer of soil on the top. The miners are exclusively Annamites, of whom about 200 are employed, but the higher officials are all Frenchmen, although the capital of the company, strange as it may seem, is chiefly held by English merchants at Hong Kong.

A TWO SEATED TRICYCLE.

The tricycle which we illustrate is built to accommodate two riders side by side. The ordinary tandem bicycle is open to the objection that the rider appears to be accompanied by a groom. In the present machine, which is of French origin, each rider actuates a pair of pedals which are connected with the wheels as in bicycles, so that each of the rear wheels is driven independently. Each rider helps to steer with one hand, while the other rests on a special support attached to the head of the tricycle. This tricycle is 5 feet 10 inches long, 25 inches wide at the level of the axles of the rear wheels, and weighs 55 pounds.

The advantages claimed by M. Matière, the inventor, and M. Laverne, the builder, of 177 Rue des Boulets, Paris, are ease of management, especially as regards turning, speed and great stability, which is insured by the position of the riders. For our illustration we are indebted to the *Revue Universelle*.

Brown-Sequard.

Dr. Charles Edouard Brown-Séquard, the eminent physiologist and physician, died in Paris, April 2, of congestion of the brain. He was born at Port Louis, in the island of Mauritius, April 7, 1817. His father was a native of Philadelphia and his mother was born in France. Dr. Brown-Séquard began his study of medicine in America. In 1838 he removed to Paris, where he graduated as M.D. in 1840. His researches on the vital properties and functions of the spinal cord were of the utmost value. He was made professor of experimental and comparative pathology in the *Ecole de Médecine* of Paris in 1869. At different times Dr. Brown-Séquard visited the United States, delivering lectures and practicing his profession. By a desire to investigate the contents of his own stomach, he was led to try experiments on himself, which at last brought on a most rare and peculiar affection known as merycism or rumination, which required him to masticate his food for a second time during the remainder of his life.

The brilliancy of his discoveries obtained for him a world-wide reputation, so that scientists were greatly shocked when he formally announced in 1890 the discovery of a fortifying fluid, which immediately became famous under the title, "Elixir of Life." For this discovery Dr. Brown-Séquard was pilloried in the eyes of the world as a charlatan. The subcutaneous injections of the secretions of certain glands of dogs and other animals proved efficacious in a number of cases, and this discovery was of equal value with those of his early life. It is perhaps unfortunate that the great physiologist should have discovered the "Elixir of Life" at the advanced age of seventy-two, when he could not spend the requisite amount of time and energy to perfect his discovery; but it is very safe to say that half the stories relating to the new remedy are untrue, and that Dr. Brown-Séquard never claimed half as much for it as his enemies, who took malicious delight in likening the aged doctor to Ponce de Leon and others of the same class.

Gas from Wood.

A western genius has invented a machine for making gas for illuminating purposes out of wood, instead of coal. The machinery is very simple, consisting merely of a retort and purifying chamber, with a tank for holding the gas. He claims that the machine can be used for domestic purposes, and that by attaching it to an ordinary cooking stove enough gas to last a day can be made by the fire necessary to do the cooking.

RECENTLY PATENTED INVENTIONS.

Engineering.

TRACTION ENGINE DRIVING GEAR.—Thomas C. Robinson, Jr., Ipava, Ill. This gear is strongly made and simple in arrangement, to facilitate running the engine with more power and less speed over rough roads and up hills, and with increased speed over smooth and easy roads. Combined with guideways on the shell of the boiler, and fixed driving and driven gears, is an adjustable slide between the gears, on which are journaled a single gear wheel and a double gear wheel to be readily engaged with or disengaged from the fixed gears. The cog wheels are designed to be so proportioned as to give any desired fast and slow speed.

TURN TABLE.—Gabriel Rohrbach, Del Rio, Texas. In turn tables for turning locomotives, this invention provides a simple lever attachment by which one man may easily turn the table and its load, the lever mechanism being easily locked in place when not in use, and not being likely to get out of order. Upon a revoluble bed carrying a circular track is mounted a bracket in which a vertical oscillating shaft is turned by a lever, a catch plate oscillating on the rail having vertical teeth to engage the rail, and there being a crank connection between the catch plate and the shaft and a lever mechanism for shifting the angle of the catch plate.

