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THE GREAT SUSPENSION BRIDGES OF THE UNITED STATES.—[See page 337.]

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DESIGN PATENTS.

The following is the text of the principal part of the existing law in relation to patents for designs:

"Any person who, by his own industry, genius, efforts, and expense, has invented and produced any new and original design for a manufacture, bust, statue, alto-rilievo, or bass-relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture; or *any new, useful, and original shape or configuration of any article of manufacture*, the same not having been known or used by others before his invention or production thereof, or patented or described in any printed publication, may upon payment of the fee prescribed, and other due proceedings, had the same as in cases of inventions or discoveries, obtain a patent therefor.

"Patents for designs may be granted for the term of three years and six months, or for seven years, or for fourteen years, as the applicant may, in his application, elect."

The government fee for a design patent of 3½ years is $10; for 7 years, $15; for 14 years, $30.

The interpretation and practice of the Patent Office in respect to that portion of the above law which we have italicized, has varied from time to time according to the particular views of the individual who happened to occupy the chair of the Commissioner of Patents. For several years past, however, the Patent Office has held the words italicized to mean that the new shape or configuration of the article must be *ornamental*, otherwise no patent could issue. Accordingly it has been the custom for the Patent Office to reject all applications for design patents for new forms of articles, unless such forms were ornamental.

We are glad to observe that the present Commissioner of Patents, General Paine, has set aside this old practice, and adopted a more liberal and evidently more correct interpretation of the law, whereby design patents will hereafter issue for any new, useful, and original shape or configuration of any article of manufacture, as stated in the law.

Commissioner Paine's decision to the above purport was announced in the recent appeal case of Shoeninger. The Commissioner says: "The examiner's objection in this case is, not that the design is for a shape or configuration wholly useful, but that it is not for a shape or configuration wholly ornamental. He thinks the presence of utility as one of the qualities of the design renders it unpatentable, notwithstanding the simultaneous presence of beauty as another quality. But I think that if the design is new and original, and also useful, it is patentable under the law, whether it be or be not ornamental or beautiful. The examiner will conform his action in the case to the foregoing opinion."

We think that this decision of Commissioner Paine will be generally received with satisfaction and that it will be upheld as correct by the courts. We regard it as a decision of considerable importance and far reaching in its scope.

Not only may inventors obtain patents in the usual manner for improvements of every kind; but they may further fortify themselves by taking design patents upon original forms or shapes of any of their articles. It is oftentimes the shape given to any article of manufacture that determines its popularity or governs its saleability in the market. Any one who can produce a new design for the shape of a plow, a fence, a chair, a dish, a garment, or other useful article, would appear to be entitled to a design patent for such novel shape, under this ruling of the Commissioner; and such patents may prove to be of intrinsic value.

For several years past there has been regularly introduced in Congress, but always defeated, a bill to so amend the patent law as to make it an offence for anybody to use a casting as a pattern for making other castings, except by consent of the maker of the original pattern. We have always felt constrained to oppose the enactment of this law, and have shown that while it is very annoying in some cases to pattern makers to have their unpatented designs appropriated by others, still it is one of the conditions of trade. Whatever is good and popular others will, of course, desire to imitate; but it would be iniquitous, as was intended by the proposed law, to empower the owner of a wooden pattern of an old stair plate, for example, costing him perhaps a dollar, to collect hundreds of dollars in damages of any poor fellow simply because he used one of the plates for moulding.

In discussing this proposed pattern law we showed that the design patent law as it stands, if properly interpreted, would be adequate to protect the owners of original and useful patterns; and we are glad that the Patent Office now adopts substantially the same view.

Pattern makers have no further occasion to grumble or seek for special legislation. The Patent Office, as we understand it, is now ready to grant proper claims for anything that is original and useful in the shape of any article. This is a broad, liberal, and encouraging view of the law; and is likely to give a renewed stimulus to the art of designing, not only in decorative applications, but in the proportioning of patterns, goods, and manufactured articles of every description.

THE IMPATIENCE OF YOUTH.

Not long since the SCIENTIFIC AMERICAN ventured to suggest that in the matter of education a late beginning was better than none, and that not a few men whose early advantages had been small had by diligence and earnest application in maturer years achieved an enviable degree of scholarship. A far less hopeful view of the advantages of trying to make up in later life for opportunities missed in youth is taken by a correspondent, who prints his name in very large letters at the top of his paper, and under it the words "Lecturer and Essayist," but does his writing with a lead pencil. He says:

"True it is, that the young men who regret educational deficiencies are legion. Many make no effort to remedy the evil, and it is little wonder they do not. There is but little encouragement given the young man who does strive to better his education. I cite my own experience as an instance: I am a young man, and have employed my spare moments, since beginning active life at 16, in the acquisition of knowledge. I apply for a situation requiring a knowledge of one of the branches I have studied and am asked for my 'diploma.' I have none, am self-educated. I am not wanted. A person who has a certificate of ability from some school takes the situation. Is it, then, strange that so many young men cease to strive for knowledge? Especially when they apply, as I have done, for a place at manual labor and—because they are known to be students—are told that 'no dreamers or theorizers are wanted.' And that, too, when they were strong, active, and willing, when they could have brought to bear on the work a superior muscle, operated by a good intellect. Around me to-day I see ignorant men, unable to read or write, basking in the smiles of Dame Fortune, while with great effort only I keep a crust in my mouth for my pains to cultivate body and mind. Now when such encouragement as this is given to him who improves spare time, is it strange that many decline to tread the thorny way up the hill of science?"

This is a characteristic plaint of youthful eagerness and impatience. The ambitious stripling, whether self-taught, college-taught, or not taught at all, is confident of his ability to fill any position, and marvels that the world does not hasten to set him to work on his own terms. And not unfrequently his lofty estimate of his own merit is the sole bar to his getting a chance to show what stuff there is in him. From a purely business point of view we confess that with all our regard for culture, perhaps because of it, we should hesitate to engage for manual labor a young man, however muscular, who wrote "Lecturer and Essayist" after his name. This not from any feeling of disrespect for reading and writing, but rather the contrary. What right-minded man, for example, would enjoy having a Tyndal or a Tennyson to black his boots, let the work be done by him never so cheaply or skillfully?

That, other things being equal, the man with a diploma will ordinarily be preferred for the work covered by the diploma is very true. In many cases the intending employer has no other means for estimating the fitness of a candidate. Any lack on this score, however, so far from deterring a youth from study, should incite him to study the more, that he may the more speedily overcome the obstacle thus opposed to his progress in life. But our young friend must not think that the self-taught are peculiarly afflicted in having to wait overlong for a public recognition of their deserts. Speaking of the conflict between general and special education, a clever writer touches this very grievance as one particularly felt by young men fresh from college. He says:

"It has been said that the higher education of the period scatters too much—that it gives the aspiring youth much that is of no practical value and little that is. This is not so. There are few graduates of our colleges who cannot take up a specific business as soon as they get their sheepskin, and follow it much more to their own satisfaction than anybody else can, however extended the latter's experience and however great the sacrifice of time and money he has been at to fit himself for that particular branch. The young collegian feels hurt if he is not granted at once all the emoluments which belong to the older person alluded to, and frequently hopes, and says as much in forcible and elegant language, that the time will speedily come when people will appreciate the general education more and the specific less. This shows that he is adapted to everything from the word "go"—if we may be permitted the expression; that there is no limit to his powers in any branch of business or in the professions, from the matter of sawing wood to that of presiding on the bench."

Another phase of the same trouble was noticed in a recent address before a college society by a prominent jurist of this city, who remarked that "one great obstacle to the advance of young men in political life is the arrogance which too many of them affect in their relation to public affairs. They are too apt to assume that because they are well read and cultivated they may be at once assigned to command without ever carrying a musket in the ranks. From old soldiers, hot, dusty, and begrimed with battle, the brightness of the new uniforms commands but slight respect."

It matters little whether the aspiring youth acquired his learning in college or in the solitude of his own chamber, he is too apt to overrate its amount and importance, and to feel very much sat down upon by the world when it manifests no urgent desire to furnish him free scope and vantage ground for the exercise of his peculiar talent, which too often exists only in his own imagination. "Knowledge comes, but wisdom lingers," and it is ever the sore affliction of impatient youth that the world cares most for wisdom. Ten years from now our correspondent, if he does not give over his efforts to grow in knowledge, will probably smile at the narrowness of his present view, and possibly laugh at the callow foolishness of his fancy that the world offers no encouragement to such as patiently strive to better their intellectual condition.

COMMON MISTAKES IN HOUSE BUILDING.

A writer in the *American Architect and Building News* has recently directed attention, with considerable truthfulness, to certain mistakes of plan in house building, which too often occur in this country. These mistakes, he says, have their origin outside of the profession of architecture, and are due to the ignorance of those who build. It is certainly reasonable to expect that a person who is about to build should know such simple matters as the number and character of the rooms he will have; yet this is just what many people do not know, and here is where the first mistake is made. People in their ignorance err in wishing too many rooms. Many people, with a desire to imitate the nobleman's mansion, decide to have a jumble of hall, drawing-room, morning-room, dining-room, library, study, boudoir, billiard-room, breakfast-room, music-room, reception-room, and so on; and to these they add others of their own invention, till there is a separate room for the performance of almost every act of daily life. As all this costs, and there is a limit to every man's purse, economy is attained by copying the stone wall of their model in wood and plaster, woodwork in paint, cheapening the foundations, and making thin walls that keep out neither cold nor wet.

A sensible man in building his house proceeds on a different plan. He wants just such accommodation as he needs, and no more. He knows that for the average American family in good circumstances three principal rooms are sufficient: drawing-room, library, and dining-room—these he has use for. He also needs a hall by which to reach the others, and a vestibule or porch, as a shelter to the hall. He omits the "family sitting-room," knowing that the three other rooms will serve that purpose, and that any room too good for daily use has no right to exist. The habit of keeping shut-up parlors for occasional company is so absurd that it is difficult to give people who practice it credit for common sense.

Another common mistake is the small scale of the kitchen and offices as compared with family rooms. A kitchen, if work is to be well done in it, and the dinner to be well cooked, should not be less than the equivalent of 15 feet square, and should be still larger in a house employing many servants. The communication between the kitchen and offices and the family apartments, and the concealment of the former from public view, are matters which are much neglected. The usual arrangement of placing a butler's pantry between kitchen and dining-room, with doors to both rooms, often directly in line, makes the best possible conveyance for odors from the kitchen to dining-room, and thence to the rest of the house. In the case of a basement kitchen the same result follows from having the basement stairs open instead of inclosed, as they should be. The English manage better: they put next the dining-room sometimes the butler's pantry, but oftener a small serving-room, opening not to the kitchen, but to a passage leading thither; and this passage is made the only means of access from the family rooms to the kitchen and offices, which, if not in the basement, are in a wing under a separate roof from the main building, so that by closing one door (or two at the most) all communication is cut off, and the odors from the kitchen do not annoy the family.

A common thing in country houses, though often omitted in the city, is a servants' staircase. People of small means, who can afford but one servant, insist upon the separate staircase for that one, while many a city family with three or four servants gets along perfectly well without it. This hobby with country people amounts almost to fanaticism. The second staircase, a great convenience in large houses, is out of place in a small one, there being nowhere to put it; to a small family it is unnecessary, and therefore wasteful.

The place of a veranda may seem a thing of small moment; yet it may prove either a great comfort or a great nuisance, according to its position. Most people seem to suppose it should be on the sunny side of a house, where it darkens the rooms, itself being ablaze with light and hot as a furnace. But the object of a veranda is not to keep the light out of the room, because this can be done better by the window hood or shutters, but to afford a cool, sheltered, shady place out of doors for summer use. Hence it should be on the shady side of the house—on that side that is shady in the afternoon. To prevent the rooms behind it being too much shaded they should, if possible, have one or more windows on the side not covered by the veranda; or, if this cannot be, the windows looking upon it should be made very large, and the veranda itself of light construction and painted as light a color as the rest of the house will admit. No one should worry about too much light in the house; there are many days when there cannot be too much, and when there is, it is easy to shut it out.

CHICLE, OR MEXICAN GUM.

The great interest which has for some time past been manifested by technologists in the search for substitutes for India rubber and gutta percha has led Drs. Prochazka and Endemann to undertake the examination of a Mexican product, known in the United States for some years under the name of chicle and sapota. The latter name would imply that the product is derived from one of the many species of the order Sapotaceæ, to which belongs also the tree producing the balata gum. The difference in the manner of obtaining the material is evident from the chemical composition. While balata is an almost pure hydrocarbon, chicle contains, also, the various impurities of the juice from which it is derived. The only description that has been given of this material seems to be that of Mr. J. R. Jackson, who states that it is probably derived from *Chrysophyllum glycyplacum*, of the order sapotaceæ, that it is also known under the names of Mexican gum and rubber juice, and that it resembles gutta percha in appearance, but is more friable and brittle.

The material examined was in the shape of rectangular cakes, of light chocolate color, which was deeper on the surface owing to atmospheric influences. It crumbled between the fingers, but had a certain degree of softness and tenacity, which was more perceptible after heating. Taken into the mouth it disintegrated, united again after chewing, forming a soft plastic mass. The latter quality has made it a favorite material for "chewing gum." On heating, it first evolved a sweet caramel odor, after the disappearance of which there was perceptible the peculiar smell that is generated when caoutchouc or gutta percha is treated in a like manner. Boiled in dilute acids the substance disintegrated, the brown solution containing oxalic acid and saccharine matters. The residue, subsequently boiled with dilute solutions of caustic alkalies, united again, forming a doughy mass. The authors found the following constituents (the figures being approximate): Chicle resin or gum, forming 75 per cent of the crude material; oxalate of lime (with small quantities of sulphate and phosphate), 9 per cent; arabin, about 10 per cent; sugar, about 5 per cent; salts, soluble in water (chloride and sulphate of magnesia, small quantity of potash salts), 0·5 per cent.

As the results of their investigations (which was the subject of a paper read before a recent meeting of the American Chemical Society, of this city) the authors draw the conclusion that chicle is merely the product of direct evaporation of the juice, without attempt at separation, as practiced in the case of gutta percha and India rubber. They have no doubt that by proper treatment of the raw juice a far more valuable product can be obtained than the chicle gum now found in the market. Whether the product, then obtained, will be one similar to gutta percha, balata, or India rubber, must be left to future examination of the raw juice, which, so far, they have been unable to obtain.

THE CAUSE OF CONSUMPTION.

Dr. Rollin R. Gregg, of Buffalo, New York, is confident that he has solved the mystery of consumption. Regular physicians will be apt to say that he has mistaken a condition for a cause; nevertheless we are inclined to think that good may come from the emphasis he lays upon that condition, since it seems calculated to work a beneficial change in the customary treatment of the disease.

Dr. Gregg argues that as the loss of albumen from the blood through the mucous membrane of the kidneys in Bright's disease, rapidly and fatally depletes the system, much more must the more rapid loss of albumen through the mucous membranes of the lungs be serious in all its stages and speedily fatal in its results, if proper measures are not taken to stop such waste before fatal conditions have arisen. The expectorations of consumptives, and all their other catarrhal or mucous discharges from whatever organ, are mostly albumen and a direct loss of so much of this constituent from the blood. It is this wastage which causes the great emaciation characteristic of consumption, and not, he thinks, any failure of the system to assimilate food. And this loss of albumen does mischief not only in robbing the muscles of their proper nutrition, but also in throwing the constituents of the blood into disproportion. The loss of one ounce of albumen destroys nearly a pound of blood for all purposes of healthy nutrition, and leaves in the blood a relative excess of 5¼ ounces of water, 7 ounces of blood corpuscles, 9 grains of fatty matter, 15 grains of fibrin, and 41 grains of salts. These elements in excess act the same as foreign matters in the blood, and disturb the entire economy of the system. Night sweats and dropsy are the result of the excess of water. The blood corpuscles left in excess are decolorized by the too watery blood, and are deposited in the capillaries or smallest blood vessels, where they shrivel and become tuberculous corpuscles, so called; the fatty matters in excess cause the fatty livers and other fatty degenerations attending the disease; the excess of fibrin causes the adhesion of the pleura to the inner surface of the ribs, the heart, or to each other, often among the most serious of the complications of consumption; and, finally, the excess of salts causes calculi, enlargement of the joints, ossifications, and similar morbid developments.

In such cases of consumption as are characterized in their earlier stages by an absence of profuse expectoration, Dr. Gregg would attribute the beginning of the disease to a loss of albumen through some other organ or organs, the shriveled blood corpuscles lodging in the lungs, starting tubercules there and setting up a dry cough, with the resultant irritation of the mucous membrane and outpouring of mucus. From this point of view, there is but one source of hope to the consumptive in any stage of the disease, and that is through the healing of the mucous membranes and the stopping of the waste of albumen. By this means, in the earlier stages of the disease—with all who have not inherited the most feeble constitutions—there is much to hope from judicious treatment.

Whatever may be the primary cause of consumption, it is pretty evident that the mucous discharge which attends the disease and finds relief in expectoration is to be repressed rather than encouraged; and to do this must radically change the usual treatment of the disease, at least in its early stages.

FUMIGATING PAPER.—Apply to bibulous paper a strong ethereal or alcoholic solution of benzoin, tolu, storax, olibanum or labdanum. To burn well the paper should first be impregnated with an aqueous solution of niter and dried.

AMERICAN INDUSTRIES.—NO. 14.

SUSPENSION BRIDGES.

We present our readers with engravings of four of the great suspension bridges of the United States, and give a history of each as furnished by the eminent engineers and constructors, the John A. Roebling's Sons Company, of Trenton, N. J. The fact that this establishment is the largest of its kind in this country, and probably the largest in the world, adds interest and weight to the particulars given below.

THE NIAGARA BRIDGE.

This bridge was constructed by John A. Roebling between the years 1852 and 1865.

It has a span of 821 feet 4 inches between centers of towers. It has two floors, an upper and a lower one, suspended separately to separate cables, but connected with each other by two longitudinal trusses. The railroad track, which is over the roadway, is 245 feet above the river.

The base of the tower at the level of the lower floor measures 60 feet by 20 feet, and is pierced by an arch 19 feet in width, which forms the entrance to the lower bridge. Above the level of the railroad track each tower forms a single column, 60 feet high, which is 15 feet square at the base and 8 feet square at the top.

This bridge has four cables, each 10 inches in diameter, composed of 3,640 wires, No. 9 gauge. The suspenders, 624 in number, are placed 5 feet apart. The floor is further supported by 64 diagonal stays, and there are 56 under floor stays, fastened to the rocks underneath the bridge.

THE COVINGTON AND CINCINNATI BRIDGE.

Work on the Cincinnati Bridge was commenced in September, 1856. The financial crisis of 1857 stopped the work, and owing to the civil war which soon followed work was not resumed again until 1863, and the bridge was completed in 1867. Since January 1st of that year it has formed the great public highway between Covington and Cincinnati. It cost one and a half million of dollars.

This bridge has a single span of 1,057 feet from center to center of towers, and two half spans of 281 feet each. The total length of the bridge, including its approaches, is 2,252 feet. Its height is 103 feet above low water.

The floor of the bridge is composed of a strong wrought iron frame, overlaid with several thicknesses of plank and fastened to the cables by means of suspenders. The suspenders are arranged between the roadway and the sidewalks. The roadway is 20 feet wide, the sidewalks 7 feet each. The whole width of the floor is 36 feet.

