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THE GRAND PRIZE DIPLOMA OF THE FRENCH EXHIBITION.

The accompanying excellent engraving represents a *facsimile* of the grand prize diploma, awarded to a few of the most meritorious exhibits displayed at the French International Exhibition last year.

According to the statement of Mr. McCormick, our Commissioner General, there were only eight grand prizes awarded to United States exhibitors. The Wheeler & Wilson Manufacturing Company received, in addition to the grand gold medal, the grand prize diploma from which our engraving is taken.

Although there were hundreds of sewing machines exhibited by manufacturers from almost every country, it was left to our countrymen to bring away the only grand prize awarded to this class of exhibits.

Dr. Cresson's Megascope.

The Whittaker will case in Philadelphia brought into prominence the need of some more efficient means of examining and comparing documents where alteration or forgery is suspected. The result is an improved megascope, devised by Dr. Charles M. Cresson, in which the object to be viewed is firmly fixed upon a sliding screen, and is illuminated by two calcium lights placed on either side of the instrument, and so arranged that by means of compound condensing lenses of five inches diameter, the rays thrown upon the object by one light are reflected by the condensers of the opposite light, making a thorough illumination. There is provided, also, a device by which the rays from a third calcium light can be thrown upon the back and through the object under examination, if the nature of the object will permit it. The image is projected on the screen by an enormous compound achromatic objective lens of over seven inches in diameter. The screen is made of plate glass, finely ground upon one side, and is movable and suspended in a frame by steel tapes and accurately balanced. The frame which carries the screen is placed upon large rollers, and the focusing is done by moving the screen instead of the lens. In order to secure a uniform light, the massive blocks of lime upon which the hydro-oxygen flame is thrown are moved by clockwork, so as to continually present new points of contact for the flame. In using the apparatus, the object to be viewed is laid upon a table in the exact position in which it is desired that it shall be represented upon the screen. A sliding frame is then pressed upon it by springs, and the table with the object on it is slid into place.

This instrument, the Philadelphia *Record* says, has been successfully used in the examination of altered documents and altered and counterfeit bank notes. In legal contests, where the merits of a case depend upon the genuineness of a particular signature, or that of an entire written document, the megascope, though dumb, is capable of giving stronger evidence, and more reliable, than the most consummate expert that ever took the stand. Placing the genuine and spurious documents side by side in the instrument, after placing the screen before the eyes of the jury, both documents are thrown upon it, so that the jury may decide for themselves which is the real and which the fraudulent. The eloquence or ingenuity of counsel cannot disturb its story.

The peculiar arrangement of the lights and screen enables the examiner to discover the surface of the paper through the ink, so that patching or shading or painting of letters becomes evident the instant it is brought under the focus of the megascope. An arrangement of screens by which the light is cut off alternately from either side of the instrument discovers any tampering with the surface of the paper either by scratching or washing with chemicals. The instrument is of sufficient capacity to view at once two bank notes placed side by side, and the pictures are of such fineness that the image is produced without color from chromatic aberration or distortion from spherical aberration.

Alexis St. Martin.

Alexis St. Martin, whose open stomach furnished Dr. Beaumont an opportunity for studying directly the processes of gastric digestion, is still living at St. Thomas, Canada. He is described as hale and hearty at the age of 87, though the orifice in his stomach is still open. It will be remembered that the wound was the result of a charge of buckshot accidentally received, laying open the stomach so that food could be injected and removed at will by the attending physician, whose observations were of such great value to medical science. It is now 57 years since the accident occurred.

THE GRAND PRIZE DIPLOMA OF THE FRENCH EXHIBITION.

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NEW YORK, SATURDAY, AUGUST 2, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 187,

For the Week ending August 2, 1879.

Price 10 cents. For sale by all newsdealers.

SHALL WE HAVE A CANAL OR SHIP RAILWAY?

In a recent speech at Rouen, M. de Lesseps expressed the belief that the Darien Canal would be completed in five or six years. A few days earlier, at Amiens, he said the first sod would be turned next New Year's day, and that the work would be completed in seven or eight years. Evidently these utterances are mere talk to hurry up subscriptions. Evidently, also, M. de Lesseps is not in position to form any definite idea of the time which the proposed "heroic" treatment of the Isthmus will require, even in the absence of climatic, political, and financial hinderances. The "official" utterances with regard to the probable cost of the proposed work are doubtless equally wild. The original estimates for the route selected were considerably more than double the sum now pronounced sufficient, and there has been no change of plan nor any cheapening of processes to account for the difference.

At Rouen M. de Lesseps declared that the friendship between France and the United States would greatly facilitate the work. Undoubtedly friendship is better than enmity, but it is not so clear that American good will toward France will go so far as to overcome the decided objection of our people to the establishment and control of such a commercial route across the Isthmus by European powers. The Monroe doctrine still has force among us, as Senator Burnside's resolution in Congress shows; and there is a further difficulty likely to arise, should the canal be built as proposed, from the circumstance that the greater part of its trade would be with American shipping, and American shipmasters might prefer to have the profit of the enterprise kept at home, and might prefer a route more convenient for them. That this is no shadowy difficulty is evident from the position of M. Paul Leroy Beaulieu, who points out in the *Economiste* that the advantages of the Nicaragua route may lead to the creation of a second canal, which would deprive M. de Lesseps' enterprise of the trade of the two coasts of the United States, on which it relies for its chief profits.