Mechanical.

DRILLING MACHINE.—Louis Reichert, Scranton, Pa. This machine has two aligned rotatable and sliding spindles carrying drills adapted to slide and rotate, while a series of independent spring leaves act on the outer ends of the spindles, the leaves being reinforced one by another to gradually increase the pressure on the drill. The machine is designed chiefly for boring eyeglasses, and provides for but a slight pressure on the spindles at the beginning of the boring, to avoid chipping the glass, the pressure being afterward graduated as desired.

FELLY PLANER.—William R. Dunn, Alton, Ind. In a suitable frame are slides adapted to move up and down, felly-supporting beds being hung on shafts in the upper and lower ends of the slides, each supporting bed having a segmental holder for supporting the felly to move it in contact with a revoluble cutter head journaled in stationary bearings, friction rollers pressing the fellies in place on the holders during the time the cutter heads are cutting. The planer is of simple and durable construction and designed to correctly and uniformly plane the inner and outer faces of the felly to the desired diameter.

CRUSHING AND GRINDING ASPHALT ROCK.—John H. Tabler, Russellville, Ky. In this machine a revolving feed drum is mounted over a heating chamber, the material fed into one end of the drum being heated as it passes through and is discharged into crushing and grinding rolls with different contact faces of different diameters, differentially spaced apart and journaled to rotate at different speeds, whereby the continuously fed material is successively crushed into small particles. Steam and hot water are mixed with the material as it is being crushed to prevent clogging or adhering to the rolls.

Railway Appliances.

NUT LOCK FOR RAILS.—Jefferson D. Tynes, Fort Smith, Ark. This improvement comprises a base plate having apertured washer-like ends adapted to fit over the bolts, a spring metal key bar being fixedly held at its center on the base plate, with its opposite ends held for a free twist movement and projected beyond the face of the washer portions of the base plate. The device is a double lock nut, especially designed to lock nuts against the fish plates of rail joints.

Miscellaneous.

PROCESS OF MANUFACTURING GAS.—Gustaf M. Westman, Hackettstown, N. J. A furnace of special construction is provided by the inventor for carrying into effect this process, which consists in passing a mixture of gases through iron oxide in a reducing furnace to produce iron sponge, the mixture consisting partly of new formed gases and partly of gases previously passed through the iron oxide and afterward heated and carbureted, then passing steam through the iron sponge to reconvert it into iron oxide and produce hydrogen, and passing the latter through glowing coke to take up and combine with its carbon.

STORE SERVICE CARRIER.—James R. Pollock, Mansfield, Ohio. This invention provides a simple, economical and easily operated apparatus, so arranged as to conveniently brake the car on its return to the stations, to avoid unnecessary noise. The apparatus has a grade track formed with inclines and supported upon depending hangers, and combined with the track and a propelling line for moving the car is a cylinder in which is fitted an air-tight plunger, there being connections between the plunger and the propelling line whereby the plunger will retard or brake the return of the car, and, by the vacuum produced beneath it, aid in actuating the propelling line to drive the carriage.

ADJUSTING DEVICE FOR BICYCLES.—John H. Prince, Carroll, Montana. This device is to facilitate tightening the driving chain and to hold the spindle of the driven wheel always in parallel position, relative to the pedal or crank shaft, so as to cause the wheel to run true. It consists of a frame having in its forked ends racks meshing with gear wheels secured on a spindle turning on bushings sliding in the forked ends of the frame, a screw screwing in the frame engaging one of the bushings, and there being nuts screwing on the ends of the spindle and abutting on flanges formed on the bushings.

CHECK BOOK.—Isaac B. Alter, Rossville, Kansas. This invention consists of a casing having a pocket and a check tab adapted to be fastened to the inside of the pocket, the arrangement being such as to permit of conveniently removing the checks and of replacing the check tab when used up without requiring an entirely new book. The check tab carrier is connected to the casing within the pocket, to slide in and out, and is formed of a plate having a slide and points or hooks for engagement with the tab.