The towers rest on timber platforms, 110 feet long, 75 feet wide, and 12 feet high. These platforms are composed of 12 courses of timber. The excavations for the platforms were carried 12 feet below extreme low water mark, where a bed of gravel and coarse sand afforded a good foundation. The bases of the towers are 82 feet long and 52 feet wide. Above the floor of the bridge the tower is divided in two solid shafts, connected above by a semicircular arch. The total elevation of the towers is 230 feet above low water mark. Each tower contains about 400,000 cubic feet of masonry, mostly sandstone from the Buena Vista quarries. The base and upper cornice are of limestone.

The floor is supported by two cables, 12¼ inches in diameter, containing 5,180 No. 9 wires. The cables at a medium temperature have a deflection of 89 feet. The total quantity of wire worked into these cables, including the wrapping, amounts to 1,050,183 pounds.

The principal vertical rigidity of the floor is obtained from the two trusses which separate the roadway from the sidewalks. They are 10 feet high, and are formed of top and bottom chords, connected by vertical posts and diagonal ties. Each chord consists of two 9 inch channel bars, separated by the upright 7 inch I-posts. The flat bars which form the diagonals are 3 inches wide and ⅜ of an inch thick.

The flooring of the roadway consists of three thicknesses of plank, making a total average thickness of 8 inches. The general appearance of the floor is that of an easy curved arch, having its apex in the center of the main span. The grade is from 3 to 4 feet in 100 feet.

THE ALLEGHENY BRIDGE.

This bridge was begun in the year 1858 and finished in the year 1860.

The length of the bridge is 1,037 feet 5 inches, divided into two main spans of 344 feet each, one half span of 117 feet 5 inches, and another half span of 171 feet.

It was built for heavy road travel. The width of the platform is 40 feet, divided into a roadway 20 feet wide, and two sidewalks each 10 feet wide.

It is supported by four cables, of which the two outer ones incline outward from the towers, and the two inner ones incline toward each other, giving lateral stability to the structure. The outer cables, which support the sidewalks, are 4½ inches in diameter, and composed of 666 wires, No. 9 gauge. The inner cables are 7½ inches in diameter, and contain 1,926 wires, No. 9 gauge. The deflection of the cables is 30 feet.

The towers are 45 feet high. They are composed of four inclined cast iron columns, braced together by latticed castings, and crowned with an ornamental cap.

The bridge has two longitudinal iron lattice girders which give it stiffness.

THE EAST RIVER BRIDGE.

The bridge now in process of construction connecting the cities of New York and Brooklyn will have the longest single span of any bridge in the world. The main span will be 1,595 feet 6 inches, and the land spans 930 feet each.

This bridge was designed in 1867 by John A. Roebling, but he died in 1869, before any work on it had begun, and it has been built entirely under the guidance of Washington A. Roebling, the present Chief Engineer.

The bridge extends from the junction of Sands and Fulton streets, in Brooklyn, to Chatham street, in New York—a total length of 5,989 feet, the Brooklyn approach being 971 feet, the suspended part 3,455½ feet, and the New York approach 1,502½ feet.

The approaches will consist of a series of brick and granite arches, which, when finished, will be ornaments to the two cities. It has taken nine years to complete the towers and anchorages, construct the cables, and get everything ready for the suspension of the floor.

Preparing the foundations for the towers was one of the most difficult parts of the work. Huge timber caissons, each 170 feet long, 102 feet wide, and 25 feet high, containing over 1,600,000 feet of timber, were sunk below the bed of the river until they rested on rock or on an equally firm stratum. On the Brooklyn side this was reached at a depth of 45 feet below high water; but it was necessary to go 78 feet below high water on the New York side. The pneumatic method of sinking caissons is not new, but the operations here surpassed by their immensity everything of this kind that had ever been done before.

The towers are 278 feet high. The anchorages are 129 feet by 119 feet at the base, 117 feet by 104 feet at the top, and 89 feet high.

The total quantity of granite and limestone in the towers and anchorages is about 145,000 cubic yards, and it required the continuous work for four years of over 20 quarries in Maine, Massachusetts, Rhode Island, and New York to furnish the necessary supply. In the summer of 1876 the masonry was completed.

On the 29th of May, 1877, the first wire for the cables was stretched across the river. There are four cables, each consisting of 19 strands, each strand containing 280 galvanized cast steel wires, No. 8 gauge. These cables are 15¾ inches in diameter. For wrapping the cables galvanized annealed iron wire was used. March 1, 1879, the four cables were completed just 21 months after they were commenced.

The platform of the bridge, which is 5 feet wider than Broadway, is sustained by the iron cross beams, and stiffened by six longitudinal trusses. It is divided into five parts, two outer ones intended for horse-cars and general vehicle traffic, two intermediate divisions intended to accommodate the rapid transit passenger cars, and a central promenade, a little above the level of the main floor, and intended for pedestrians. The stiffening trusses will be of iron, six in number, the two outer ones 9½ feet high, the other four 16 feet each in height. The total weight of the bridge will be 13,300 tons. It is proposed to move the cars on this bridge by means of wire ropes and stationary engines. This method is considered preferable to the use of locomotives on account of the steep grade of the bridge.

It is estimated that the bridge, when completed, will have cost $13,500,000, of which $9,500,000 will be spent on the bridge itself, and $4,000,000 in acquiring the necessary real estate. It is hoped that in 1881 the bridge will be open to the public.

All of the twisted cables, stays, and suspenders used in the construction of these four bridges were manufactured at the John A. Roebling's Sons Company's works, at Trenton, N. J. Some of the stays are so large that special machinery has been built for the purpose of making them, and no other establishment possesses the facilities for doing such heavy work properly.

Education in China.

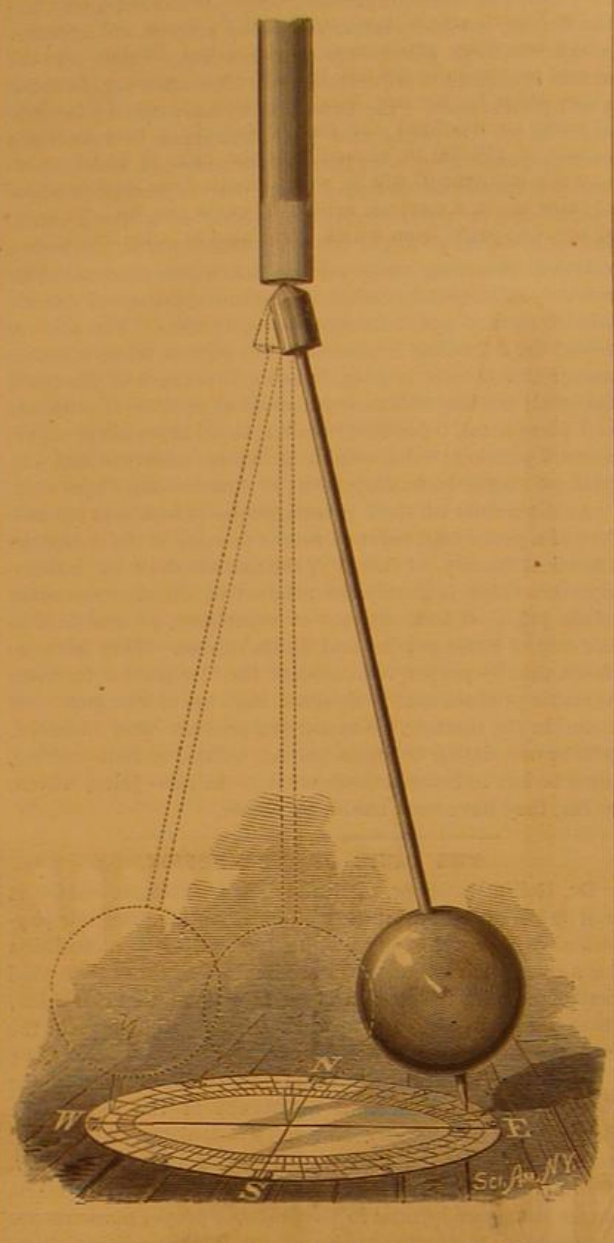
We have been apt to consider China as a heathen country, and such it is from our Christian standpoint, but it is far from an ignorant land. It has, without doubt, according to *Barnes' Educational Monthly*, over 400,000,000 people, of which vast number there is scarcely one who cannot read and write. It has 2,000 colleges, and their libraries outnumber ours ten to one. There are in that land of pig-tailed Mongols 2,000,000 highly educated men, while there is hardly a woman who is educated of all the vast number of its people, and not one who is thought to have a soul. Education is principally a discipline of the memory, and their schools are based upon an entirely different idea from ours. A live Yankee schoolmaster would find little employment in China, even though he understood the Chinese language and literature perfectly.

The Water Commissioners of Troy, N. Y., have awarded the contract for the extension of the water works of that city to the Holly Manufacturing Company, of Lockport, N. Y., for the sum of $235,000.

Pendulum for Showing the Rotation of the Earth.

To the Editor of the Scientific American:

The following description of a simple device for indicating the rotation of the earth on its axis may be of interest to



some of your readers. I secure a large permanent magnet to the ceiling of a room or a steady tripod, and from it suspend a wooden pendulum rod of any length, having at the top a cone-shaped tip of soft iron, which is turned to a smooth round point to allow it to swing freely in any direction. To the lower end of the rod is hung a ball of one half the weight required to pull the rod from the magnet. This pendulum, once set in motion, will swing in the same plane for 30 hours. By placing a dial under the pendulum the apparent change in the plane of oscillation of the pendulum may be observed. However, this change of position is not in reality in the pendulum, but in the dial, which is moved under the pendulum while the latter preserves its plane of motion. Placed at the poles, this simple instrument would indicate 15° per hour, which is exactly the rate of the earth's rotation. In this latitude it would indicate an hourly motion of 9° 47′. With this simple instrument, which any ordinary mechanic can construct at a small cost, the movement of the earth may be clearly demonstrated in fifteen minutes.

April 5, 1879. W. W. Le Grande.

Employment and Labor in Massachusetts.

Discussing the present condition and the future prospects of labor, with reference to past and possible Congressional action, the Boston *Journal of Commerce* remarks that since the date of resumption, January 1, the leading industries in that State have continued to show improvement in many instances and to hold their own in all. In all the great manufacturing centers there is an increased activity and a consequent improved demand for labor. In Massachusetts the improvement has become remarkably conspicuous. The Lowell factories are all busy, and several are on extra time; the Essex county mills are, with one or two exceptions, kept fully employed on orders; and throughout the shoe towns there is, late as it is in the season, plenty of employment for willing hands. The great paper mills of Western Massachusetts experience so active a demand for their goods as to stimulate new enterprises in this line, which we may be assured have not been undertaken without a mature survey of the field of operations. In a word, manufacturing help is well employed, at prices which, if not up to the high rates prevailing a few years ago, are far preferable to the wages of idleness.

Manufacture of Tin Plates in New York.

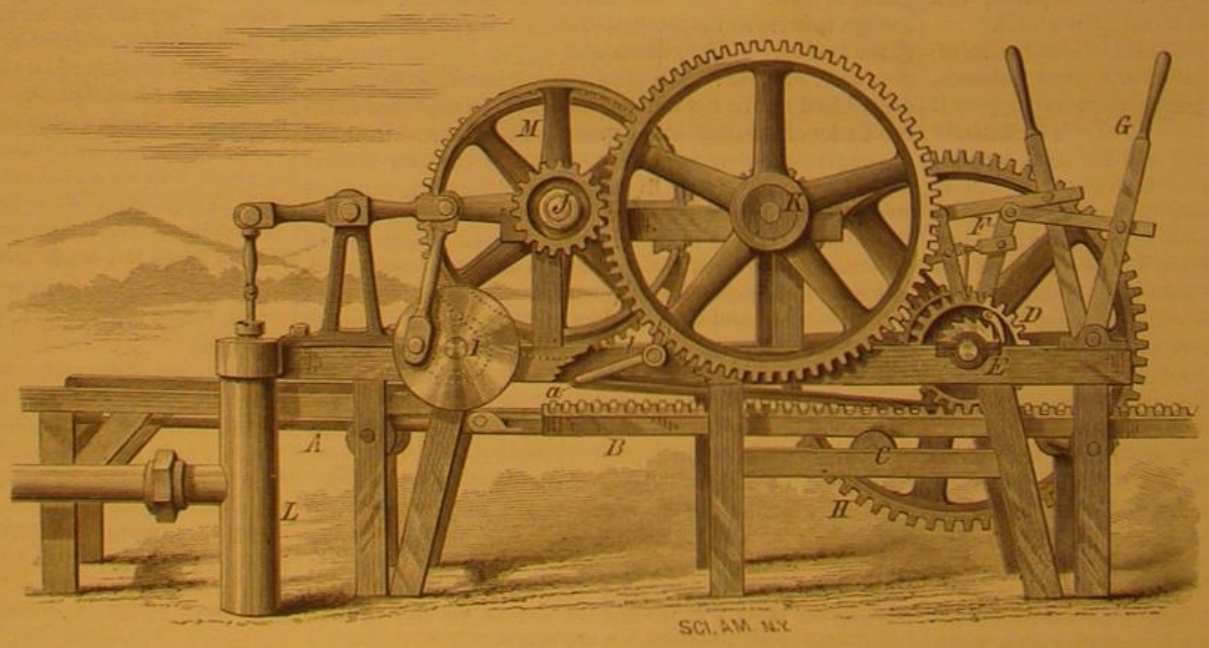
The Monitor Tin Plate Company of New York occupies a building in Horatio street, where the tinning is done; but the iron is rolled at a mill in Pittsburg. The tinning house is 100 feet square, fitted with every modern appliance. The sheets are rolled in the ordinary way, then cut or sheared to size, and immersed in a pickling bath. They are then cold-rolled again, annealed and pickled, and put into baths of Russian tallow or palm oil. Then they pass through several baths of tin melted at a high temperature, and again through sawdust and bran to cleanse the surface. Finally, they are polished with lamb's wool buffers, and assorted, ready for boxing and shipping.

A NOVEL MOTOR.

Our engraving illustrates a simple and manageable motor recently patented by Mr. Joseph Plattenburg, of Allegheny, Pa. It depends for its action upon a series of contractile rubber springs put under tension by an arrangement of pawls, ratchets, pinions, and racks, and the power is conveyed from rubber springs to the machinery to be driven, through a train of gearing, and the motion is controlled by a very simple and ingenious governor.

The rubber springs, A, are rigidly secured at one end to the main frame of the machine; their other ends are attached to the ends of the racks, B, which rest upon rollers, C, and mesh into pinions, D, placed loosely on the shaft, E. To one side of each pinion is secured a ratchet wheel, and upon the opposite side there is a pawl which engages a ratchet wheel keyed to the shaft, E. It will be understood that there is one rack, one pinion, and two ratchets to each rubber spring, and for each set of apparatus of this kind there is a stout lever, F, fulcrumed on the shaft, E, and carrying a pawl that engages the ratchet fixed to the side of the pinion, D. The lever, F, is connected with a longer hand lever, G, by which, through the agency of the parts just described, the springs are put under tension.

Upon the shaft, E, there is a spur wheel, H, which drives the crank shaft, I, through intermediate wheels and pinions on the shafts, J, K. In the present instance the power is employed for working the pump, L, but the inventor does not confine himself to this application.



PLATTENBURG'S MOTOR.

As this apparatus, without some kind of a governor, would run with great speed when first set in motion, and with a rapidly diminishing speed toward the end of the work given out by the spring, the inventor has devised a simple contrivance for controlling the action of the machine with regularity. It consists in elastic rubber strips, *a*, attached to the free ends of the racks and connected with an angled lever, *l*, fulcrumed in the main frame, and carrying at its longer end a brake shoe, which bears upon the friction wheel, M, with more or less force according to the tension of the rubber strips, *a*. When the rubber springs, A, are under the greatest tension the strips, *a*, are also under their greatest tension, and the brake exerts its greatest pressure on the friction wheel and as the springs, A, contract, the brake pressure is diminished while the speed remains unchanged. The inventor claims that, for running machinery of any kind, this motor is more economical both as to its first cost and maintenance than other motors made for a similar purpose, and he states that it is especially adapted to pumping oil or water, and to the performance of other continuous work where steam is not available.

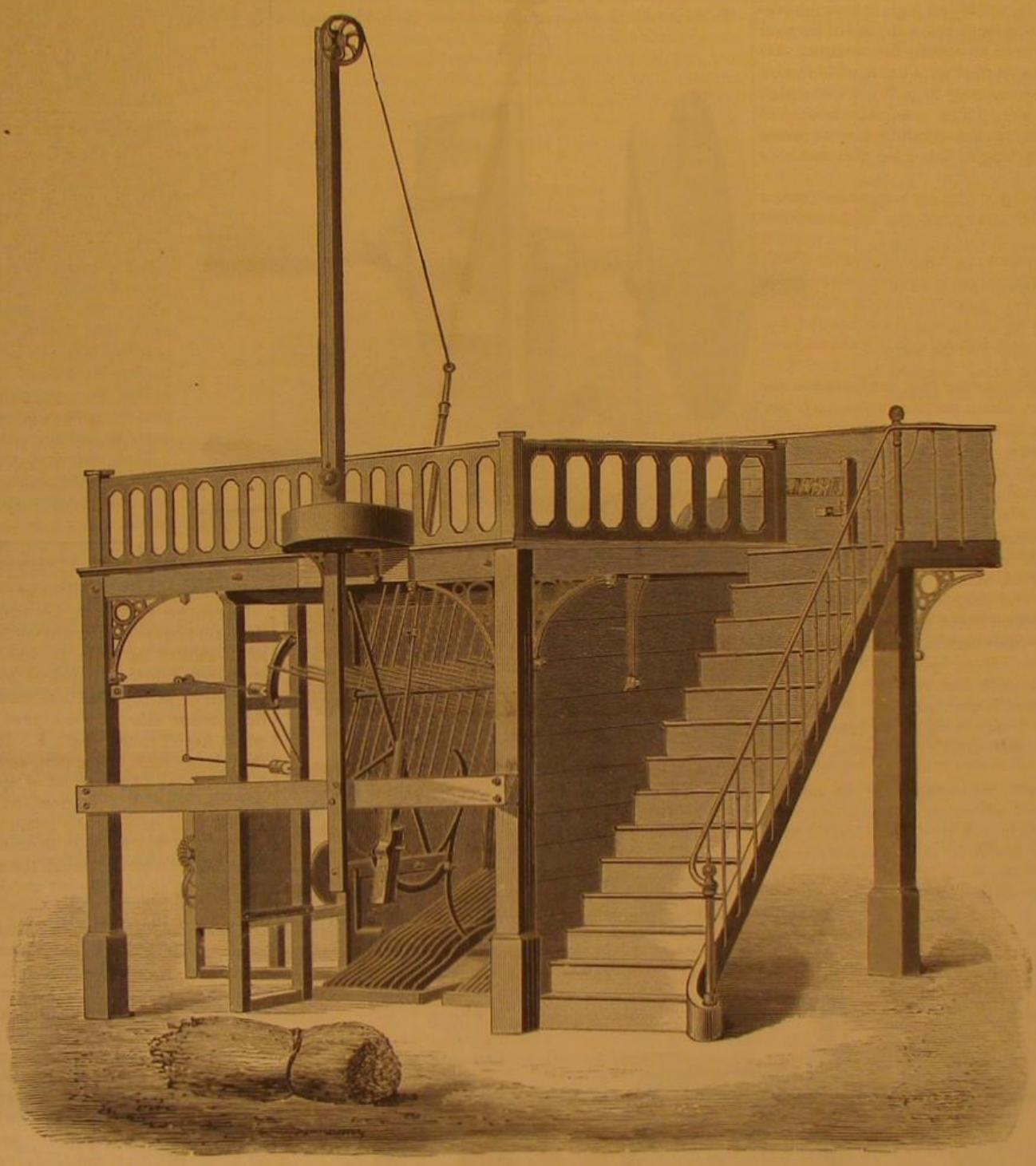
Further particulars may be obtained from the inventor, or from Mr. F. J. Hoyt, 733 Broadway, New York.