FIRE ESCAPE.—C. P. Elieson, New York City, and Francis A. Pellas, Greytown, N. Y. According to this improvement swinging ladders are adapted to be dropped from various balconies to form a passageway from the windows of a building to the ground, means being provided for automatically opening the balcony doors by the movement of the ladders, the doors and ladders being so geared that one acts as a counterbalance for the other. A whole vertical series of ladders may be quickly released and dropped together. A building provided with this improvement will ordinarily appear to have only the usual balconies under the windows.

FIRE ESCAPE OR LIFTER.—William Wellens, Oldham, England. This is a simple and inexpensive apparatus by which weights or loads may be easily transferred from one floor to another, while also affording a fire escape, and a device for use as an ordinary ladder, to facilitate the painting and repair of buildings. As a fire escape, it has upper and lower shafts journaled in brackets to support drums carrying an endless belt ladder in front of a building opposite the windows, the ladder moving, under control of a brake, to convey to the ground persons stepping on it. When used to support workmen the ladder is locked in fixed position, and one form of the apparatus provides for its use on a portable frame adapted for lifting.

AWNING.—Catherine Leclercq, Lima, Peru. This awning is constructed on the principle of Venetian blinds, and is adapted to be folded in a box fastened over the door or window on which the awning is to be applied. The invention consists of a head mounted to turn and connected by tapes with the slats, supporting rods connecting with either side of the outermost slat so as to hold the slats in a ventilating, sheltering position, or in a closed position during rainy weather.

METALLIC SHELF.—Charles W. Marquardt, Detroit, Mich. This shelf consists of tubular brackets engaged by tubular braces, connecting plates secured to the brackets and braces, and a shelf plate secured to the brackets and resting on the braces, the entire device being cheaply manufactured and conveniently assembled, and designed to be very ornamental in appearance, for use as a metallic mantel, bracket shelf, table top, etc.

PACKING CASE.—David F. Griffiths, New York City. After the parts of this case have been nailed or screwed together they cannot be separated without showing that the parts have been tampered with, but the nails or screws are entirely concealed by parts which act as braces or ties. The case has a continuous dovetail or under-cut groove surrounding it at each end, through which the nails or screws are driven, and through which a tie or strap is afterward passed and its ends sealed. When the straps have been carefully removed in opening the case, the case may be again used for packing.

HANGING OR SWINGING CHAIR.—Samuel F. Purington, Brunswick, Me. This chair has forked lower extremities removably connected with a platform support, and the arms are removably connected with swinging supports and with the back of the chair, the arms having a pivotally connected link at one end and an angle iron at the opposite end, the link and angle iron having slots receiving studs on the swinging supports and on the chair body. These chairs may be quickly and easily connected with their supports, and disconnected, to be folded compactly for shipment.

FASTENING SLIP COVERS ON FURNITURE.—Henry Seher, New York City. This inventor provides a device whereby the covers may be firmly and smoothly held on the furniture, especially on the seat, preventing an untidy appearance. The improvement consists of spring fasteners held on a rod, the fastening devices being located along the edge of the seat, back, or other part, and where the cushions of two such parts meet the spring fasteners are adapted to be forced, with the slip cover, into the crease between the cushions.

COMBINATION FOLDING BED.—Edward E. Murphy, Madison, Wis. The legs of this bed are automatically unfolded when the bed is lowered and locked when the bed is down. The casing is finished off in the style of a wardrobe, with cabinets on each side of the casing, one intended for bedroom articles and the other fitted up as a writing desk or secretary. Means are provided for tightening the mattress spring and for holding the bed clothes when the bed is folded up. The invention affords a cheap, simple, and safe folding bed, with few operating parts, and one in which the balancing weights are dispensed with.

UMBRELLA CANE.—Rufus Waples, Jr., New York City. This is an improvement on a former patented invention of the same inventor, providing for bracing the inner ends of each of the ribs against the opposite rib or ribs by a pivotal attachment which will permit of freely closing and opening. A metal strap plate, ring or flange, may also be durably attached to the ends of the ribs to greatly increase the strength without adding sensibly to the bulk, making possible also much more rapid manufacture. When the cane is used as a walking stick its canopy is entirely concealed.