THRASHER, STRAW SCALE, AND SHEAF BINDER.

The apparatus shown in the accompanying engraving is a combined thrasher, straw scale, and sheaf binder, of French manufacture. The straw, as it is forced out by the teeth of the thrasher is received on the straw scale, which is formed on an axle, and consists of iron wires crossing each other at right angles. On the arms so formed the straw is deposited by the arms of the thrasher. The axle on which the scales are secured is supported by the lever of a steelyard, sufficiently weighted to prevent the axle from turning until the quantity of straw thrown on the arms of the scales has attained the prescribed weight. The rotation of the axle, which is limited to a quarter of a revolution, permits of one set of arms replacing the others. This also imparts motion to the sheaf binder, the arms of the thrasher and those of the scales together compressing the straw to prepare it for the binding. Near the middle of the inclined grate, at the bottom of the apparatus, there is a bobbin of fine wire. As soon as the bundle is prepared, the wire is carried around it after having passed through the sheaf binding apparatus, and meets the part opposite the bobbin, where it is twisted and cut off.

The bundles follow each other very regularly, without any great trouble, and the services of five or six persons, necessarily accustomed to the binding of straw in sheaves, are dispensed with.

The thin metallic wire forms a strong band, which, however, is very easily cut by an instrument which also pulls it out of the bundle, so that the cattle may not be injured.



THRASHER, STRAW SCALE AND SHEAF BINDER.

Rock Drilling by Electricity.

In a recently published work of M. Gaston Planté, "Recherches sur l'Electricité," noticed in one of our French exchanges, the author mentions a new application of electricity which had not been hitherto published by him, and which is of considerable interest.

After describing the process of engraving on glass by electricity, that he made known in 1877, and the account of which has been so widely copied by scientific papers, M. Planté goes on to say: "We have seen that one of the electrodes conducting an electrical current of a certain tension being brought in contact with glass, in the presence of a saline solution, it acts like a graver or diamond by tracing grooves in the surface of the glass, and even digs into it quite deeply. In spite of its great hardness, rock crystal can also be attacked by the same method; and, if not engraved regularly, it at least cracks into small fragments, and is finally disintegrated." In view of this, M. Planté suggests that the electric current, under conditions analogous to those above described, might be substituted for diamonds in the operation of drilling rocks. He states that electrodes of platinum would not be necessary, for here it is not the metal of the electrode that is affected, but the silicious matter in contact with a saline solution. Metallic points or projections suitably located at the extremity of the drill, isolated on a part of its length and actuated by a rotary movement, would lead the electric current to the surface of the rock to be pulverized, and would thus replace those numerous and expensive diamonds which are set in the head of the drills employed in the present system of rock boring.

New American Industries.

The recent rapid increase in American chemical manufactures, in many cases from native crude materials, is a very encouraging feature of American trade.

The *Grocer* notes that six years ago we imported from France cream of tartar to the extent of 6,000,000 lb. yearly, but so successfully has the manufacture of it in this country been carried on, that last year not a single pound was imported. Notwithstanding that the crude materials have at present to be imported, the price of the manufactured article has been reduced from 32 cents per pound, the rate for the French article here, to 23 and 24 cents per pound for the American production. France and England formerly sent us annually 500,000 lb. of tartaric acid, while the importation for the last fiscal year was 183 lb. England formerly monopolized our market for citric acid to the extent of 250,000 lb. annually, at the rate of $1.30 per lb., while last year 27,013 lb. were imported and sold at the same price as the American article, 57 cents per lb. At present the lime juice from which citric acid is made has to be imported, but it could easily be produced from fruits grown in Florida, if only sufficient energy were put into the work. If the lemon and lime growers of the South can be induced to prepare the lime juice, the entire production and manufacture of citric acid will be kept in this country, saving hundreds of thousands of dollars annually and developing another great industry. Borax was formerly brought from England at the rate of from 600,000 to 1,000,000 lb. every year. Owing to the development of borax mines in Nevada this importation has largely fallen off, and the report for the last fiscal year showed only 3,492 lb., and the price of the refined article, which is now prepared in this city, is only from 8 to 9 cents per lb., when formerly it was 35 cents, England being now among the buyers where she was the principal seller, both of the crude and refined product.

MISCELLANEOUS INVENTIONS.

An improved canceling stamp, patented by Mr. George W. Stephens, of Denison, Ia., is designed for post offices and business purposes generally. It is simple and rapid in its operation.

Mr. Samuel F. Leach, of Boston, Mass, has devised an improved gas regulator, which is combined with a gas burner, for automatically regulating the gas as it is consumed.

An improved flexible printing film for use in artistic and decorative purposes, and for printing and the preparation and finishing of drawings, has been patented by Mr. Benjamin Day, of West Hoboken, N. J.

An improved bin, or receptacle for flour, sugar, and similar articles in bulk, for stores and households, has been patented by Mr. Edward S. Bliss, of Richburg, N. Y. It consists of a bin having a front curved rocker and a curved top, the bin being arranged to tilt in casing so as to render its contents easily accessible.

An evaporating pan, in which the heating pipes alternate, one half being supplied with steam at the center and one half at the circumference, has been patented by Mr. H. O. Ames, of New Orleans, La. The object of this peculiar arrangement of pipes is to perfectly equalize the heat throughout the entire mass of boiling sirup.

Mr. G. V. Sheffield, of New York city, has patented an improvement in the manufacture of leather articles, which consists in stretching the raw green hide upon a last or form, and subjecting the hide to a tanning process while on the form. Before removing the article from the form it is dressed and colored.

A toy, composed of two or more pieces of veneer, cut and embossed to imitate an animal or other object, and provided with a strengthening backing, has been patented by Mr. Charles Schwartz, of New York city.

Mr. S. C. Buchanan, of Camden, Ark., has patented an improved liniment composed of fusel oil, arnica, aconite, camphor, and sassafras combined in proper proportions. It is designed for the relief and cure of rheumatism, neuralgia, and other similar diseases.

An improvement in finishing yarns of wool or soft hair, such as camel's hair, mohair, and alpaca, or yarns composed of a mixture of two or more of these, has been patented by Mr. Charles Hastings, of Bradford, England. The object of the invention is to give the yarns additional strength and to otherwise improve their quality.

A hot air furnace, constructed entirely of refractory bricks or clay, has been patented by Mr. Thos. Crooke, of Newark, N. J. It is claimed that this furnace is free from the objections which are urged against cast iron furnaces.

An improved board for ironing shirts has been patented by Mr. John Boger, of Powhatan Point, Ohio, which is so constructed as to give a swell to the shirt bosom when it is ironed, and it admits of ironing the neck band in an erect position.

A sash tightener, consisting of two sheet metal tubes, closed at one end and adapted to slide one within the other, the closed end of the inner tube being forced against the sash by means of a coiled spring contained within it, has been patented by Mr. Frederick J. Hoyt, of New York city.

Mr. Ernest T. Gennert, of New York city, has patented an improvement in processes for extracting saccharine matter from vegetable substances. The invention consists in moistening the dried beets or other vegetable substances with a solution of superphosphate of lime just before the water is introduced into the extracting vat.

An improved truss hoop, having a metal strap fitted to the outer side of a wooden body, and extending from the end of the inner lap to or a little beyond the end of the outer lap, has been patented by Mr. John W. Maltby, of Rochester, N. Y.

An improvement in heating pots, patented by Mr. H. J. Nelson, of Pentwater, Mich., consists of a water receptacle provided with a central chimney, which rests on the flange of a lamp burner. The water receptacle is provided with suitable supporting legs.

Mr. Thomas M. Righter, of Sandy Run, Pa., has invented an improved sheave for wire ropes or cables. It consists of sector shaped sections of wood, clamped between suitable heads, with the grain running in a radial direction.

AMATEUR MECHANICS.

ROTARY CUTTERS.

The saving of files, time, materials, and patience, by the employment of such rotar· cutters as may be profitably used in connection with a foot lathe, can hardly be appreciated by one who has never attempted to use this class of tools. It is astonishing how much very hard labor may be saved by means of a small circular saw like that shown in Fig. 1. This tool, like many others described in this series of articles, can, in most instances, be purchased cheaper than it can be made, and the chances are in favor of its being a more perfect article. However, it is not so difficult to make as one might suppose. A piece of sheet steel may be chucked upon the face plate or on a wooden block attached to the face plate, where it may be bored to fit the saw mandrel, and cut in circular form by means of a suitable hand tool. It may then be placed upon the mandrel and turned true, and it is well enough to make it a little thinner in the middle than at the periphery.

There are several methods of forming the teeth on a circular saw. It may be spaced and filed, or it may be knurled, as shown in Fig. 2, and then filed, leaving every third or fourth tooth formed by the knurl; or it may, for some purposes, be knurled and not filed at all. Another way of forming the teeth is to employ a hub, something like that used in making chasers, as shown in Fig. 3; the difference between this hub and the other one referred to, is that the thread has one straight side corresponding with the radial side of the tooth. The blank from which the saw is made is placed on a stud projecting from a handle made specially for the purpose, and having a rounded end which supports the edge of the blank, as the teeth are formed by the cutters on the hub.

The saw, after the teeth are formed, may be hardened and tempered by heating it slowly until it attains a cherry red and plunging it straight down edgewise into cool, clean water. On removing it from the water it should be dried, and cleaned with a piece of emery paper, and its temper drawn to a purple, over a Bunsen gas flame, over the flame of an alcohol lamp, or over a hot plate of fron. The small saw shown in Fig. 4 is easily made from a rod of fine steel. It is very useful for slitting sheet brass and tubes, slotting small shafts, nicking screws, etc. Being quite small it has the advantage of having few teeth to keep in order, and it may be made harder than those of larger diameter. A series of them, varying in diameter from one eighth to three eighths of an inch, and varying considerably in thickness, will be found very convenient.

These cutters or saws, with the exception of the smaller one, may be used to the best advantage in connection with a saw table, like that shown in Fig. 8. This is a plane iron table having a longitudinal groove in its face to receive the guiding rib of the carriage, shown in Fig. 9, and a transverse groove running half way across, to receive a slitting gauge, as shown in Fig. 8. The table is supported by a standard or shank which fits into the tool-rest socket. The saw mandrel is supported between the centers of the lathe, and the saw projects more or less through a slot formed in the table. The gauge serves to guide the work to be slotted, and other kinds of work may be placed on or against the carriage shown in Fig. 9.

It is a very simple matter to arrange guiding pieces for cutting at any angle, and the saw table may be used for either metal or wood. The saws for wood differ from those used for metal; the latter are filed straight, the former diagonally or fleaming. Among the many uses to which metal saws may be applied we mention the slitting of sheet metals, splitting wires and rods, slotting and grooving, nicking screws, etc. Fig. 10 shows a holder for receiving screws to be nicked. It is used in connection with the saw table, and is moved over the saw against the gauge.

To facilitate the removal of the screws the holder may be split longitudinally and hinged together. Another method of nicking screws is illustrated by Fig. 11. A simple lever, fulcrumed on a bar held by the tool post, is drilled and tapped in the end to receive the screw. After adjusting the tool all that is required is to insert the screw and press down the handle so as to bring the screw head into contact with the saw.

Where a lathe is provided with an engine rest, the cutter shown in Fig. 6, mounted on the mandrel shown in Fig. 5, is very useful; it is used by clamping the work to the slide rest and moving it under the cutter by working the slide rest screw.

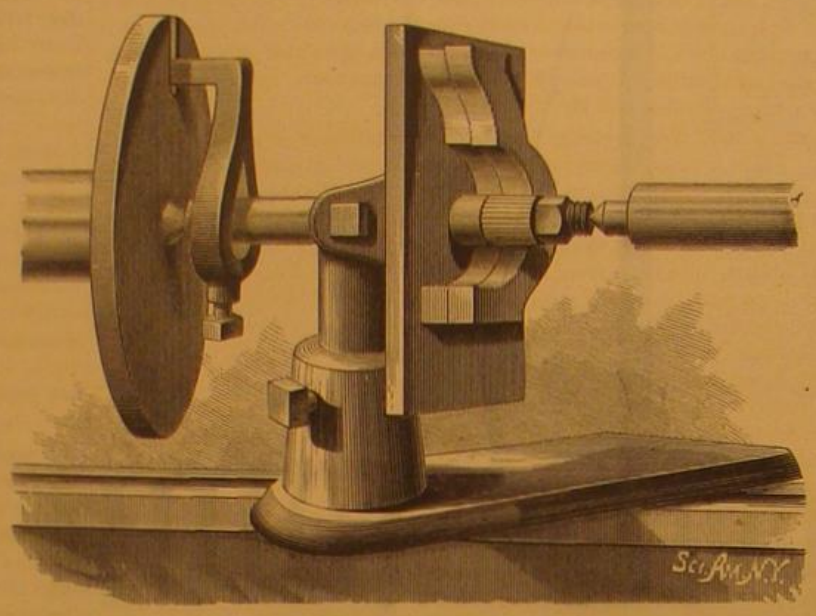
To make a cutter of this kind is more difficult than to make a saw, and to do it readily a milling machine would be required; it may be done, however, on a plain foot lathe by employing a V-shaped cutter and using a holder (Fig. 7) having an angular groove for receiving the cylinder on which the cutting edges are formed. The blank can be spaced with sufficient accuracy, by means of a fine pair of dividers, and after the first groove is cut there will be no difficulty in getting the rest sufficiently accurate, as a nib inserted in the side of the guide enters the first groove and all of the others in succession and regulates the spacing.

One of the best applications of this tool is shown in the small engraving. In this case a table similar to the saw table before described is supported in a vertical position, and arranged at right angles with the cutter mandrel. The mandrel is of the same diameter as the cutter, and serves as a guide to the pattern which carries the work to be operated upon. The principal use of this contrivance is to shape the edges of curved or irregular metal work. The casting to be finished is fastened—by cement if small, and by clamps if large—to a pattern having exactly the shape required in the finished work.

By moving the pattern in contact with the table and the mandrel, while the latter revolves, the edges of the work will be shaped and finished at the same time. By substituting a conical cutter for the cylindrical one, the work may be beveled; by using both, the edge may be made smooth and square, while the corner is beveled.

The tool shown in Fig. 12 might properly be called a barrel saw. It is made by drilling in the end of a steel rod and forming the teeth with a file. To avoid cracking in tempering a small hole should be drilled through the side near the bottom of the larger hole. To insure the free working of the tool it should be turned so that its cutting edge will be rather thicker than the portion behind it. This tool should be made in various sizes.

Tools for gear cutting and also cutters for wood have not been mentioned in this paper, as they are proper subjects for separate treatment. M.

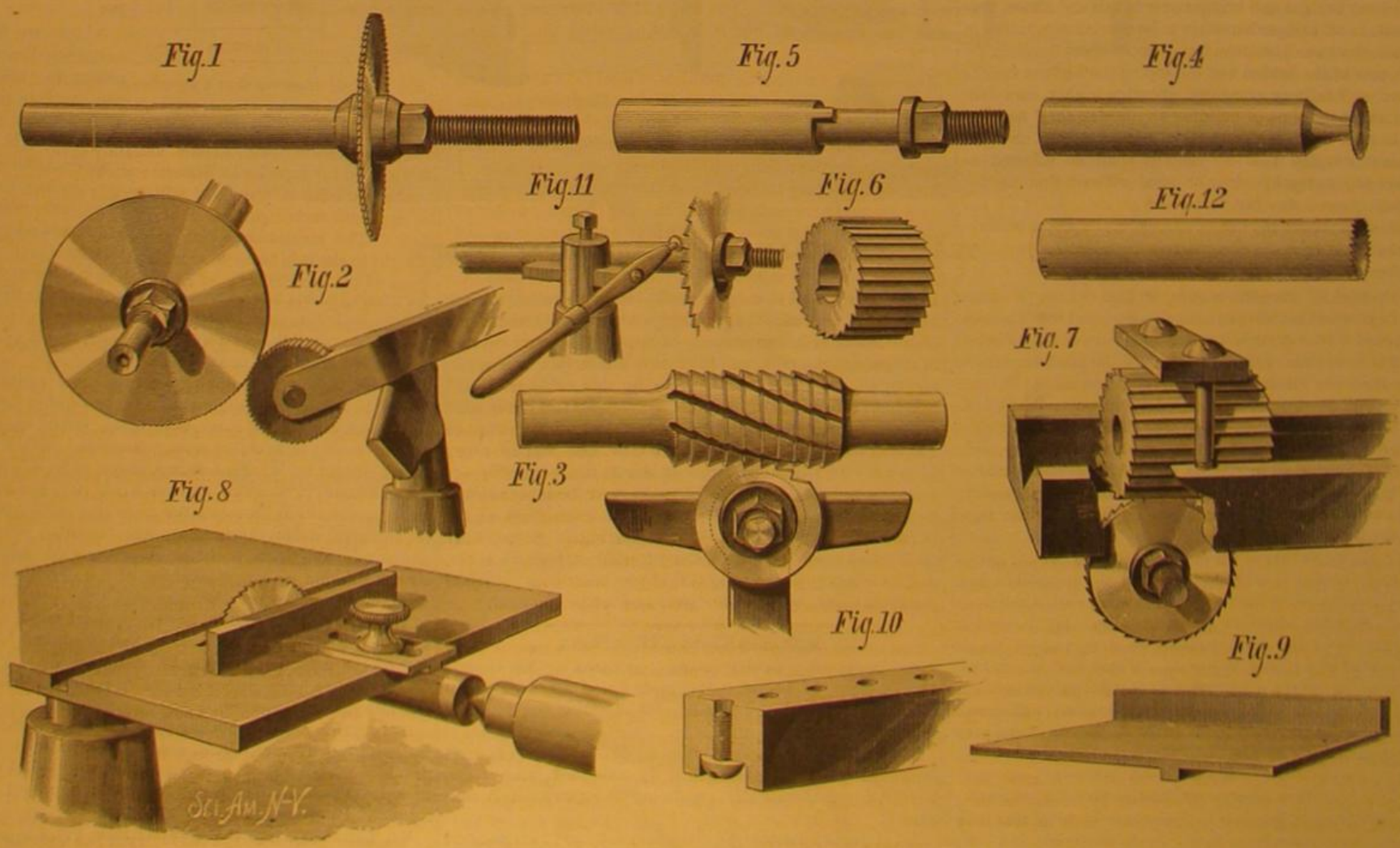


METAL SHAPING.

The Ventilation of Ships at Sea.

The Board of Naval Officers, consisting of Commander Beardslee, Medical Inspector Gibbs, and Naval Constructor Mintonye, commissioned to test and report upon Dr. Thiers' new apparatus for ventilating ships, have pronounced the principle of this apparatus, in ejecting the air, as the only true method for securing perfect ventilation in ships.

The apparatus consists of a copper cylinder attached to the ship's rudder, extending seven feet below the water line, and five above it, to which are connected two sets of valves opening into pipes running to all parts of the ship. The motion of the ship in rising and falling with the waves pumps the foul air out of the ship. The principle is simple, and the apparatus would seem to be efficient wherever there is much motion to the water. Whether it would work as well in still water, where ventilation is most needed, as in the calms of the tropics, is rather doubtful.



ROTARY CUTTERS.

RAILWAY NOTES.

SINCE the building of the Mount Washington Railway eight similar roads have been constructed in Austria and Switzerland. The engines for these roads were first built with vertical boilers; next with boilers that were level on an average grade; now they are built with horizontal boilers like ordinary locomotives. Various methods have been devised for enabling the locomotives to work by adhesion of their smooth wheels, as well as by means of their cog-wheel drivers, and by means of either at will. No one of these has been permanently successful, however, so that the proper construction of a double engine of this sort is still a matter of experimental inquiry.

THE Prussian Government railroad management is making great efforts to reduce the expenses of the state railroads. The principal reforms are said to be as follows: First, the construction of tunnels on new roads for a single track only. Hitherto, when a road was built, though with a single track and a very remote prospect of needing another, the tunnels on it were made wide enough for two tracks. Second, the use of steel rails exclusively, and the adoption of an iron superstructure (the Hilf system) instead of wooden cross-ties. Not much credit is claimed for the adoption of steel, the price being about the same as that of iron, but the iron superstructure is hailed in Germany as a forward step, and also likely to be a good thing for the German iron works. Third, the abandonment of optical signals for sections of the road between stations. This simply makes the Prussian practice like that of the greater part of the rest of the railroad world, in Europe as well as in America. The change is said to have been without any injurious effects, while there has been a considerable saving in the army of road guards who have been accustomed to stand along the roads and salute the trains as they pass—a saving which has been re-enforced by substituting women for men to attend the crossing gates found at short intervals along every road. Fourth, the introduction of central interlocking switch and signal apparatus, of the Saxby & Farmer or similar patterns. Not only, it is said, has this resulted in greater safety, but also, by substituting a mechanical apparatus worked by one man to set a large number of switches and signals, the number of switchmen has been considerably reduced, even at small stations. Fifth, the introduction of continuous brakes. These have been put since 1878 on nearly all the passenger trains of the government roads, pretty much all kinds being used—the Westinghouse, Smith (vacuum), Heberlein, and Steele. Experiments have been made with the Heberlein brake on freight trains, and it is said with prospects of success in economizing the number of brakemen as well as increasing safety. Sixth, the reduction of the cost of switching service by arranging sorting tracks on inclined planes, where the movement is generally made by gravity alone, without the use of an engine. This has been the practice at a few great yards in Germany for a number of years, with very excellent results, it is said. Horses have been used instead of engines in switching cars, also with economy. Seventh, the adoption of regulations for working roads with light traffic without all the precautions and appliances which are made necessary only by frequent, heavy, and fast trains.

AN act, introduced by the Minister of Public Works, for the amendment of the Canadian railway act of 1874, as regards railway bridges and bridges over canals and rivers, provides that, in all bridges hereafter to be erected over railways in Canada, there shall be seven feet clear of space between the lower beams of the bridge and the top of the highest freight cars; and any railway company adopting higher cars than those in use at the time of building any bridge shall be compelled to raise such bridge at their own cost and charges. It is also provided that no railway shall be allowed to pass over any navigable river or canal without first having built such proper flooring under and on both sides of the track as shall be deemed sufficient by the Minister of Public Works to prevent anything falling from the railway into such river or canal, upon boats or vessels navigating it.

THE Springfield *Republican* reports that the new 42 inch railroad car wheel is disappointing the confident expectations it awakened. Out of 80 tested on the Boston and Albany road, 22 have broken, and the expenses of the fast train which runs on them are greater than last year, when the old 33 inch wheel was used. The 42 inch wheel weighs 850 pounds, and the 33 inch wheel 450 pounds. Vice-President Reed, of the Southern road, does not think favorably of the big wheel. Possibly if the manner of manufacture could be altered, there would be less breakage. At all events, says the *Republican*, the idea will not probably be given up without further trial of at least six months.

THE Sacramento (Cal.) *Bee* reports that in the shops of the Pacific road in that city 25 new style sleeping cars for emigrants are being fitted up. The new cars are provided with upper and lower berths, somewhat after the manner of caboose cars. The upper berth swings freely on iron rods, and when not in use can be hung up on the roof of the car, where it is not in the way. The lower berths are formed from the seats, which are made up after the manner of the present sleepers, by turning down the backs, etc. Slats are then placed crosswise, and when laid out the berths are exceedingly neat and comfortable. This will be a great convenience to persons traveling third-class, as heretofore they have been compelled to sit up or make shift as best they could.

TOUCHING the recent steel rail controversy, Mr. Wm. A. Sweet, an American steel manufacturer, asserts that the steel rails made in England and rolled on two high trains are better for wear—the chemical constituents of the steel being the same—than the rails made in this country and rolled on a three high train; not because the train is a three high or a two high train, but because the rail, when it is finished, is colder, and is left in a more condensed condition, and therefore better prepared to receive the wear of wheels. In other words, it is stronger and tougher. Mr. Sweet claims to be able to prove the correctness of this assertion, and that any steelmaker can test it for himself in a few hours. He claims also that if the American rail is rolled until the scale is set, the rail will be better than the English.

THE *Journal* of the German Railroad Union gives a list of the European railroads on which the Pintsch system of gas lighting is used, and the numbers of cars on each to which it is applied. The total shows 22 roads in Germany, 1 in Austria, 3 in Russia, and 2 in England, besides a sleeping car company, 2 imperial court trains (German and Russian), and 2 cars for the Crown Prince of Germany. In all, application has been made to 3,600 cars and ordered for 705 more. There are 42 locomotives that have been provided with the apparatus. It was first introduced ten years ago on the Lower Silesia and Märk road.

THE *Railroad Gazette* finds a statement of some of the long distance grain rates from Russia and Austria to Germany in a complaint that the rates from Russia are so excessively low that the Austrian producers have no fair chance to compete. The rates are for a car load of grain (22,040 lb. = 367 bushels of wheat) from the Russian station Brody to Leipsic, a distance of 658 miles, $99.40, which is at the rate of 45 cents per 100 lb.; from the Austrian station of Debreczin to Leipsic, 654 miles, the rate is $116, or 52·6 cents per 100 lb. It is years since the rate from Chicago to New York, nearly one half further (911 to 980 miles, according to route) has been as high as 45 cents on grain, and for two or three years it has probably not averaged more than 25 cents, going at times on a few shipments as low as 15 cents. The roads west of Chicago, which are often charged with "extortion" and which do usually make a profit on their grain traffic, do not get anything like the Russo-German rates. From Kansas City to Chicago, about 500 miles, the highest winter rate has been 25 cents for wheat and 20 cents for corn. On the basis of the Brody-Leipsic rate they would be about 34 cents. The Chicago-New York rate on that basis would be, by the shortest route, 61½ cents per 100 lb.

AT the regular monthly meeting of the Engineers' Club, of Philadelphia, March 15, C. E. Buzby exhibited a model of Travers' iron railroad tie, which is being tried on the Philadelphia and Baltimore Central road, near Lamokin. The device dispenses with all spikes, bolts, nuts, or fish plates, and drilling or punching the rails, avoiding fractures from such causes. The iron tie, it is claimed, will outlast twelve renewals of the ordinary tie at one half the cost to keep in repair. Each tie is recessed under its rails, and along the bottom of the recess wedge-shaped pieces are cast transversely. At the sides of each recess are creosoted blocks, which form a cushion and fulcrum for two clamps, which grasp the flange and web of the rail above, bearing upon opposite faces of the wedge below. The weight of the train forces the clamps upon the wedge, spreads them at the bottom, and grips the rail. The first cost is somewhat greater than the wooden tie, but it is said to offset this in durability.

DISCUSSING the wearing qualities of steel rails at the meeting of the American Institute of Mining Engineers in Baltimore, Mr. R. W. Hunt said: "I am convinced that more rails have been broken by the treatment which they received before leaving the rolling mill than from any other cause. I allude to the injury inflicted upon them in the cold straightening press, where each blow of the gag forms a wedge of the particles of steel pressing upon the surrounding ones, and thus serving to rend the rail asunder. I am certain that of all the broken steel rails that I have seen, fully 75 per cent have been ruptured at the gag mark. So well recognized is this cause of breakage that the Troy Works and others have spent large sums in introducing machinery to more perfectly hot straighten the rails, and thus leave less work for the cold press. While I admit that Dr. Dudley's physical analyses show a difference in the broken and crushed and the unbroken and uncrushed rails, I am not prepared to accept these results as coming entirely from the chemical properties of the metal. If I mistake not, 7 of the 25 samples are from crushed rails. May not these failures have been caused by mechanically imperfect bars, piped ingots, or some other mechanical defect? Then, again, the possibility of the steel having been overheated in the rail rolling mill must not be ignored. For it is well known that the same steel worked at different temperatures will afterward yield widely differing physical results. We, who have to encounter the difficulties of manufacture, know how many and vexatious they are in their physical as well as chemical forms."

INTERLOCKING switch and signal apparatus is becoming the rule rather than the exception on many English roads, being used not at important points only, but elsewhere. The London and Northwestern has apparatus at 2,888 places, and has between 17,000 and 18,000 levers. The Chairman, Mr. Richard Moon, at a recent half yearly meeting, said that the total expenditure for interlocking and the block system had been between £800,000 and £900,000—say something more than $4,000,000.

DISCUSSING the practical superiority of the American locomotive for the rough and ready requirements of ordinary railways, a writer in *Harper's Magazine* says:

"It is to the American we must turn to learn what are the requirements of the modern railway, and to get some suggestion of its future. More than this, the moment the English locomotive is taken from its island line it exhibits defects and a certain want of pliability that completely unfit it for a Continental railway. But if the English road and the English engine are the best in the world, why are they not the best for the world? Simply because they do not pay. There can be no higher reason than this. Anything that does not pay is useless, because it does not meet a human want. The cost of any operation is the measure of its value to human beings, and if the road does not pay, of what good is it? Now a railway, to be cheap, must follow the face of the country; that is, the line must go up and down hill, pass around abrupt curves, according to the lay of the land, and without much attempt at a straight line or level bed. It is upon this idea that American railroads have been built, and all Continental lines are likely to be built in the future. If a railroad can thus follow the face of the country, it will not cost so much, there being no high bridges, deep cuts, and tunnels. Of course there is a limit in this direction, and even the American engine cannot climb up the side of a house, or turn a right angle in its own length; but within certain broad limits it may be said that the future locomotive must follow lines that run up hill and down dale, and get around very remarkable corners. This being the case, what of the English locomotive? Can it travel in safety over crooked lines that wander in astonishing freedom over hill and dale through all the sinuous lines of a winding river valley? There is no need to say it ought, or it may, for it never did. It has been tried again and again, and the end of it all is, the engine is in the ditch, and the unlucky stockholders are clamoring for American engines, or at least engines built on American plans."

A TIME schedule of the special train ordered by the National Democratic Committee to bring Hon. John Whitaker, Congressman-elect from San Francisco, to Washington, in time to take part in the organization of the House, shows that the whole distance was made in 4 days 14 hours and 30 minutes actual running time. The speed of the train averaged thirty-one miles per hour between San Francisco and Ogden, and fifty-one miles per hour between Cheyenne and Sydney. The whole time is the quickest ever made between the Pacific and Atlantic.

The World's Product of Iron and Steel.

In his report on the iron and steel display at Paris, Commissioner Morrell gives the following statement of the present annual production, based on the latest statistics:

Country.	Cast and Pig Iron.			Steel.		
	Year.	Production. Tons of 2,240 lb.	Per ct. of Total.	Year.	Production. Tons of 2,240 lb.	Per ct. of Total.
Great Britain....	1878	6,300,000	45·63	1878	1,100,000	39·70
United States....	1878	2,301,215	16·67	1878	735,000	26·53
Germany, including G. Duchy of Luxemburg...	1876	1,816,672	13·16	1876	384,159	13·87
France.....	1878	1,417,073	10·26	1878	281,801	10·17
Belgium.	1876	562,086	4·07	1877	100,000	3·61
Austria and Hungary....	1876	443,689	3·21	1876	113,152	4·08
Russia..... ...	1875	420,035	3·04	1875	12,720	·46
Sweden...	1876	346,955	2·51	1876	23,692	·86
Other countries..	1877	200,000	1·45	1877	20,000	·72
Total.....	... ..	13,807,725	100·00	.....	2,770,524	100·00

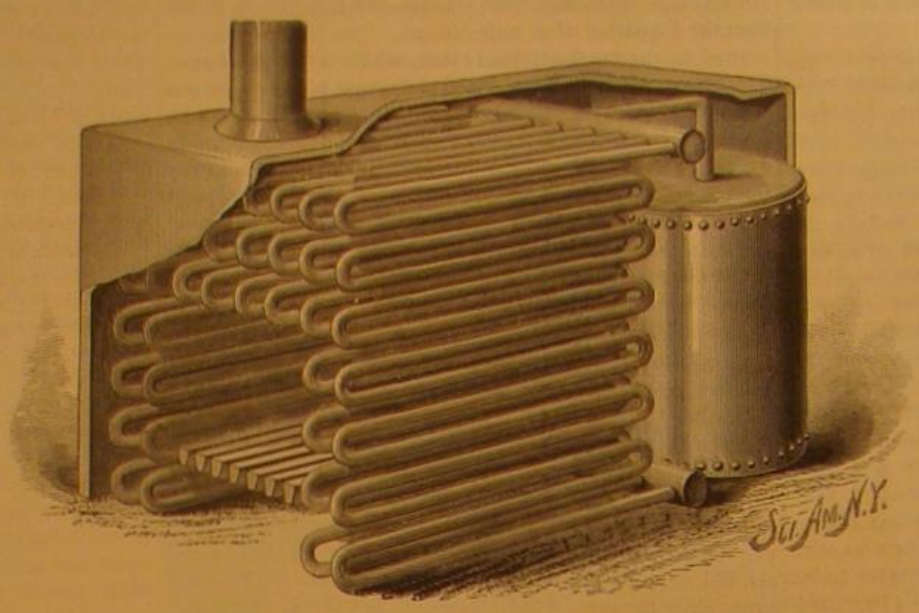
Mr. Morrell observes that a significant fact illustrated at Paris was that (owing to the marvelous increase in the production of Bessemer steel) the manganiferous and non-phosphoriferous ores of Spain, Algeria, and Italy have been largely drawn upon for supplies to Bessemer works in countries rich in other varieties of ores. Of still greater significance was the large and varied collection of Bessemer products exhibited. The revolution which the Bessemer process has wrought in the iron trade was made strikingly manifest in a survey of the contributions of European countries, but to an American who remembered the wonderful development of the Bessemer industry in his own country, which sent no Bessemer products to Paris, these contributions were more impressive and more suggestive than they could be to any European. The Paris Exhibition showed that the progress made during the past two or three years in the manufacture of Bessemer and open hearth steel is so great that statistics fail to give any proper conception of its magnitude. The London *Times* remarks that "the Bessemer process has ruined the manufactured iron trade." Mr. Morrell says: "It has done more than this—it has distributed among many countries the manufacture of Bessemer steel, and thus enabled them to supply more fully their own metallurgical wants, and the metallurgical wants of other countries, in lieu of their own previous partial dependence upon Great Britain for both iron and steel products. It has thus aided not only to ruin the manufactured iron trade of all countries, but to ruin that of Great Britain particularly, and it has placed a limit upon the Bessemer steel industry of Great Britain itself. Here is a new revolution, or a new revelation, in connection with the world's iron industry which was reserved for Paris to make clearly manifest through the abundant proofs there furnished of the wide distribution of the Bessemer process and the wide substitution of Bessemer products for those of iron and other steel processes. And what has been said of the Bessemer process and of the injury it has inflicted upon the British iron trade is applicable also in a large degree to the Siemens-Martin process and its modifications."

NEW STEAM BOILER.

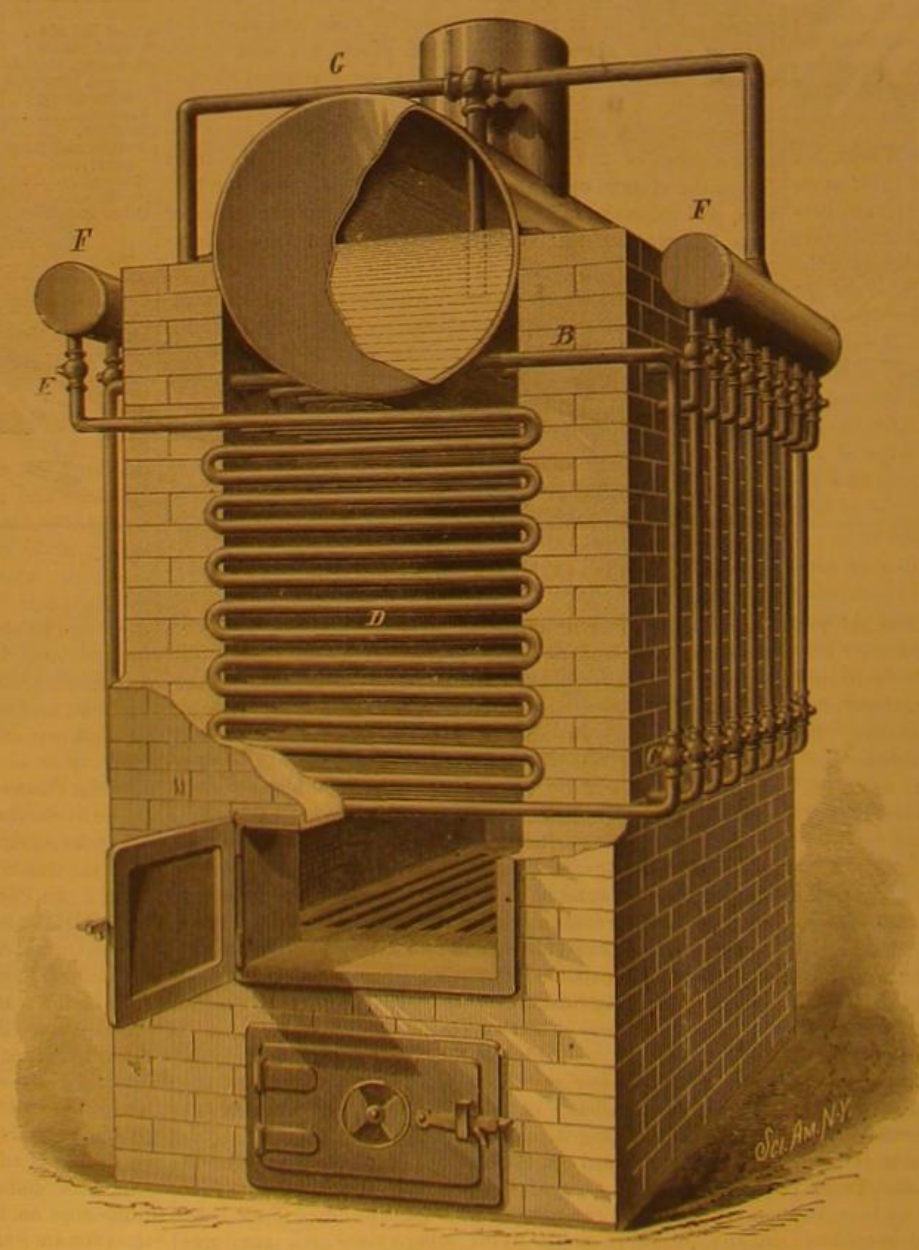
We illustrate one of the most recent improvements in steam engineering, the larger engraving representing a stationary boiler, and the smaller one a portable boiler, both made under a patent recently granted to Mr. Guy D. Daly, of Flatbush, N. Y. In devising this boiler the inventor claims to have effected a great saving in first cost, in repairs, in the use of fuel, and to have diminished the danger of explosion. The boiler is certainly very compact, and the water appears to be exposed to the best advantage to the action of the fire. There are two systems of pipes starting from opposite sides of the water reservoir, A, near the bottom. By tracing the course of the first pipe, B, the entire arrangement will be at once understood. It passes from the reservoir, A, outward through the brickwork which supports the reservoir, thence downward to a point just above the fire, where it turns inward and passes from one side to the other of the fire arch, forming the coil, D, and finally terminates in the steam drum, F. The pipes, starting from the opposite side of the drum, are arranged in exactly the same way, but run in the opposite direction, and discharge into the steam drum, F, on the opposite side of the arch. In the pipes that leave the boiler there are check valves, C, and in the upper terminal of each coil there is a check valve, E. These valves insure a complete circulation and facilitate the generation of steam. The drums, F, are connected by pipes, G, with a single pipe, which discharges downwardly into the reservoir, A. The coils, D, being subjected to the intense heat of the fire, rapidly converts the water entering through the check valves, C, into steam, which is discharged through the check valves, E, into the drums, F, whence it finds its way through the pipes, G, to the reservoir, A. Whatever spray or moisture is carried along with the steam remains in the reservoir, while the steam is delivered in a dry state to the engine.