HAIR CURLER.—Sylvester K. Mathews, Albany, N. Y. This is a device designed to be manipulated with one hand, and cause the hair into which it is introduced to curl or wrap around it as the curling section is manipulated, the hair so encircling the curling section that the section may be withdrawn from the hair and the latter will remain in curl. The curling section consists of a cage in which are longitudinal parallel spaced rods.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

MODERN AMERICAN PISTOLS AND REVOLVERS. By A. C. Gould. ("Ralph Greenwood.") Boston: Bradlee Whidden. 1894. Pp. iv, 222. Illustrated. Price $1.50.

This most interesting book treats of modern pistols of the single shot type, such as the Stevens rifle, the Remington, Derringer and others, interesting either historically or practically, of revolvers of the most modern type, of target and pocket revolvers, and gives not only their points of construction, but treats in considerable detail of relative accuracy of different weapons. In addition to illustrations of the same and of target reproduced by them, numerous portraits of celebrated marksmen, many of them in shooting attitude, are interspersed through the volume.

ELEMENTARY LESSONS IN STEAM MACHINERY AND THE MARINE STEAM ENGINE. By Staff Engineer J. Langmaid and Engineer H. Gaisford. London and New York: Macmillan & Co. 1893. Pp. xv, 267. Price $2.

This work is prepared for naval cadets on the English ship Britannia, and the syllabus of subjects dealt with is based on the plan of the London University. The work is very attractive and general in the treatment of its subject, and is really a work rather for reading than for hard study. Quite a striking feature is found in one of the cuts, Fig. 84, which represents the section of a steam cylinder and D valve, the valve and piston both being movable, so as to make the cut in some sense a working model.

DYNAMO AND MOTOR BUILDING FOR AMATEURS, WITH WORKING DRAWINGS. By C. D. Parkhurst. New York: The W. J. Johnston Company, Ltd. 1893. Pp. vi, 163. Price $1.

Lieut. Parkhurst has a name familiar to our readers from his articles on electrical apparatus which have been published in our SUPPLEMENT. This book will, we doubt not, be welcomed by many constructing amateurs, who are interested in motors and dynamos.

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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(5939) J. M. H. asks: 1. How are carbon plates made? A. See query 5942. 2. Please tell me how many gravity cells it will take to charge a storage cell about the size of a two quart jar, and how long will it take? A. Allow three gravity cells, and one or two days.

(5940) H. A. M. writes: 1. We have a maple sugar camp and use three old-fashioned pans, 26 inches wide and 12 feet long. Would they evaporate more by having them partly covered? A. The pans should not be covered, but will evaporate faster by continual stirring with a rake. A hay rake makes a good stirring implement. 2. Can I put under one of them a coil of 1¼ inch gas pipe to heat the sap before it reaches the pans? How many feet of pipe would be required to heat 1,500 gallons in about 15 hours, sap to be taken from a tank by the side of the pan? (Good dry wood used.) A. We do not recommend the coil under the pan. It interferes with the proper management of the heat of the pan and is not easily cleaned. A supplementary pan placed at the rear, a little higher, so as to draw into the sugar pan, is preferred. It can be heated by extending the flue and chimney. 3. What is the best way to cleanse maple sirup? A. The white of eggs frothed by beating with a little of sirup, stirring thoroughly in the sugar pan, and skimming off the scum is the usual process for clarifying maple sugar. Milk is also used. Much stirring whitens the sugar while granulating. 4. The Odd Fellows here have a two-story hall, and they cannot rent the ground floor on account of the plainness with which they can hear below what is going on upstairs. Can it be deadened in any way? The building is a two-story frame, sealed with inch lumber, and the upper floor is double, with a 2 inch strip between them. A. A thick paper felting, or strawboard, laid on the floor and another floor laid on the strawboard, or below ceiling, with a thin second ceiling, with strawboard or felt between; or, what would be better, furoff the ceiling, and lath and plaster; this will deaden the sound from above.

(5941) C. N., Vienna, Austria, asks: 1. What should be the proper size and pitch of a propeller wheel for a steam yacht to attain greatest speed possible, fitted with a compound engine of 60 indicated horse power, making 300 revolutions per minute? A. The size of propeller suitable for your engine and its proposed speed should be about 6 feet, more or less, to suit the model and allowed draught of the vessel. The pitch should also vary with the lines of the boat, longer for a sharp, fine-lined boat than for a boat of burden or a tugboat. A pitch of $1\frac{3}{10}$ to $1\frac{1}{2}$ times the diameter is about the range for different models and uses of steam vessels. For the speed of engine as stated, probably a pitch of 8 feet for a 6 foot wheel in a boat built for speed can be recommended. See an excellent work by Kunhardt on "Steam Yachts and Launches," $3 by mail. 2. Please give simplest method of determining and finding the pitch of a propeller wheel. A. There is no simple method of determining the size or pitch of a screw propeller. The resistance of the vessel, depth of draught, required speed, and power are all factors for size and pitch of screw propellers. 3. Where can I get the patent Bartlett wheel in America? A. We do not find that the Bartlett wheel is made under that name by makers of propeller wheels in this vicinity.

(5942) E. P. says: Will you kindly tell me how the carbon for arc lights is made and what is the material used? A. Clean pieces of coke are selected, pulverized, and passed through a fine sieve. It is then thoroughly mixed with from one-sixth to one-eighth its bulk of wheat flour, both being in a dry state. The mixture is moistened with water containing a small percentage of molasses. It should be allowed to stand for two or three hours in a closed vessel to prevent the evaporation of the water. At the end of this time the mixture may be pressed into moulds of any desired form, then removed from the moulds and dried, slowly at first, afterward rapidly, in an ordinary oven at a high temperature. When the rods or plates thus formed are thoroughly dried they are packed in an iron box, or, if they are small, in a crucible and completely surrounded by coke dust. The box or crucible must be closed by a non-combustible cover. Then place in a fire and heat to a red heat for an hour or so, then allow the box to cool, remove the carbons, then boil for half hour in thin sirup or molasses water, then bake in an ordinary oven and recarbonize as already described.—From "Experimental Science." This same applies to battery plates.

(5943) J. T. T. asks: 1. For formula for making sealing compound suitable for dry batteries. A. Use resin 4 parts, gutta percha 1 part, melted together with a little boiled oil. 2. For full directions for amalgamating zinc cup, such as used in dry batteries. A. Do not amalgamate it, as amalgamation renders zinc very brittle. If you must do so, wash the inner surface with a slightly acid solution of mercury nitrate. 3. In attempting to amalgamate a cup of zinc, used dilute sulphuric acid (acid 1 part to 10 parts water) for cleaning zinc and then applied few drops mercury on inside cup, rubbing it over surface by means of brush, but bottoms of cans would unsolder and drop out. On examination of zinc found it like rotten, being easily pulled in pieces. What caused this? A. You used too much mercury, but it will always make zinc brittle. 4. What amount of No. 32 cotton-covered magnet wire is necessary for making an electro-magnet, having core ⅜ by 2 inches, using Norway iron? A. Wind it to a total diameter of ¾ inch.

(5944) H. M. writes: In mounting condensers for magic lanterns, how close should they be placed together? A. Place them, if double, with convex sides inward and generally not more than a quarter of an inch apart. If there are three, you may determine the proper setting by trial.

(5945) J. C. M. asks for the best method of tempering the steel for the magnets used in the Bell telephone. A. Heat to a cherry red the ends only of the steel bars, plunge them in water to harden them, and draw the temper to a dark straw color or bronze bordering on purple.

(5946) R. F. W. asks: 1. In making dynamo described in SUPPLEMENT, No. 600, will not brass do just as well as bronze for the yokes? A. Brass will answer the purpose, but not as well as bronze. 2. Copper as well for the commutator as bronze? A. Yes, provided it is hard rolled. 3. If you have any paper giving full working drawings and complete description of the construction of a folding canvas canoe, will you please give the number? If you have no paper on a folding canoe, can you give me one on an ordinary canvas canoe? A. For an answer to this query we refer to SUPPLEMENT, No. 181, which contains a full description of a folding canvas canoe.

(5947) G. W. asks: 1. Can I obtain a sufficient spark to ignite the gaseous mixture in an oil engine by winding copper wire around a soft iron core? A. Yes. 2. If so, what size core and length of wire will be required? A. On a bundle of No. 18 soft iron wires ¾ of an inch in diameter and 8 inches long, wind No. 20 wire to the depth of 1¼ inches.