The boiler shown in the smaller engraving is similar in construction to the one already described, the difference being that the brickwork is dispensed with, and a portion of the coils is used to form the side of the fireplace, and the entire series of pipes is covered with a smoke jacket of cast or sheet iron.

The reservoir, which, in the stationary boiler, virtually forms the crown sheet, is so distant from the fire that it cannot become injured by heat, and the pipes which form the coils have such a surplus of strength that it would be almost if not quite impossible to burst them. Even if one should, from any cause, give out, it cannot harm the other portions of the boiler, and it may be very readily replaced.



DALY'S PORTABLE BOILER.



DALY'S IMPROVED STEAM BOILER.

ENGINEERING INVENTIONS.

An improved cut-off, especially adapted to beam engines, has been patented by Mr. Thomas E. L. Collins, of Fall River, Mass. It can be adjusted without stopping the engine or changing the position of the lifter, the latter being provided with a movable lower part pivoted to the fixed upper part.

An improved road ditcher, patented by Mr. Isaac Karsner, of Florida, O., is designed for opening ditches along the sides of roads and in fields, and it is capable of forming ditches on inclined surfaces.

Mr. John Witsil, of Bridgeborough, N. J., has patented an improved car coupling. The principal feature of the invention consists in using the car platform as a draw head.

An improved lubricator for steam cylinders, patented by Messrs. John H. Taylor and Richard W. Miller, of New Haven, Conn., is arranged with a view to supplying a measured quantity of oil to the cylinder at each stroke by a forced injection.

Mr. James W. Brown, of Mayfield, Ky., has invented an improved propeller for vessels, consisting in a series of paddles of peculiar construction, which are thrust backward from the stern of the vessel.

An improved water wheel, to be used in streams where there is little or no head, has been patented by Mr. John Ebersole, of Chambersburg, Pa. It is designed to be run by the current, and is not retarded by still or back water.

Mr. Andrew J. Hopewell, of Edinburgh, Va., has patented an improved turbine water wheel, in which water is admitted through laterally opening chutes or water ways. The chutes are controlled by a corresponding series of gates having a rotary adjustment.

An improved coupling for railway freight cars has been patented by Mr. Washington L. Harvey, of Danville, Va. The cars are coupled automatically, and may be uncoupled by a person standing on the top of the car.

Mr. Daniel Abrey, of Greenville, Mich., has patented an improved rotary engine. The improvement relates principally to a cut-off, and to a novel movement for the abutments.

An improved device for attachment to locomotive engines to prevent the smoke, cinders, and dust from the smokestack from entering the cars, has been patented by Mr. T. B. Taylor, of Mount Meigs, Ala. It consists in an inclined or diagonal plate placed so as to deflect the cinders and smoke from the path of the train.

An improved car coupling, designed to automatically couple cars without the necessity of going between the cars, and which also permits the cars to become automatically disengaged in case of accident, has been patented by Mr. James D. Martin, of Johnson City, Tenn., assignor of one half his right to Mr. James R. Meek, of Carter's Depot, Tenn, to whom communications should be addressed.

An improvement in stock cars has been patented by Mr. Franklin B. Hall, of Palatine Bridge, N. Y. This invention is designed to afford rest and support for cattle during transportation.

Dangers of Wall Street.

A New York correspondent to one of our contemporaries thinks there is not a better place in the United States to stay away from than Wall Street in this metropolis, with the exception, perhaps, of Memphis or New Orleans in a yellow fever season. I know five men, says the writer, who went there to try their luck about a year ago. One was a confidential clerk in a foreign house that operated largely in the street. He was in a good position to get "points," and the understanding was that the others should operate upon them, letting him in for a share of the profits in consideration of the information he should furnish. These five formed a little ring with a cash capital of about $50,000. They hadn't the slightest doubt about doubling it in six months. They were to be on equal ground with the biggest operators so far as "points" were concerned, and no such word as fail could be found in the lexicon of their calculations.

Where are they now? Well, the confidential clerk is in a lunatic asylum. One of the others is a street-car conductor at $1.75 a day. A second is clerk in an insurance office at ten dollars a week. A third made his way West toward the Black Hills, and has not since been heard from. The last of the party of five still hangs around the street, watching the indications, but unable to put up even five dollars in a bucket shop. Their whole capital melted away in three months, and they were left without a dollar.

Here is another case: A retired business man of my acquaintance considered himself too smart to be beaten at any game. He lived in fine style, kept horses and a carriage, and was well known in society. The Wall Street fever struck him and he began to speculate. He made out pretty well at the start and that led him into larger operations. In less than six months from the day he put up his first $10,000 margin, he was an insolvent debtor, with suits against him by the brokers through whose hands all his money had passed! He now manages to scrape up a cheap living as an insurance agent, but he is hard pressed half his time for his board.

Scores of such warnings against tempting the goddess of the Stock Exchange might be given, but so long as her snares are set, men will walk straight into them, with their eyes open, and the notes of warning will be raised in vain.

A New Apparatus for Testing Petroleum.

The uncertain and irregular results obtained by the flash test of petroleum in different hands has led to much dissatisfaction on the part of consumers, especially abroad. To get a uniform test, Mr. Holly, of the firm of Lockwood Brothers & Holly, of New York city, has devised a testing machine which was exhibited before a committee of the New York Produce Exchange, May 1, giving very promising results. By this method the poles of a galvanic battery are brought within three eighths of an inch of the surface of the oil, which is meantime being slowly heated by a lamp placed beneath a small retort. A thermometer attached gives the temperature of the oil, and at each degree of heat attained above, say, 90°, a discharge of electricity is applied, the spark at last producing an explosive flash in the gaseous fumes rising on the surface of the oil. These discharges are continued with the rising temperature of the oil until the flash extends into a flame, and the surface of the oil begins to burn.

A sample of oil, marked as flashing under the old test at 95°, flashed at 93° under the new test; and Mr. Holly stated that this test would always produce the flash on this sample of oil at a variation of not more than 2° from that point. The sample flashed at 93°, 94°, 99°, 104°, 108°, 112°, and 114°, and, finally, burned at 115°.

Subsequent experiments made by gentlemen present produced substantially similar results. All that is claimed by Mr. Holly for the machine is that it secures uniformity in the method by which the standard of the oil is determined.

The Block Island Breakwater.

The Block Island breakwater, begun nearly nine years ago, is at last completed. The enterprise has been attended with almost insurmountable difficulties, by reason of the severe storms which prevail at this place during all seasons of the year. The breakwater now affords a safe shelter for hundreds of mariners, and is a secure refuge for vessels. It extends almost due north from the steamboat landing, on the

east side of the island, a distance of 1,250 feet. The first work was done in October, 1870.

The main breakwater reaches at its northern extremity a depth of 18 feet, and contains about 65,000 tons of rip-rap. A detached pier, about 200 feet from the principal structure, is 300 feet in length, and contains about 28,000 tons of rip-rap. On the main breakwater there is a lighthouse near the 60 foot entrance to the basin. A mammoth basin has also been constructed, in which vessels drawing not more than seven feet of water may ride safely at anchor. There are contained in this structure 320,000 feet of timber (board measure) and 6,000 tons of stone. The total cost of the entire work was $285,000.

Block Island is an isolated island in the Atlantic ocean, about midway between Montauk Point, at the Eastern extremity of Long Island, and Point Judith, R. I. It is eight miles long and from two to five miles wide.

THE EQUINE ANTELOPE.

A young animal of this species, from Nubia, has lately been added to the collection of the Zoological Society, at the gardens in Regent's Park. There was a specimen brought to London some time ago, which unfortunately died within two or three days of its arrival, from disease contracted before. This one seems to be doing well, like most of the other antelopes in the collection, of which they form an important and interesting feature. The antelope genus of ruminating mammals, distinguished from the ox, the deer, the goat, and the sheep, includes nearly a hundred diverse species, the majority of which are natives of Africa; a few belong to Asia and Europe, while America has scarcely any true antelopes. Among the more conspicuous and familiar instances are the Persian or Arabian gazelle, the Indian nylghau, the ibex and chamois of the Alps, the eland, the gnu, the springbok and blessbok, and others, in South Africa.

The equine antelope grows to as large a size as the eland, sometimes measuring as much as 7½ feet in length and 4 feet in height at the shoulder, or the ordinary stature of a horse. Its color is a reddish-gray, with brown head and a white spot over each eye; the horns are large and heavy, round in shape, and marked with a series of rings, except toward the points, which are very sharp; and the entire horn curves backward when fully grown. This species is also found in South Africa, inhabiting the plains of the Transvaal and other elevated parts of the country.

We present an illustration of the individual specimen of the Nubian race which has taken up its abode in London.

THE EQUINE ANTELOPE.

A Telephone Concert.

One of the most successful, and, in some of its features, peculiar, telephone concerts ever held, lately took place at the Wesley Chapel, Columbus, Ohio. Mr. Sidney Short delivered, at the church, his lecture on the "telephone." The lecture was illustrated by charts and apparatus. During the lecture demonstration of the practical operation of the telephone was given, which greatly surprised, interested, and gratified the audience. The arrangements of the apparatus were as follows:

Four Edison transmitters were placed in the Western Union main office, and two Phelps crown receivers at the church, a quarter of a mile distant. The lecture was delivered in the Sunday-school room, which is 50 feet square. The crown receivers were placed at one end of the room, and were provided with paper cones 4 feet long and 10 inches in diameter at the large end. With the apparatus thus arranged, a solo sung in the Western Union office was distinctly heard by the audience. After this, Mr. George Makepeace, of the State University, gave a cornet solo. Every note was distinct, yet as sweet and low as though heard from a distance, and coming over still waters on a quiet summer eve. When "Great Deliverer, Come," by the Wesley Chapel quartette, came through the instrument, not only were the tones of different parts distinct, but even the words could be understood in every part of the room. As an encore, "We're Going Home To-morrow," was given. This, also, was clear and sweet. A cornet duet by Messrs. Makepeace and Hyatt, and, in response to an encore, "Old Virginia" was given with equal success. The musical programme was closed by the Doxology. After a short conversation with Mr. Ross, at the Western Union office, Mr. Short, in a glowing tribute to America's work on this, the invention of the age, brought his remarks to a close. Every word spoken or sung at the office was not only distinctly heard by the entire audience, but the voices of the speakers and singers were recognized, and could have been distinctly heard in a hall capable of seating a thousand persons.—*Journal of the Telegraph.*

Academy Notes.

The *Public Ledger* report of the recent meeting of the Philadelphia Academy of Natural Sciences, contains the following interesting items:

Professor Edward D. Cope stated that he had in his collection a large number of specimens illustrating the natural history of the extinct rhinoceros from the Loom Fork horizon and elsewhere in the West, where these remains form more than one-half of all the fossils found. Four distinct genera, anchisodon, hyrachodon, aceratherium, and aphelops, were described, and the species characterized. A beautiful specimen of an extinct skate, embedded in shale from Bear river, was exhibited and described. It belonged to a new genus of the family of trygons. The distinguishing characters are found in the teeth, which are like those of the genus raia, and in the spines of the tail, which are three in number, compressed and with one serrated edge. The name Ziphotrygon acutidens was proposed for the genus and species.

Professor Cope stated in this connection that, contrary to the assertion of Mr. Clarence King, no species of fossil fish was found common to the shales east and west of the Wasatch Range. The name Amyzon beds was given to the deposits west of the range, which were also found in the South Park.

Mr. John A. Ryder described a beautiful little crustacean found for the first time on this continent in the vicinity of Woodbury, N. J., by Mr. Seal, an indefatigable collector of the minute life of his neighborhood. The head is provided with robust claspers and two long, fleshy proboscis-like organs, which are coiled up between the claspers when at rest. The little creatures, which are about half an inch in length, are provided with eleven exquisitely delicate branchiæ on each side, by means of which they float gracefully on their backs in the water. The specimen was named Chirocephalus Holmanii, in honor of Mr. D. S. Holman, the Actuary of the Franklin Institute, from whom the specimen was obtained, in recognition of the services he has rendered in devising methods for studying living objects, both large and small, under the microscope.

Dr. Chapman exhibited and described the placenta of a species of monkey (Macacus cynomolgus) which was remarkable in being single, and thus differing from the placenta of the other Old World monkeys, except the chimpanzee.

Dr. C. N. Pierce called attention to a skeleton of a maori, dug out of the sand on the beach of Chatham Island, South Pacific Ocean, and presented to the Academy by Mr. Wm. H. Rau. He pointed out the fact that in the lower jaw the third molar was the largest instead of the smallest, as in civilized man, thus approaching the condition in the lower animals. Other peculiarities of dentition were noticed.

American Coal at the Mediterranean.

Since referring in our last issue to the fact that anthracite coal was advertised for sale in Geneva, Switzerland, we find the following item in the New York *Tribune:* The rumor that an Italian firm was negotiating in the United States for an immediate supply of 100,000 tons of coal, in place of obtaining it from England as heretofore, has caused uneasiness in London. A cargo of American coal reached

the Mediterranean sixteen months ago, and met with a ready sale, and more than twenty cargoes have been sent over since that time. The *Globe* apprehends that before long the coal industry of Great Britain will have to encounter determined rivalry on the part of the United States. American coal will not be landed in England, but will be shipped to ports on the Continent which are now dependent upon supplies from the coal fields of the United Kingdom.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M

POSITION OF PLANETS FOR JUNE, 1879.

Mercury.

On June 1 Mercury rises at 3h. 41m. A.M., and sets at 5h. 43m. P.M. On June 30 Mercury rises at 5h. 31m. A.M., and sets at 8h. 34m. P.M.

Mercury should be looked for during the last week in June, nearly in the parallel of the point of sunset; it will be in conjunction with the new moon on the 19th.

Venus.

On June 1 Venus rises at 7h. 22m. A.M., and sets at 10h 29m. P.M. On June 30 Venus rises at 8h. 15m. A.M., and sets at 10h. 6m. P.M.

Venus passes 4° south of Pollux on June 2, and 2½° north of Regulus on June 30.

Venus will be near the crescent moon on the evening of June 23.

Saturn.

On June 1 Saturn rises at 2h. 2m. A.M., and sets at 2h. 35m. P.M.

On June 13, according to the Nautical Almanac, Saturn will be in conjunction with the moon at 5h. 31m. Washington time. The planet will therefore rise on the morning of that day, following the crescent moon.

On June 30 Mars and Saturn will rise very nearly together, at 0h. 13m., and will keep nearly the same path until they set.

Uranus.

On June 1 Uranus rises at 10h. 47m. A.M., and sets at 15m. after midnight. On June 30 Uranus rises at 8h. 58m. A.M., and sets at 10h. 23m. P.M.

Sun Spots.

The sun has been examined daily, since the first of the year, with a glass of 3 inches aperture. As late as May 8 no spot had been found. On May 9 a small spot was seen, which had developed within the previous twenty-four hours. It could not be found with the same glass on the 12th, but the large telescope showed that it had broken up into several minute sections, and was rapidly diminishing.

Mars.

On June 1 Mars rises at 1h. 20m. A.M., and sets at 51m. after noon. On June 30 Mars rises at 0h. 13m. A.M., and sets at 39m. after noon.

Mars will be near the waning moon on June 12. According to the Nautical Almanac Mars will be in conjunction with Saturn at 2 P.M. on the 30th. The two planets will therefore be seen to rise nearly together.

Jupiter.

The planets Jupiter, Saturn, and Mars are all best seen in the morning.

On June 1 Jupiter rises at 44m. after midnight.

Mars rises north of Jupiter at 1h. 20m. A.M., and Saturn rises north of Mars at 2h. 2m. A.M.

On June 30 Jupiter rises at 10h. 50m. P.M., nearly as Venus sets.

Jupiter is very brilliant. We are coming nearer to it, and its moon can be seen with very little optical aid.

The Coney Island Pier.

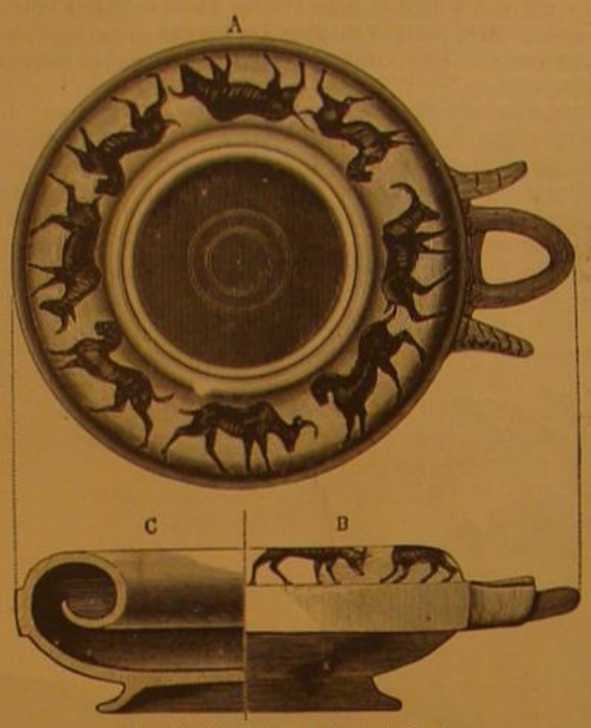
The Ocean Navigation and Pier Company, of which Mr. Jacob Lorillard is president, are erecting off West Brighton, Coney Island, an immense iron pier. The contractors are the Delaware Bridge Company, and the construction is under the supervision of Messrs. Maclay & Davies, civil engineers. The pier, when completed, is to be 1,000 feet in length, extending outward from high-water mark. Its width is to be 50 feet, with enlargements of 100 feet in width at the shore end, the center and the pier head. It is to be double-decked, with iron substructure, the whole supported by wrought-iron tubular piles 9 inches in diameter, made of one-half inch metal. These piles are arranged in rows, at distances of 20 feet longitudinally and 16 feet 8 inches laterally. Each pile has at its base a circular cast-iron disk 2½ feet in diameter, which, when sunk into the sand, acts as a supporting base, and at the depth of 15 or 20 feet insures a perfect foundation. The piles are driven by the "jet water" system.

Iron capitals are bolted to the tops of the piles, and they support 15-inch wrought-iron beams, bolted together, upon which the superstructure will rest. The entire structure is to be made more secure by being braced throughout with diagonal rods an inch and a half in diameter, and heavy horizontal struts bolted to the beams transversely. When completed, the entire structure will be supported by 260 iron pillars. The flooring of the lower deck will be well finished and inclosed in a handsome iron railing. The landing stage will be at the lower deck of the pierhead, and will be guarded by massive oak fender pieces.

More than 100 workmen are engaged in pushing forward the work. At night two electric lights, one on shore and the other on the movable derrick, are used. The first pile was driven on the 22d of April. All the material for construction is on the ground, and it is intended to have the last pile in place by the 1st of June. On the upper deck of the pier are to be spacious pavilions and saloons. The whole structure will cost more than $150,000.—*Iron Age.*

GREEK DRINKING CUP.

The engraving represents the upper face and a diametrical section of an ancient Greek drinking cup which was used



ANCIENT GREEK DRINKING CUP.

by the soldiers for dipping up the muddy water met with in their marches. The inwardly turned rim prevented the mud from following the water as it was poured from the vessel. This vase or cup is preserved in the Pourtalis collection.

NEW PROVISION SAFE.

The accompanying engraving represents a very useful household article recently patented by Mr. Samuel Inman, of 929 South Asland Ave., Chicago, Ill. It is designed for keeping bread, pastry, meats, milk, and other articles of food which require protection from insects or other vermin. The safe is made in two parts, the upper part being made air-tight, or nearly so, for containing bread and pastry, and protecting them from the influence of the atmosphere and from insects. The lower portion consists of a light frame having a door in one side, the whole being covered with wire gauze, which permits of a free circulation of air, while it prevents the entrance of rats, mice, or insects. The shelves are formed of slats of wood, secured to end cleats. This part of the safe is intended for receiving meats, butter, milk, and other articles which require a free circulation of air around them. The safe may be set upon the cellar floor or hung up by wires, as may be most convenient.

Inman's Provision Safe.

Painting Walls—Seasonable Hints.

Of course, says the *American Builder*, everybody knows, or ought to know, that walls and ceilings are finished with plaster. But everybody may not be aware that plaster has the property of absorbing moisture. This, perhaps, will not take place in rooms where a fire is kept steadily; but in rooms left, as is often the case, for weeks without a fire, the walls will take up a considerable quantity of damp. The effect will be injurious to the health of the inmates. There are few persons who have not suffered from a mysterious cold, caught they know not how, though, perhaps, damp in the plaster had something to do with it.

The extent to which damp is absorbed in a plastered wall may be discovered by noticing what so often takes place in rooms where the walls are painted and have become chilled by a season of cold weather. As soon as the temperature becomes warmer the atmosphere is condensed on the walls, and at times in such quantities as to run off in streams. Now, had it not been for the paint, the greater portion of this moisture would have been absorbed by the plastered walls. And as a consequence the quality of the plaster would have been impaired and the room made unwholesome. In view of this defect in plastered walls, it becomes a question well worth considering, whether, in finishing a house, the walls should be papered or painted. If paint is decided on, it is highly necessary that the painting be properly done and good materials employed. White lead, which is the chief ingredient of all paint used, is of late years heavily adulterated—a reason why some painters can do work so much cheaper than others. There are also dishonest painters who will lay on nothing but "whiting" and size for the first coat, and finish off with one coat of oil paint. It is not easy to detect the fraud at the time, but as such paint soon wears off the wall, and attaches itself to the garments of those who rub against it, the customer speedily finds out that he has been cheated. It takes three or four coats of good oil paint honestly laid on to make good work of painting plastered walls.

In painting walls there is ample scope for taste, and such colors may be chosen as are most suitable for each apartment, and in harmony with the furniture. Apartments lighted from the south and west, particularly in a summer residence, should be cool in their coloring; but the apartments of a town house ought all to approach toward a warm tone. In a drawing room the coloring should be characterized by vivacity, gayety, and light cheerfulness; by light tints of brilliant colors with a considerable degree of contrast and gilding—the walls being kept in due subordination to the furniture, though partaking of the general liveliness. The characteristic coloring of dining rooms should be warm, rich, and substantial, without vivid contrasts, and gilding should be avoided, unless in small quantities for the sake of relief. Parlors ought to be in a medium style, between that of a drawing room and dining room. Libraries should be solemn, grave, and quiet in color and finish, while bedchambers should be light, cleanly, and exceedingly cheerful. A greater degree of contrast between the room and its furniture may be admitted in the chamber than in any other apartment. Stairways, halls, and vestibules should be of a cool tone and simple in their style of coloring, being in that what they are in utility—a link between the exterior simplicity of a house and its interior richness and comfort.

Mr. Gary has the Last Word.

To the Editor of the Scientific American:

As your correspondent "E.," in your issue for May 17, page 304, has made some misstatements, will you allow me to correct him? In referring to a letter written by me and published by you, April 5, he says, "Mr. Gary's knowledge of history is as defective as his knowledge of magnetism and electricity," and he advises me, before I write any more history of science, to be at the pains of studying it a little more carefully.

Allow me to say that all the history I attempted in the letter referred to was the following sentence: "The law of gravitation was not discovered in a laboratory, nor was the power of steam nor electricity." This is all the history that I attempted, and the SCIENTIFIC AMERICAN, which your correspondent will acknowledge is good authority, remarked in regard to this, in the same number in which it appeared, that "everybody will agree with what our correspondent says about laboratory discoveries, Newton and the apple, Franklin and the kite string."

Your correspondent E. also holds up before your readers a list of honored and respected names as martyrs to "conceited ignorance, and mutilated and outraged history," and tries to vindicate history and himself by making other misstatements. He says: "Mr. Gary brags that he is ignorant of what others have done." I humbly acknowledge that I do not know it all, but I never brag about it. As to his assertion that Professor Henry advised me to buy $50 worth of books and study up on magnetism before wasting more time, I have to say that Professor Henry never said anything of the kind. Another eminent scientist made a similar remark before he saw my discovery, but after seeing it, he advised me to go ahead.

Let us hope your correspondent's knowledge of history and science is more accurate than his assertions in regard to current events. It is to be feared that "much learning hath made him mad." W. W. GARY.

Boston, Mass.

Malleable Nickel and Cobalt.

Fleitmann has succeeded, by a very simple device, in obtaining cast nickel in a malleable and ductile form, even when cold, while cobalt prepared in the same manner possessed such hardness when cold that he expects it can be used for cutting instruments, while hot it is both malleable and ductile. His process consists in adding to the fused metal, through a hole in the lid of the crucibles, ½ per cent of metallic magnesium, which possesses a remarkable power of destroying carbonic oxide. The author is of the opinion that the porous and crystalline character of cast nickel is due to its absorption of carbonic oxide gas while in a molten state. It is not impossible, however, that owing to the great affinity of magnesium for nitrogen, its action may be due to the destruction of cyanogen in the metal.

Cobalt prepared in this manner possessed none of the reddish color attributed to it in the text-books, but actually excelled nickel in whiteness and brilliancy.

He also welded these metals on to iron and steel at a white heat, and strips thus welded were rolled out to the finest number without separating from each other.—*Berichte d. d. ch. Ges.*

SOOT FOR ROSES.—Collect some soot from a chimney or stove where wood is used for fuel, put into an old pitcher, and pour hot water upon it. When cool, use it to water your plants every few days. The effect upon plants is wonderful in producing a rapid growth of thrifty shoots, with large thick leaves and a great number of richly-tinted roses.

Plantains and Bananas.

Of all plants which are the produce of the tropics, none are superior in interest to the plantains and bananas, two closely allied species of the genus *Musa*. Of the several species of this genus, one has received the specific name of *paradisiaca*, under the supposition that it was the "tree of life," or the "tree of the knowledge of good and evil," spoken of in the Scriptures. St. Pierre observes that the violet cone at the end of a branch of plantains, with the stigmas peering through like gleaming eyes, might well have suggested to the guilty imagination of Eve the semblance of a serpent tempting her to pluck the forbidden fruit it bore, as an erect and golden crest. Though some of the species attain a height of 20 to 30 feet, they are herbaceous plants, growing up, flowering, fruiting, and then dying down to give place to other shoots from the same root. The fruit ripens in succession from the base to the apex of the flowering stem, so that on the same plant flowers and ripe fruit will be found associated. One stalk of fruit will attain three feet, and bear from 120 to 150, even 180 plantains, the entire weight of which would be from 50 to 70 lb. Dried plantains form an article of internal commerce in India, and, in a few instances, have been exported. When deprived of their skin and dried in the sun, they are reduced to meal, in great request in the West Indies for children and invalids. A recent French exchange states that efforts are being made in Venezuela to get up an export trade for meal of this sort, the supply being much greater than the home demand. Professor Johnston states that the fruit approaches most nearly in composition and nutritive value to that of the potato, and the meal to that of rice.

All the species contain a large number of spiral vessels, and afford a strong and valuable fiber, from which cloth and cordage are made. The substance called manila hemp, much employed for cordage in America and Europe, is obtained from one of the species (*Musa textilis*). Scarcely any parts of these useful plants are devoid of use to man. A limpid fluid issues from wounds in the body of the plant, which is used in medicine, as is also the root. It has been recently stated in a foreign medical journal that the property which these plants possess of keeping the surrounding soil moist (as pointed out by Boussingault) has been taken advantage of to afford shade and moisture to the coffee plant in Venezuela; and that the cultivation of the latter has therefore been greatly increased.

Still another industrial use has lately been proposed for the fruit in the latter country, this being the distillation of brandy. Banana brandy, even from the first distillation, is said to have a pleasant taste and smell, recalling that of the fruit. It contains 52 per cent of alcohol. As two hundredweight of the fruit produces about ten quarts of alcohol of 96°, banana brandy may yet be destined to play as important a part in economy as the alcohol of the sugar cane.

Ramie Fiber and its Manufacture.

This fiber, the utilization of which in textile manufactures has for many years engaged the attention of practical men, still continues to command a large amount of notice. It is undoubtedly deserving of all it receives, because if the difficulties that have hitherto stood in the way of its extensive use can be overcome, we shall have at command a fiber that will do much to emancipate manufacturers from dependence upon the American cotton, the Russian flax, and the Italian and Chinese silk crops. Besides the independent position it would take on its own merits, it possesses qualities that would enable it to be substituted, by means of a little ingenuity, for any of those fibers. If it can be produced sufficiently cheap it may even become a permanent substitute for one or more of them, and to a considerable extent displace them. Whether such an occurrence would be an advantage or otherwise time only could reveal.

During the past month we have had submitted to our notice some specimens of goods manufactured entirely from the rhea plant fiber. The raw material in its dried state, as it is taken in the first process, was shown. This is a pliant, reddish brown, straw-like substance. After passing through the first stage it yields a long, light flaxen-colored fiber, of great strength and fineness, and which appears to be divisible to an extreme degree. The next forms in which it was exhibited were in wet spun and dry spun yarns. In the former it possessed a solidity which gives it a somewhat wiry appearance and great strength; in the second it is almost as soft as wool, and may almost be mistaken for it. These yarns wrought into cloth display similar characteristics. One specimen appears very much like a good brown Hessian, and another a Belfast brown linen. A third had passed through the bleaching process, and showed its capability of being adapted for table linen, napkins, diapers, etc. It bleaches clearly and evenly, coming up of a rich pearly whiteness, with a cool, pleasant feel, but with more fiber on the face of it than a linen article would possess. In each phase of it the distinguishing features are great strength and probable durability. In another case the fiber had been reduced to its finest condition, spun into a soft, pearly-white hosiery yarn, and worked into an undershirt, possessing all the softness, luster, and beauty of a similar article in silk.

So far as the samples allowed us to discover, it would appear to be free from the distinguishing fault of China grass, from which creases cannot be removed. The inventor stated that he had numerous other fabrics woven from yarns entirely of this fiber, such as dress goods, ribbons, dyed and printed fabrics, either completed or in process, and which could be shown when necessary. The specimens exhibited formed an interesting display, the importance of which, however, depends entirely upon whether, as affirmed, they have been produced by a process and at a cost that will enable the rhea fiber to take its position in commercial markets as a practically useful article.—*Textile Manufacturer.*

THE EDIBLE MUSSEL.

The common edible mussel, *Mytilus edulis*, attracts our special attention on account of its value as an article of diet and commerce.

In the accompanying engraving, Fig. 1 shows the animal laid open to view, the left half of the triangular shell having been removed, while the brim of the mantle has been thrown back a little to allow a better inspection of the inner organs. Both parts of the shell are alike in shape and size. The hinge or lock uniting them is located in the smallest

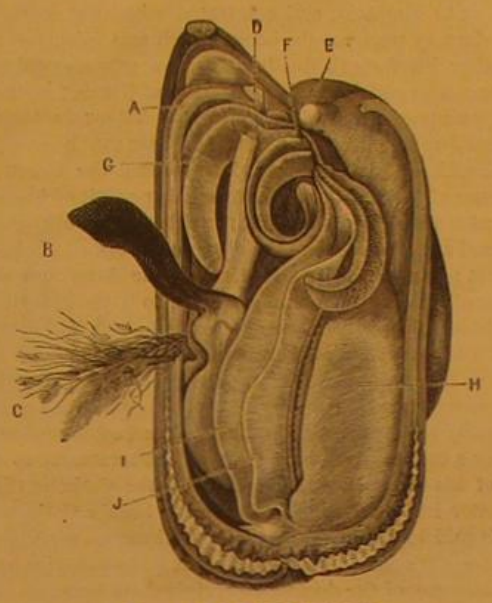


Fig. 1.—EDIBLE MUSSEL.

angle of the triangle formed by the shell, and both of the latter end at this point in short conical elevations. At the opposite end there is a small opening in the shell corresponding to the anus of the mussel; and in close proximity runs a short fringed tube connecting with the inner organs of respiration.

The peculiar digital form of the foot and the presence of a spinning gland or byssus are characteristic, and both are undoubtedly related to the stationary mode of life of the animal. The hypothenuse of the shell being the face side of the mussel, A is the brim of the mantle of the latter. On both

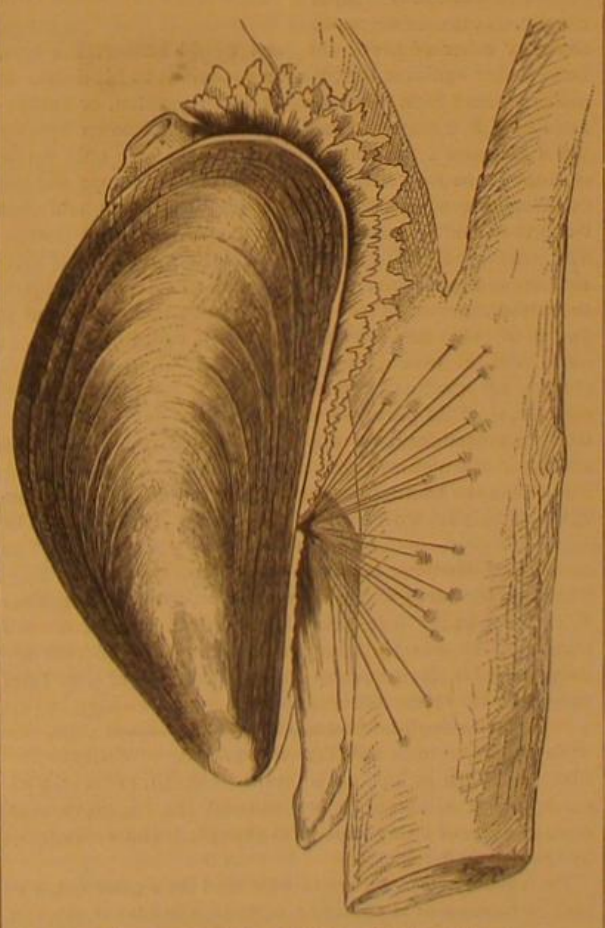


Fig. 2.—EDIBLE MUSSEL.—(*Mytilus Edulis.*)

sides of the mouth, F, will be noticed the long, narrow, folded tentacles, G; J is the exterior, I the interior respiratory muscle; E and D are muscles controlling the foot, B, under and behind the base of which is situated the byssus or spinning gland. From its cavity a groove extends along the lower side of the foot, and ends at its tip in a transverse cavity containing a small plate, perforated by seven small apertures, used for sucking.

By means of the foot and the byssean gland the animal is enabled to spin a net or barb, C, consisting of numerous thin threads, attached firmly to the surface of the rock or other object forming its abode. These threads are produced from a viscid liquid substance secreted in the byssean gland, which is sucked up into the apertures of the end of the foot and drawn out into threads, which become quite firm in a short time. Once attached to a rock or log they resist the action of the strongest current and the heaviest gale. Fig. 2 is a correct representation of the mussel as attached to a fixed object.

If the mytilus desires to change its residence it draws itself forward as far as possible, and attaches a few threads as far ahead as the foot reaches. At the same time a few of the old threads are severed. This manipulation is repeated until a suitable site is reached. Although this mode of locomotion is extremely slow, the animal nevertheless manages to traverse considerable distances in this manner.

The edible mussel inhabits, by preference, those portions of the shore which are laid dry at low tide; and in the neighborhood of the mouths of rivers, where the percentage of salt in the water is low, broad thick bands may be observed covering that particular section and marking it distinctly. Sometimes as many as 2,000 individuals have been counted on an area of one square foot.

As above mentioned, the animal prefers water containing only a little salt. It abounds, therefore, especially in those European waters cut off partly from free communication with the Atlantic, as in the German North Sea, the Baltic, and the Adriatic. They have also been acclimatized in the Caspian Sea, the water of which is not extremely salt.

In northern waters the edible mussel attains its full size in four to five years, and in the Mediterranean in one to two years. When they propagate each individual produces (they being hermaphrodites) millions of offspring.

Besides being almost indispensable as bait for certain fish, they are extensively used as an article of food. They are largely cultivated in all European waters, in so-called "parks." In the North Sea these consist of large numbers of trees, from which the smaller branches only have been cut, and which are planted in the bottom of the sea at such a distance from the shore that their upper portion is partially laid bare at low water. After four or five years they are raised, stripped, and replaced by others. In the bay of Kiel, Germany, alone about 1,000 of these trees are annually planted and about 1,000 tons of mussels are brought on the market. Bad seasons occur, however, both with respect to quality and quantity, owing to various causes. In the Adriatic the mussels are raised on ropes extended between poles rammed into the ground. The ropes are raised and stripped once in eighteen months.

American Sumac.

Dr. William McMurtrie, Chemist of the Department of Agriculture, has been making elaborate investigations as to the relative amount of tannic acid and coloring matter in American and Sicily sumac. He finds the American product, when properly gathered, to be fully equal to the foreign. Samples of Winchester, Va., sumac were collected in the months of June, July, and August respectively. Of these samples those collected in June and July were mixed varieties, and of the product collected in August we secured samples of the leaves of *Rhus glabra* and *Rhus copallina* separately.