(5948) S. L. P. asks how dents are taken out of cornets and other brass horns. A. If the dents are inaccessible, so that tools cannot be applied to them on the inside of the horn, you can take them out after a fashion by soldering to the deepest part of the dent a wire and drawing the metal out, afterward unsoldering the wire and cleaning the surface of the brass. If the part of the horn containing the dents is of uniform diameter, you can draw through the horn a spherical metallic button that will fit the tube. If you desire a perfect job, it will be better for you to send the horn to an instrument maker.

(5949) J. asks whether fish oil is injurious to rubber goods. Also what effect it would have when applied to rubber hose? A. Fish oil has a deteriorating effect on rubber. It tends to soften hose.

(5950) F. H. W. asks for a formula for a quick dry plate hardener, or something he can put on the plate that will dry rapidly by heat (without causing the film to run), in order to get a print shortly after development. A. The following is said to be a good gelatine hardener: The negative, after fixing and washing in the usual manner, is treated with a hardening solution composed of chloride of aluminum 5 to 12 grains, water 1 ounce. The stronger the aluminum solution, the greater the amount of heat the negative can stand without softening. The plate is immersed in the solution, and allowed to remain therein for a short time, and after immersion can be dried in sunlight or by artificial heat without danger of deterioration.

(5951) W. C. S. writes: 1. In the SCIENTIFIC AMERICAN for February 24, 1894, is given a description of a magneto call bell for telephones. Could I make a cheaper call? A magneto bell is rather expensive. A. On page 162, current volume of SCIENTIFIC AMERICAN, under the head of "Telephone Experiments," you will find a description of a simple telephone call, which is effective for quiet places. 2. Will you give me a receipt for a stove polish? A. Mix 5 parts, by weight, of black lead (plumbago), 5 parts of boneblack, 10 parts of iron sulphate. Mix thoroughly and make into a paste with water.

(5952) Nick wants to make a sign having the letters smooth and clear, the balance of ground to be chipped or torn off and left rough. No particular pattern. A. Clean the glass thoroughly, then apply a solution of good glue or of gelatine to the portions to be chipped. On drying, the glue or gelatine will contract and chip the glass.

(5953) Y. M. C. A. says: Would you kindly inform me, through your answer department of SCIENTIFIC AMERICAN, how to resilver a mirror? A. See page 183 of the issue of the SCIENTIFIC AMERICAN for March 24, 1894.

(5954) J. R. S. asks: 1. What is the receipt for making laundry starch and mode of using same so as to produce a gloss when applied with a hand iron, such as used in families doing their own washing and ironing? A. One ounce each of gum arabic and borax are dissolved in 10 ounces of water; 1 ounce each of white wax and spermaceti are melted, and while liquid are rubbed with the solution of borax and 10 drops oil of cloves to make emulsion, mixing them thoroughly. A teaspoonful of this mixture in a pint of starch gives a fine polish. It may also be applied after starching by rubbing over the starch with a cloth and then polishing with the iron. The starch mentioned above is the ordinary dry starch made into a paste with hot water. 2. What is a formula for making black ink? A. Black Ink.—Gallnuts, coarsely powdered, 75 parts; sulphate of iron, 42½ parts; over this pour 2,000 parts of cold water. Digest from twenty-four to forty-eight hours. Strain through a cloth and add 24 parts gum arabic.

(5955) C. W. H. writes: I am going to lay 1,800 feet of piping to carry water from a pond to a well. The fall is about 10 feet in the 1,800, with about a 6 foot head, one turn at right angles. What I want to know is this: Which would convey the most water under above conditions—one pipe 4 inches in diameter the entire distance or begin with a 6 inch pipe 600 feet, then 4 inch pipe 600 feet, and then 3 inch pipe the remainder of the distance? Also, about how much water would flow through each of the above systems in 24 hours? A. With a continuous 4 inch pipe you will have a flow of 144,000 gallons per day of 24 hours. With sections of 6 inch, 4 inch, and 3 inch pipe in equal parts, you will have a flow of 129,000 gallons per day. If 1,200 feet of 4 inch, with 600 feet of 6 inch pipe at the pond end, you will have a flow of 180,000 gallons per day.