In reporting his experiments Dr. McMurtrie states that in some of the tests the precipitates obtained by means of the solution of the June collections of Winchester mixed sumac were perfectly white and very much cleaner than any obtained with the Sicilian product. "The difference in the color of the precipitates obtained from the solution of the June collection and that obtained from solutions of the samples of later collections, was sufficiently marked to prove that the great difficulty in the way of the universal employment of the American to the exclusion of the expensive Sicilian product may be obviated by making our collections early in the season—that is, in the month of June. The percentage of tannic acid is not, it is true, quite as high as obtains in July, but it compares favorably with the Sicilian product, which, be it remembered, communicates a slightly yellowish tinge to the gelatine precipitate. The amount of coloring matter found in the July collection is sufficient to account for the difference of $50 a ton in the market values of the sumac of home and foreign growth, regardless of the proportion of tannic acid. We would therefore advise that, for the purpose of tanning white and delicately colored leather, the collection be made in June, while for tanning dark colored leathers, and for dyeing and calico printing in dark colors, where the slightly yellow color will have no injurious effect, the collections be made in July. It appears that for all purposes the sumac collected after the 1st of August is inferior in quality. In view of the facts here presented, we cannot help urging upon manufacturers the importance of encouraging the home production—of insisting that the collections be made early in the season, in order thus to bring about such a change in this matter as to prevent the annual expenditure of over $600,000 in gold for the sumac of foreign growth."

NEW AGRICULTURAL INVENTIONS.

An improved trap attachment for corn cribs, patented by Mr. Adam Harper, of Boswell, Ind., consists in combining with the raised and slatted bottom of the corn house a series of swinging side racks that rest inwardly on a subjacent floor.

Mr. James W. Rudolph, of Carmi, Ill., has devised an improved agricultural implement, that is adapted for both hoeing and digging, and is easily adjusted for either use.

A machine for dropping corn and other seed at regular intervals, and also dropping at the same time a regulated supply of fertilizing material into the hill, has been patented by Mr. Geo. W. Miller, of Fawn Grove, Pa.

An improvement in harrows, patented by Mr. George Lettenmyer, of Little Georgetown, W. Va., consists in an arrangement of yielding teeth, which renders the draught of the implement light, and lessens the chance of breakage.

Mr. Henry M. Keller, of Newark, O., has patented an improved harrow having teeth of peculiar form, and provided with a clod crusher, that breaks up the clods as the harrow advances.

GERARD MERCATOR, THE COSMOGRAPHER.

Gerard Mercator, the cosmographer, and inventor of the map projection which bears his name, was born on the 5th of March, 1512, in the small town called Rupelmonde, in East Flanders, about eight miles from Antwerp. He was the youngest of six children of a poor shoemaker. Losing both parents at an early age, he was kindly cared for by a great-uncle, to whom he became indebted for the advantage of an education in the best schools of the Netherlands. At the age of eighteen he entered the University of Louvain, where he was eventually matriculated under the faculty of arts, which nearly corresponded with the faculty of philosophy in a modern German university. Remaining at Louvain till his removal to Germany, he at first devoted himself to philosophical studies of such abstruse subjects as the origin, nature, and destination of the physical universe, and became absorbed in the great problems of science and revelation. He found it impossible to reconcile the Mosaic account of creation with the doctrines of Aristotle. Here he began to tread upon dangerous ground, for in Louvain, as at Paris, the authority of Aristotle in the domain of physical philosophy was sacred and supreme. To dispute or question the perfect consistency and harmony of his teachings with those of the church was heresy. Finding no one to sympathize with him in his doubts, Mercator left Louvain and secluded himself for study at Antwerp for several months; but whatever skeptical views he may have had in regard to the divine inspiration of the Scriptures were dispelled before he returned to Louvain.

As Mercator grew older he began to turn his attention to the practical problem as to the best means of earning a livelihood. Having obtained permission from the Faculty of Arts of the University of Louvain to give private instruction in mathematics, he thus began to support himself; and having previously chosen for his vocation the manufacture of mathematical instruments, he was thus enabled to establish a workshop of his own, where he manufactured astrolobes, astronomical rings, globes, etc., of great accuracy.

As a chartographer, Mercator appears to have begun his career by the publication of a map of Palestine, at Louvain, in 1537. Increased interest in religious matters naturally led to an increased demand for such maps. No copy of this has come down to us; but it seems to have been well received, as it was highly praised by his contemporaries. His next work was a map of Flanders, undertaken at the request of certain Flemish merchants. He traveled over the country, making surveys and measuring heights and distances. It took three years to complete the work, and it was published at Louvain in the year 1540. A masterpiece of his handiwork, at this period of his life, was a large terrestrial globe, which he finished in 1541. This is now lost, but the original drawings for its exterior surface are still preserved at Brussels. This became the means of commending him to the favor of Charles V., from whom he received an order for a complete set of mathematical instruments for use on his expeditions. About this time he was maimed. In 1544, there occurred in his life an incident which has been only recently brought to light—he was imprisoned as a heretic. It appears that an imperial edict was issued at Brussels, by Mary, queen dowager of Hungary, condemning all heretics to death. Under the operation of this edict, forty-three citizens of Louvain, Mercator among the number, were accused of participation in what was styled the "Lutheran heresy."

We have no information as to the cause or circumstances of Mercator's discharge from imprisonment; all is shrouded in mystery; we can only glean from the records of the time that he must have been imprisoned nearly four months. After his release he resided at Louvain seven or eight years. He made a new set of instruments for the Emperor, to replace the former, which had been destroyed; and completed and dedicated to the Bishop of Liege a celestial globe of the same size and style as the terrestrial one which he had before presented to Granville.

In 1552 he removed to Duisburg, in Germany. Here he shortly after completed for the Emperor an astronomical ring and a set of globes elegantly equipped and ornamented. There was a celestial globe of glass or crystal, and on it were engraved the constellations with a diamond. Inside of this was a terrestrial globe of wood. Attached to this set were a compass, an hour circle, a quadrant of altitudes, and other instruments. In 1554 Mercator published at Duisburg a large map of Europe, which, more than any other work of his, contributed to his fame as a chartographer among his contemporaries. This is now lost, although a reduced copy of it published by his son still exists. In 1564 he published a map of Great Britain; in the same year, a map of Lorraine, based on a trigonometric survey made by himself. In 1569 he made his first appearance, after his removal to Duisburg, as the author of a printed book—a folio volume on chronology, written in Latin and published at Cologne.

Even after the discoveries of the 15th and 16th centuries, and in the lifetime of Mercator, the works of Ptolemy were still regarded as the groundwork of all geographical knowledge. Mercator was a great admirer, but not an implicit follower, of this author, and in 1578 published a corrected and revised edition of the maps or charts of Agathodæmon which accompanied the work of Ptolemy. Six years later, he republished this collection of charts, twenty-seven in number, together with the text of Ptolemy's eight books on geography. This work added greatly to the reputation of Mercator as a geographer and scholar, and is still held in high estimation by modern authorities.

We now come to the work of Mercator commonly known as his Atlas of Modern Geography, and which he did not live to complete. The modern application of the word "atlas" we owe to Mercator, and originated with this work. The introductory pages of the book, which was published by his son after his father's death, contain a genealogical tree of the ancestors and descendants of Atlas of Grecian Mythology, who, as a punishment for leading the Titans in their war against Jupiter, was condemned to bear the heavens upon his shoulders. As Humboldt has adopted the Greek word "Kosmos" as a title to the crowning work of his life, so Mercator adopted "Atlas" as the title to the work which he planned and projected as the crowning work of his life. He did not mean to call it an Atlas, or the Atlas, but simply "Atlas." He never intended to give to it the generic sense in which it is now used, as applicable to any and every collection of maps; but as there was no word in the classical or modern languages that had done such service, the title was borrowed in course of time by other chartographers, until it has gradually lost its special application, and come to designate simply a collection of maps. From the treatment to which two of his works were subjected by the Catholic Church, Mercator has been supposed to have been a Catholic; but this is said to be an error. His posthumous work on the creation was condemned in the Index Expurgatorius because its treatment of the doctrine of original sin bore too close a resemblance to the teachings of Luther; and his chronology was prohibited on account of the extracts contained in it from writings that had been condemned. Mercator, having lost his wife in 1586, married again. His second wife was the widow of a burgomaster of Duisburg. The issue of his first marriage was six children, three sons and three daughters. He died in December, 1594.

The fame of Gerard Mercator rests chiefly upon his achievements in the department of mathematical geography and chartography. He is known to us, principally, as the inventor of the projection which bears his name. The value of what is now known as the "Mercator Projection" was so little appreciated at first that his successors did not deem it of sufficient account to place it in the Atlas of Modern Geography. If it ever occurred to the inventor that this rather than any other of his productions would immortalize him, he probably banished the idea long previous to his death. It seems to have been thrown aside and forgotten, or only remembered as a scientific curiosity. It is unknown exactly when Mercator's projection was first used; we only know that about the year 1630, the French seaport Dieppe was the principal emporium for the sale of nautical charts, and that those then sold at that place were mostly on this projection. The practical signification of Mercator's projection is this: He says to the mariner: "If you wish to sail from one port to another, here is a chart and a straight line on it, and if you follow this line carefully, you will certainly arrive at your port of destination. The length of the line is not correct, yet it points exactly in the right direction. Consequently, if you follow the line, you may get to your destination sooner than you expect, or you may not get there as soon. But you will certainly get there."

Such are the leading features in the life of one to whom Malte-Brun paid an eloquent and fitting tribute when he said: "Modern geography dates from Mercator." The memory of Mercator has been sadly neglected by the English speaking races, and until the recent paper of Mr. Elial F. Hall before the American Geographical Society, no full account of his life has appeared in our language. We are indebted to Mr. Hall's paper for the materials of this brief sketch of the celebrated cosmographer.

DAVID PAGE.

In the death of Professor David Page, LL.D., which occurred at his residence, Newcastle-on-Tyne, March 9, geology loses one of its most popular expositors and voluminous, and practiced writers.

Professor Page was born in Fife, and the earlier years of his life were spent in literary occupations in his native country. Subsequently he entered the employ of Messrs W. & R. Chambers, of Edinburgh, and took an active part in the preparation of their large series of educational works. During his connection with this house, the once-celebrated but now half-forgotten "Vestiges of Creation" made its appearance. Although Robert Chambers has always been credited with the greater share of this anonymous volume, Page is supposed to have lent powerful assistance with his versatile pen. Leaving the service of the Messrs. Chambers, he embarked on the sea of successful authorship, and, following in the wake of Hugh Miller, kept up an interest in geological science, by his voluminous writings, which were characterized by a graceful and easy style not usually possessed by scientific men. He rewrote his "Introductory Text-Book of Geology," and prepared an advanced text-book on the same science. He also published works on physical geography, and various popular works on geological subjects. Taking up the study originally as an amateur, he ultimately devoted himself to it professionally, although he is not credited with much original power as an observer. In fact, field work for him was almost impossible, owing to physical infirmity, yet he had a most lucid and pleasing way of presenting the discoveries of others before non-scientific readers. On the establishment of the College of Physical Science, at Newcastle, he was chosen Professor of Geology. Here he pursued his vocation with much zeal and success until within a short period of his death. He was in the sixty-fifth year of his age.

The New Northwest.

In a long review of the condition, prospects, and possibilities of the vast and comparatively undeveloped country lying to the north and west of Minneapolis, Minn., the *Northwestern Miller* says that the Northern Pacific Railroad passes nearly through the center of the finest wheat region on the face of the earth. Nearly 300 miles further north another great trans-continental railway is being constructed, and our Canadian neighbors even contemplate building a railroad having its northern terminus on the shores of Hudson's Bay. It will thus be seen that to the north and west of Minneapolis is a vast and productive agricultural region, extending far up into the British possessions on one side, and losing itself in the mountains of Montana on the other. It is capable of producing wheat enough to supply the world, and the water powers of Minnesota alone are capable of converting the larger part of its product into flour. It embraces within its limits immense forests of pine and hard wood, and mines of iron, copper, silver, and gold. Nature has provided in abundance the elements necessary to the support of a great population, and the population is now coming.

It is only within the last few years that a systematic effort has been made to develop this valuable section of the national domain. The success of the pioneer settlers has been such as to attract the attention of others seeking homes in the West, and the stream of immigration thus started has suddenly swollen to gigantic proportions. Last year the settlers poured into Western Minnesota and Eastern Dakota by thousands; this year they are coming by tens of thousands. As yet only a tithe of the magnificent wheat lands of the western portion of this State are under cultivation, and the sod of the greater part of Dakota's fertile prairie is unbroken. There is a steady exodus from the eastern part of this State and from Wisconsin and other States, of young men and old men, to the "promised land," which, if it does not literally flow with milk and honey, does promise an abundant harvest and a competence to those who are willing to work hard and wait patiently.

It cannot be doubted, the *Miller* remarks in another connection, that this great accession to the wheat growing territory of the United States will have a marked influence on the milling industry of the country. With an abundant supply of breadstuffs prices must rule low, and the margins in flour manufacturing be small. Every effort of inventive skill will be made to cheapen the manufacture and better the product. The inevitable result must be that the making of wheat into flour will be done in large mills employing immense capital, and that the class of small combined merchant and custom mills will become a thing of the past. The present high standing of spring wheat flour, which many have thought and some have hoped would be lost with the exhaustion of the Minnesota wheat fields, will be maintained through the superabundant supply of the choicest kinds of hard wheat from the new fields now being opened.

Scientific Views of Nature.

Who does not see that Galileo, Descartes, Newton, Lavoisier, Laplace, have changed the foundation of human thought in modifying totally the idea of the universe and its laws, in substituting for the infantile imaginings of non-scientific ages the notion of an eternal order, in which caprice and particular will have no thought? Have they diminished the universe as some think? For my part I think the contrary. The skies as we see them are far superior to that solid vault spangled with shining dots and upborne some leagues above us by pillars which contented the simpler ages. I do not much regret the little spirits that had wont to guide the planets in their orbits; gravitation does the work much better, and if at times I have a sad remembrance of the nine angelic choirs wheeling round the orbs of the seven planets and for the crystal sea that lay at the feet of the Eternal, I console myself with the thought that the infinite into which we look is really infinite, and a thousand times more sublime to eyes of true contemplation than all the azure circles of Angelico of Fiesole. M. Thiers rarely allowed a fine night to pass without gazing upon that boundless sea. "It is my mass," he said. In how far do the chemist's profound views upon the atom surpass the vague notions of matter on which the scholastic philosophy was fed!—*Renan.*

Clothes Moths.

To keep furs and woolen goods from moths close wrapping in paper is enough, though a little camphor may be put into the package to keep off other insects. Any paper will do if there are no holes in it, and no openings are left for the moth to creep in. Of course care must be taken to have the articles free from moths when put away.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

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

The new fragrant Vanity Fair Cigarettes. New combinations of rare Old Perique and Virginia.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Wanted.—We wish to do Drop Forgings in exchange for new or good second-hand Milling Machines. W. H. Baker & Co., Syracuse, Makers of Breech-loading Guns.

Wanted—The address of Manufacturers of Kerosene Street Lamps. R. H. Frazee, Toledo, Iowa.

Patent Paper Boxes as applied to all wrapping purposes. Send for sample, stating size, to Wm. Meschenmoser, 120 William St., New York.

Downer's Anti-Incrustation Liquid, for the removal and prevention of scale in steam boilers, is safe, effective, and economical. Fully guaranteed. Try it. 17 Peck Slip, New York.

We have opened a sample depot for American goods, and wish to negotiate with manufacturers seeking Spanish markets. We shall be glad to receive catalogues, price lists, and samples of American products. Address Herrero Hermanos, Cadiz, Spain.

Having enlarged our capacity to 96 crucibles 100 lb. each, we are prepared to make castings of 4 tons weight. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Vertical Engines. F. C. & A. E. Rowland, N. Haven, Ct.

Howard Patent Safety Elevators. Howard Iron Works, Buffalo, N. Y.

Wanted—Consignments of Machinery, on commission, new store near Liberty St. Superior advantages. No charge for storage. Address P. O. Box 1012, New York.

Just Published.—A complete history of the Steam Engine, 450 pages, 163 illustrations, and 15 portraits. Price by mail, $2.50. Send for circular. Frederick Keppy, Scientific Book Publisher. Bridgeport, Conn.

Self-feeding Upright Hand Drilling Machines of superior construction. Pratt & Whitney Co., Hartford, Ct.

H. W. Johns' Asbestos Liquid Paints are in use by the United States Navy and Treasury Departments (lighthouse and life saving stations), and on the United States Capitol at Washington.

"Workshop Receipts" for Manufacturers, Mechanics, and Scientific Amateurs. Illustrated. $2, mail free. E. & F. N. Spon, 446 Broome St., New York.

For Sale Cheap.—A few State Rights for a Clothes Line Fastener, just patented. John A. Worley, Cleveland, O.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing. Address Star Tool Co., Providence, R. I.

Shaw's Noise Quieting Nozzles subdivide the steam into numerous fine streams. All parties are cautioned against purchasing from infringers. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

For Sale.—A New No. 5 Stiles & Parker Geared Punching Press; latest and best; cheap; no use for it. B. D. Washburn & Co., Boston, Mass.

Lincoln's Milling Machines; 17 and 20 in. Screw Lathes. Phœnix Iron Works, Hartford, Conn.

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Boilers ready for shipment. For a good Boiler send to Hilles & Jones, Wilmington, Del.

The only Portable Engines attached to a boiler having cold bearings. The Peerless and Domestic. Francis Hershey, successor to F. F. & A. B. Landis, Lancaster, Pa.

Magnets, Insulated Wire, etc., for experiments. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Shaw's Mercury Gauges, 5 to 50,000 lbs.; accurate, reliable, and durable. T. Shaw, 915 Ridge Ave., Phila., Pa.

New Pamphlet of "Burnham's Standard Turbine Wheel" sent free by N. F. Burnham, York, Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Use H. W. Johns' Asbestos Roofing.

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A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

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For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Forsaith & Co., Manchester, N. H., and 213 Centre St., New York. Specialties.—Bolt Forging Machines, Power Hammers, Combined Hand Fire Engines and Hose Carriages, new and 2d hand machinery. Send stamp for illustrated catalogues, stating just what you want.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

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The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Portland Cement—Roman & Keene's, for walks, cisterns, foundations, stables, cellars, bridges, reservoirs, breweries, etc. Remit 25 cents postage stamps for Practical Treatise on Cements. S. L. Merchant & Co., 53 Broadway, New York.

Steel Castings true to pattern, of superior strength and durability. Gearing of all kinds. Hydraulic cylinders, crank shafts, cross heads, connecting rods, and machinery castings of every description. For price list and circular, address Chester Steel Castings Company, 407 Library St., Philadelphia, Pa.

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Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

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Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Rubber Hose, Suction Hose, Steam Hose, and Linen Hose; all sizes. Greene, Tweed & Co., 18 Park Pl., N.Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Best Power Punching Presses in the world. Highest Centennial Award. A. H. Merriman, W. Meriden, Conn.

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Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 93 Liberty St., N. Y. city, U.S.A.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N.Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Manufacturers of Improved Goods who desire to build up a lucrative foreign trade, will do well to insert a well displayed advertisement in the SCIENTIFIC AMERICAN Export Edition. This paper has a very large foreign circulation.

NEW BOOKS AND PUBLICATIONS.

JOURNAL OF THE SOCIETY OF TELEGRAPH ENGINEERS. London and New York: E. & F. N. Spon.

No. 24, Vol. VII., contains proceedings of meetings held November 13 and November 27, 1878. At the first meeting two valuable papers were read: "Cable Grappling and Cable Lifting," by A. Jamieson, and "Grapnels for raising Submarine Cables in Deep Water," by Francis Lambert. Both papers are abundantly illustrated, as also is the paper read at the later meeting by Major C. E. Weber, describing multiple and other telegraphs at the Paris Exhibition.

THE FLORA OF RICHMOND COUNTY, NEW YORK: By Arthur Hollick and N. L. Britton. 8vo, paper, pp. 36. Price 50 cents.

Students of botany in and about New York will find this a handy catalogue of the flora of Staten Island. The notes indicating frequency, localities, and so on, will be specially helpful to collectors. The list contains some rare plants, and comprises nearly all those enumerated by Torrey as found within fifty miles of New York.

IMPROVED DWELLINGS FOR THE LABORING CLASSES. New York: G. P. Putnam's Sons. 8vo, paper, pp. 45. Price 30 cents.

An uncommonly valuable pamphlet, showing how the greatest and most urgent want of New York city, cheap and wholesome housing for the poor, can be profitably met. The success of Mr. Alfred T. White in providing such tenements in Brooklyn proves beyond question that, as a speculation, properly constructed tenements for the laboring classes in New York will pay their builders handsomely; while the moral, social, and sanitary advantages of such buildings to the city, would be incalculable.

ECONOMIC MONOGRAPHS. New York: G. P. Putnam's Sons. 12mo, paper. Each 25 cents.

No. 11 of this series of pamphlets contains the Hon. Carl Schurz's address on Honest Money and Labor, delivered in Boston, last October. It may be read with profit by any one inclined to harbor "inflation" notions.

No. 12, of kindred spirit, is a discussion of the history and merits of the present system of National Banking, by M. L. Scudder, Jr.

No. 13, Hindrances to Prosperity, is a lecture on causes which retard financial and political reforms in the United States, delivered before the New York Free Trade Club by Simon Sterne.

No. 15 considers International Copyright in some of its relation to ethics and political economy. The author, Mr. George Haven Putnam, puts very forcibly the ethical and political reasons for making the legal recognition of brain work as property independent of national boundaries.

THE ART OF SCIENTIFIC DISCOVERY. By G. Gore, LL.D., F.R.S. London: Longmans, Green & Co. 12mo, pp. 648.

Dr. Gore aims to describe the nature of original scientific research, the chief personal conditions of success in its pursuit, the general methods by which discoveries are made in physics and chemistry, and the causes of failure. Believing that original research is an art and not a science, a method of practical study, not a collection of laws, Dr. Gore endeavors to show how the investigator must proceed if he hopes for success. Whilst great aptitude for scientific discovery must, he says, like any other rare and peculiar ability, be born in the man, it is certain that it may, like those other natural abilities, be assisted by advice and developed by experience; and out of the stores of personal experience as an investigator, and a wealth of fact and illustration gathered from the experiences of others, the attempt is made to show how steady thought, self development, industry, and perseverance, rightly guided, may lead to valuable discoveries. The work will prove a useful addition to any student's library. It is well indexed.

COAL: ITS HISTORY AND USES. Edited by Professor Thorpe. London: Macmillan & Co. 1878. 8vo, pp. 363. Price $4.

Ten admirable lectures on coal, by Professors Green, Miall, Thorpe, Rucker, and Marshall, of the Yorkshire College, England. The geology of coal is treated by Professor Green; the plants and animals of the coal period, by Professor Miall; the chemistry of coal by Professor Marshall, who also discusses at length the coal question in its broader industrial, commercial, and political aspects. Professor Rucker discusses coal as a source of warmth and power. Unitedly these lectures make by far the most readable treatise on coal yet produced. It is at the same time singularly strong, and full of fresh and important information, as a contribution to popular science. The work is illustrated by fifty-seven wood cuts, and is well indexed.

THIRTY-SEVENTH ANNUAL REPORT OF THE BOARD OF EDUCATION, OF THE CITY AND COUNTY OF NEW YORK.

The New York Board of Education has now 261 schools and departments under its control, on which about $3,000,000 are annually expended. The total number of pupils enrolled is about 240,000, with an average attendance of nearly half that number. There are besides 15 corporate schools participating in the school fund, with an average attendance of nearly 10,000.

A REVISED LIST OF THE BIRDS OF CENTRAL NEW YORK. By Frank R. Rathburn and others. Auburn, N. Y. 8vo, paper, pp. 45.

This list is highly commended by Dr. Elliott Coues as worthy of being regarded the leading authority upon the Ornithology of Central New York.

PROGRESSIVE JAPAN. By Gen. Chas. W. Le Gendre. San Francisco: A. L. Bancroft & Co.

In this critical study of the political and social needs of our next neighbor to the West, General Le Gendre has not failed in his design to throw light, and very clear light, upon the present situation of affairs in the Mikado's Empire. He has gone further, and by tracing historically the influences involved in the recent and progressive transformation of the social and political condition in Japan, he has made possible an intelligent forecast of the future of that remarkable people.

FUEL: ITS COMBUSTION AND ECONOMY. Philadelphia: Henry Carey Baird & Co. 12mo, pp. 394. $2.25.

This volume contains an abridgment of C. Wye Williams' treatise on the combustion of coal and the prevention of smoke; T. Symes Prideaux's work on the "The Economy of Fuel;" and a review by the editor, D. Kinnear Clark, of recent practices in the combustion and economy of fuel. In the latter part will be found much fresh information touching the use of other fuels than coal, and description of recent devices for utilizing waste heat and for the use of gas and powdered fuel in metallurgical and other operations.

TRANSACTIONS OF THE ILLINOIS STATE HORTICULTURAL SOCIETY FOR 1877. Edited by the Secretary, O. B. Galusha. Chicago: published by the Society.

Contains the proceedings of the twenty-second annual meeting of the Illinois State Horticultural Society; the proceedings of the eleventh annual meeting of the Horticultural Society of Northern Illinois; and the transactions of the Warsaw Horticultural Society. It embraces several important essays and discussion of subjects relating to scientific and practical horticulture; and some valuable descriptions of the State Entomologist, Professor Cyrus Thompson, and others, of insects affecting horticulture. Professor Thompson's report on insects injurious to the vegetable garden will be found of interest everywhere.

THE AMERICAN SHIP:

The *American Ship*, published at No. 3 Park Place, New York city, terms $3.00 per annum, John W. Griffiths editor, is devoted to navigation in all its branches. In the present low state of the shipping interests of the country our legislators and shipowners will do well to obtain the best light on this subject. From our knowledge of the editor (who is the author of several works on naval architecture), we believe they can have their needs supplied in the *American Ship*.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will n to be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) G. A. H. asks for an explanation of the cause of the rise and fall of the barometer, that is, the cause of changes in the air's pressure. A. The course of the barometer is generally in the opposite direction to that of the thermometer; that is, that when the temperature rises the barometer falls, and *vice versa*, which indicates that the barometric variations at any given place are produced by the expansion and contraction of the air, and therefore by its change in density. If the temperature were the same throughout the whole extent of the atmosphere, no currents would be produced, and at the same height atmospheric pressure would be everywhere the same. But when any portion of the atmosphere becomes warmer than the neighboring parts, its specific gravity is diminished, and it rises and passes away through the upper regions of the atmosphere, whence it follows that the pressure is diminished and the barometer falls. If any portion of the atmosphere retains its temperature while the neighboring parts become cooler, the same effect is produced; for in this case, too, the density of the first mentioned portion is less than that of the others. Hence, also, it usually happens that an extraordinary fall of the barometer at one place is counterbalanced by an extraordinary rise at another place. The daily variations appear to result from the expansions and contractions which are periodically produced in the atmosphere by the heat of the sun during the rotation of the earth.

(2) A. D. gives the following method of cutting threads on 3 inch wrought iron steam pipe. After cutting the pipes to the proper lengths square the ends; then cut off a piece of threaded pipe 1¼ inch long square the end of it, and drive a wooden mandrel through it and into the pipe to be cut until the two ends meet, then center it in the lathe and chase it with an ordinary chaser. The chaser I made myself without a hub, the V being cut with a saw file. Not seeing this plan mentioned in your article on chasing and knurling, I give it for the benefit of some of your readers.

(3) "Reader" asks: Will you please inform me through your columns: 1. How I, having a good theoretical but no practical knowledge of steam engines, can get the necessary license to run a little steam launch for my own amusement this summer? Will a license be necessary? A. You had better apply to steamboat inspectors in your vicinity. 2. With a launch having steel boiler, no tank, no condenser, how far objectionable would it be to run in salt water (feed direct from outside)? Would it merely be better to go to the trouble of putting in a tank (taking out air tanks from under seats) or would it be very important? Would the fact that boiler is steel make any difference? A. You should have fresh water tanks; steel makes no difference.

(4) M. K. L. asks: 1. What was the right ascension and declination and longitude of the planets on April 1, 1879? Professor L. Swift gives us the following: The longitudes are as follows:

Mars, April 1, 1879, at noon	272° 47′ 53″
Jupiter	324° 03′ 00″
Saturn	5° 51′ 19″
Uranus	152° 35′ 20″
Neptune	39° 13′ 23″

Mars	R. A. 20h. 52m. 11s.	Dec. South	18° 48′ 00″
Jupiter	22h. 15m. 14s.	" "	11° 42′ 32″
Saturn	1h. 02m. 02s.	" North	3° 51′ 31″
Uranus	10h. 12m. 00s.	"	11° 59′ 22″
Neptune	2h. 20m. 34s.	"	12° 41′ 35″

2. Is the increase of Mercury's velocity from 0° to 180° uniform, and what is the rate of increase? A. The increase and decrease of velocity of Mercury is not 0° to 180°, but from perihelion to aphelion it decreases, and increases from aphelion to perihelion.

(5) W. T. H. asks: 1. How many cells of the larger size of "easily made bichromate batteries" mentioned in SCIENTIFIC AMERICAN SUPPLEMENT No. 159 will be required to obtain a good light from the "simple electric light" described in SCIENTIFIC AMERICAN SUPPLEMENT No. 162? A. 10 or 12. 2. Would a gallon jar give four times as much electricity as a quart jar in the above mentioned battery, supposing the other parts to be proportional? A. No. 3. What size wire should be used in connecting the cells of a battery? A. No. 14. 4. Do cells of different elements work well when coupled together, as, for instance, cells of gravity, Watson, and carbon batteries? A. No.

(6) C. E. R. asks (1) for a receipt for cementing leather to an iron face pulley to make a belt hold better. A. Try equal parts of pitch and gutta percha. Warm the wheel, apply the cement hot, and lap the ends of the leather. 2. What is best to use on belts to keep them from slipping? A. Powdered rosin, or a mixture of powdered rosin and Spanish white, is sometimes used, but it is eventually injurious to the belt.

(7) J. K. writes: I have charge of a circulating library of over 7,000, and have great trouble in keeping the paper numbers on the backs of the cloth backed books. (The leather bindings I have numbered in gold.) Book binder's paste does only for a short time, but the labels afterwards get brittle and drop off. Can you give me information regarding a real good substitute for that purpose? It will require to be adhesive and at the same time retain its elasticity. A. Four parts by weight of glue are allowed to soften in 15 parts of cold water for some hours, and then moderately heated till the solution becomes quite clear. Sixty-five parts of boiling water are now added with stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is poured, with constant stirring, and the whole is kept at the boiling temperature. After cooling, a few drops of carbolic acid are added to the paste, which must be kept in closed bottles to prevent evaporation of the water, and will, in this way,

keep good for years. This paste is of extraordinary adhesive power, and may be used for leather, paper or cardboard with great success.

(8) St. J. asks: 1. Will you please tell me how I can waterproof some straw board, cheaply and quickly, in a small way? A. Either one of the following may suffice: 1. Take of white wax and spermaceti, each, 1 oz.; mutton suet, 4 oz.; melt in 1 pint of olive oil. Or, 2. Beeswax and yellow rosin, 2 oz. each; melt in 1 pint boiled oil. The solution should be applied warm. 2. Also if either of these hair dyes would be efficient and harmless: Red wine, 2 oz.; sulphate of iron, 18 grains? A. Will probably have no injurious effect. 3. 1 drachm sugar lead; 1 drachm lac sulphur; 1 oz. oil glycerine, and 1 pint soft water? A. Not to be recommended, as one of the constituents is plumbic acetate.

(9) H. L. B. writes: In answer to the query of H. L. V., I will inform him the steamer Mary Bell was built at Metropolis city, on the Ohio River, in 1875. She was 325 feet long, and carried 12,000 bales of cotton, being the largest boat on the Mississippi at the time. She was burned at Vicksburg when six months old.

(10) J. A. H. asks: 1. Is there any advantage in what lightning rod men call "circuit" rods—that is, two ground rods to one point? What do you think of such rods put into the ground 8 or 10 feet, ground tolerably dry? A. The only advantage in such an arrangement is that it affords a better ground surface. If the ground connections terminate in dry earth, the lightning rod will not prove effective. 2. Are horse shoe magnets better than common points, or should points be magnetized so as to lift small needles? A. There is no advantage in a magnetic point. 3. What is your opinion of tin roofs as a protection against lightning? How should they be connected with the ground? A. Tin roofs, if connected with the lightning rod having good ground connections, may prove an additional protection. The ground end of the rod should be forked and buried in earth that is continually moist. The effectiveness of the rod may be increased by filling the hole around the rod with pounded coke or charcoal. The ground end of the rod should be bent away from the house. 4. Is it safe to put a rod into a well? A. Yes.

(11) J. M. asks: 1. What is the best means of fastening rubber on an iron pulley? A. Use a cement composed of equal parts of pitch and gutta percha melted together at a moderate heat. 2. I know that a belt will run to the large part of a pulley; but if a wide belt is shorter on one side than the other, will the short side work to the crown of the pulley? A. Yes. 3. What would be the effect if the pulley was flat on the face? A. In either case the short side will do the work until it is stretched. 4. What is the crown sheet of a boiler? A. The sheet or plate immediately over the grate bars. 5. What work could you recommend for general information on the use and care of machinery, *i. e.*, size and speed of pulleys and their proper place on shaft, where tighteners should be used, etc.? I want a work for information on the simple principles of machinery as well as the most scientific. A. We know of no one work that will meet your wants.

(12) F. D. R. asks: What is best to use to clean a person's hands of red color, such as used in coloring leather—chief ingredients of color, logwood? A. You may try weak solution of ammonia.

(13) G. M. A. writes: I have a gun which has all the browning off. Not wishing to go to the expense of putting it on again, what cheap substitute could I use to protect it from rust? A. Apply a thin coat of shellac varnish.

(14) J. W. B. asks: Can you give me a receipt for making fly paper? A. Consult SCIENTIFIC AMERICAN, page 171 (12), vol. 39.

(15) A. L. H. writes: 1. I wish to make an electro-magnet for a burglar alarm. How many feet of silk covered wire should I use on each spool? 2. How large should the coil be? A. As you do not intimate what sort of a burglar alarm you intend to make, it will be impossible for us to give you any definite information. Try ⅜ cores, 1½ inch long, wind them with six layers of No. 20 wire. 3. Will one cell of a gravity battery be sufficient, there being not more than twenty feet of wire connecting the battery and alarm? A. It is probable that one cell might do; but two would render the action of the apparatus more reliable.

(16) F. N. P. asks how to mount prints or engravings and colored prints on cloth so that they may be framed without a glass in front of them. A. Tack or glue a damp piece of cotton cloth to the edges of a suitable frame; cover the cloth with good paste; apply paste to the back of the print, and lay it smoothly on the cloth. When the print is dry coat it with a varnish made by diluting ¼ lb. of Venice turpentine with a gill of alcohol.

(17) R. J. F. asks: Which would penetrate wood farthest, a ball from a pistol held 4 inches from the wood or one from a pistol held 10 feet distant? A. The ball from the pistol held 4 inches distant would penetrate the farthest.

(18) W. & H. ask if whitewood is a hard wood, to be classed with oak, maple, etc., or a soft wood, like pine, hemlock, etc.? A. Whitewood (tulip tree, botanically Lirodendron tulipifera) is a deciduous tree, like the oak, maple, etc. It is not classed botanically with pine, hemlock, etc. In color the timber (having heartwood and sapwood the same color) is classed with white pine as whitewood; and in texture the wood is classed with soft woods.

(19) "A Subscriber" states that the largest steamer on the Ohio River is the U. P. Schenck, which is 5 feet shorter, but 4 feet more beam, than the Golden City, is 1,500 tonnage, and owned by Captain A. J. Schenck, of Vevay, Ind.

(20) E. C. J. writes: There are many of us mechanics in this city who own our homes, and we have a little yard and garden patch attached, but the soil is very strongly impregnated with alkali in low places, so much so as to show white on the ground; in higher places only enough to slightly discolor the soil. What will best neutralize this alkali and be the most practicable to use? A. A heavy top dressing of manure intimately mixed with clay. The decomposition of the manure forms acids. The alkali unites or neutralizes the acids as they are formed. In consequence of this the soil becomes sweeter or more propitious to vegetation, while at the same time it will cause the vegetable matter to disappear more rapidly than would otherwise be the case. The addition of the clay is to reduce the strength of the mixture, and otherwise prevent injurious action of the strong stimulants upon growing vegetation.

(21) B. B. asks: What is the difference of the electric current produced by Daniell's, Grove's, and other cells; is it in intensity or in quantity? A. The electro-motive force of the Daniell cell is 1·079 volt, and the various sulphate of copper elements are about the same. The Grove 1·956, Bunsen's nitric acid 1·964, Bunsen's chromic acid 2·028, Faure's 1·964, Grenet 1·095. Electro-motive force and intensity are the same thing.

(22) W. H. B. asks: Can you inform me what will keep a solution of paraffine with linseed oil in a liquid state, and not destroy its drying qualities? A. Turpentine spirits, since in it paraffine is soluble.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. H. B.—No. 1. Judging from your description they are probably quartz crystals containing crystals of tourmaline.—No. 2. It is doubtless banded agate; some of these stones are of value.

COMMUNICATIONS RECEIVED.

On Squaring the Circle. By G. O. v. R.
On Vehicle Wheels. By G. A. H.
On Scarlet Fever. By T. B. McC.
On the Metric System. By G. J.
Better Late than Never. By A. R. C.
On Suspended Animation. By G. F. S.
A Voice from the Dominion of Canada. By J. G.
Telephone Circuit. By F. W. W.
On Squaring the Circle. By W. D.
On Electric Light. By W. A. S.
On Solar Circulation. By E. F. D.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 22, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city.

Aerial machine, H. Badgley 214,546
Agricultural implement, J. W. Rudolph 214,709
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Paper cutting machinery, C. Cranston, Brooklyn, N. Y.
Refrigerating apparatus, B. W. & G. J. Gillett, Jersey City, N. J.
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Water closets, J. R. Moore, Philadelphia, Pa.

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FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

THE
Hancock Inspirator.

The following Letter speaks for itself.

LIMA, O., Feb. 24th, 1879.
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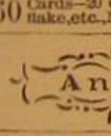

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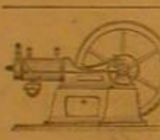

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