(5956) P. W. C. says: What is the formula for the combined toning and fixing solution for solio photographic prints, a solution which does not need mixing for use, but is always ready? A.

No. 1.

Sodium hyposulphite	10 ounces.
Alum potash	2½ ounces.
Potassium sulphate	1 ounce.
Sodium sulphate	5 ounces.
Water (distilled)	80 fluid ounces.

Dissolve the hypo. and the alum in the water; then add the sodium and potassium sulphate; allow it to stand for two or three hours.

No. 2.

Gold chloride	15 grains.
Lead acetate	6 grains.
Water (distilled)	8 ounces.

Mix in the proportion of 8 ounces of No. 1 to 1 ounce of No. 2. The mixture is stable and the bath is always ready for use.

(5957) P. O. M. writes: I have a piece of common window glass; by breathing on one side of same the outline of a person is produced as though it was drawn on with milk; but it evaporates with the dampness leaving the glass, and it is not visible again unless the glass is again moistened with the breath. A. The glass to which you refer has been slightly etched with hydrofluoric acid. The etching does not show when the glass is perfectly dry, but moisture develops the image, which disappears as soon as the glass becomes dry.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

April 3, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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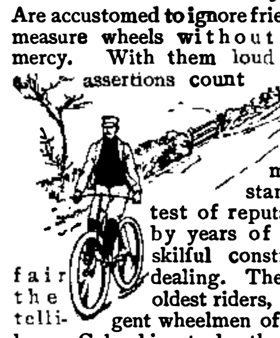

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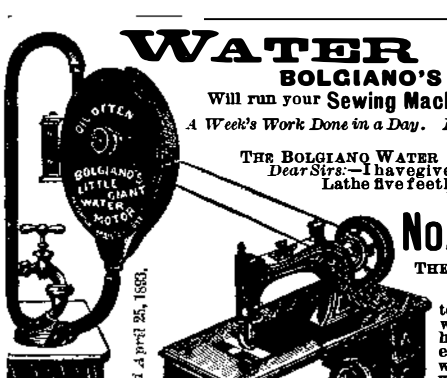

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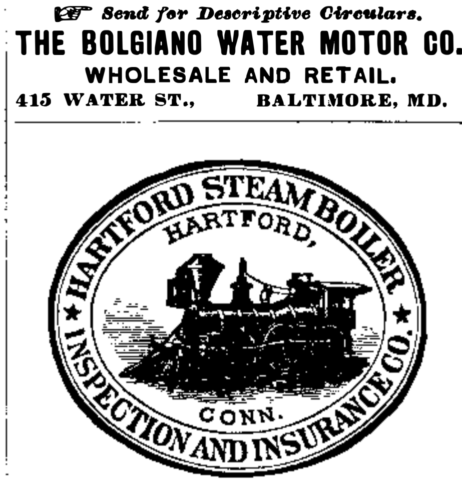

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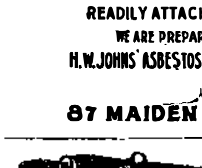

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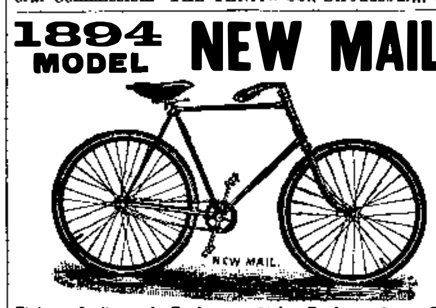

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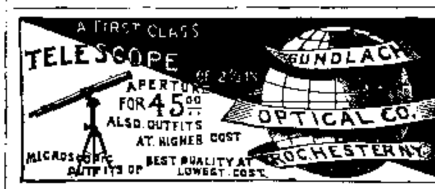

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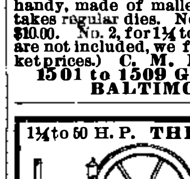

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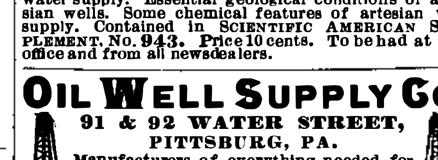

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