On the other hand, America is not at all sure that a ship canal is what is wanted at the Isthmus. As long ago as 1845 the SCIENTIFIC AMERICAN illustrated and described a plan of railway transportation for ships, with especial reference to the Isthmus of Panama. In 1867 the late Horace Day made an elaborate plan for a ship railway across the Isthmus, and took out patents for some important devices connected with the scheme. Since then the hauling of coal laden vessels overland from one water level to another has become a matter of daily occurrence in this country, and the feasibility of moving in this way, economically and expeditiously, the heaviest shipping from the Atlantic to the Pacific, is asserted by Captain Eads, whose ability to estimate the practicability of great engineering enterprises no one will question. In a recent letter Captain Eads asserts that for less than one-third the estimated cost of the Darien Canal, a ship railway can be constructed capable of transferring the largest ships, when fully loaded, in absolute safety across the Isthmus within twenty-four hours from the moment they are taken in charge in one sea until they are delivered into the other, ready to depart on their voyage. The details of the plan will be found on another page.

That such a road is practicable as a work of engineering no one can dispute. That it would be much less costly than the proposed canal, in spite of the necessity of its being made without curves, will scarcely be questioned by any one who takes account of the enormous tunnel involved in the plan of the canal. The only doubt will arise in connection with the cost of operating such a road. The opinion widely prevails that water carriage is—leaving out the time element—much more economical than land carriage. The experience of recent years, however, has tended to prove the superior cheapness of railway carriage, and in more than one instance canal beds have been converted into railways, owing to the marked advantages of the latter method of transport. When the interest on the heavier investment required for the canal is taken into account, the greater time required for the construction of the canal, the greater liability of the latter to injury by storm and earthquakes, to say nothing of the slower movement of shipping in water, the argument in favor of a railway becomes very strong.

THE CINCINNATI INDUSTRIAL EXHIBITION.

The seventh Industrial Exhibition in Cincinnati will open September 10 and continue one month. The last was held in 1875. The next year was skipped owing to the Centennial Exhibition at Philadelphia, and the two following years for lack of suitable buildings. This year the Exhibition will be housed in the splendid edifice built for the purpose by public subscription—the most spacious, costly, and suitable exhibition buildings in the country. The aim is to surpass in variety and magnitude everything in the way of industrial fairs that the country has seen, except the great International Fair of 1876.

The Cincinnati Exhibition is managed by a board of fifteen commissioners, appointed by the City Chamber of Commerce, the Board of Trade, and the Ohio Mechanics' Institute; and the commissioners especially announce that the Exhibition is in no sense a private enterprise or speculation. The management is gratuitous, and there are no charges for space.

The machinery and agricultural departments have over 60,000 feet of exhibiting space, 600 feet of line shafting, engines and boilers of over 200 horse power, steam, water, and drain pipes convenient for exhibitors. The horticultural department will be in a large conservatory constructed for the purpose, well lighted from the roof, heated with steam, and affording over 20,000 square feet of exhibition space. The fine arts and natural history departments have been generously provided for, and there is a promise of an exceptionally fine display. Great efforts are making to have the display of minerals, metals, iron and steel and their products adequately represented; and a special department has been provided for the representation of Mexican products.

Applications for space should be made early. With certain exceptions all articles for competition must be of American production. Gold, silver, and bronze medals and cash premiums are offered in the different departments.

THE OPENING OF THE MISSISSIPPI.

It is, relatively speaking, so long since the American people became convinced of the ultimate success of the splendid engineering enterprise just brought to successful conclusion at the mouth of the Mississippi, that there is danger that the immediate credit due to Captain Eads may be popularly underestimated. Men are too apt to forget that when he began the work he did so at his own risk, and in the face of strong and persistent opposition from engineers in high authority. They forget that all along he has had to conquer not only the commercial barriers at the mouth of our great river, but to do it hampered by severe restrictions, even the payments for work done being contingent on the approval of engineers whose greatest joy would be in his entire discomfiture

There is danger, too, of forgetting the magnitude of the work, and the enormous commercial possibilities the scheme involves, as well as the great power of the opposing local interests whose prosperity was endangered by every stroke done toward opening the mouth of the Mississippi to the free and easy passage of commerce. The moral and financial victory won by Captain Eads is accordingly greater even than his victory over material obstacles; and the latter were great enough to justify our classing the work among the most difficult, costly, and courageous achievements of hydraulic engineering. In commenting on the work the *Tribune* reminds us that when the jetty company began its operations at South Pass, the commercial entrance to the Mississippi was at Southwest Pass, but only light draught vessels were sure of getting in. A ship drawing over sixteen feet was liable to get fast on the bar and remain there until she unloaded her cargo upon lighters. The cost of unloading and reloading and of the long delay more than absorbed the profits of the voyage. Besides the obstruction of the bar, which constant work by Government steam dredges for more than twenty years had failed to remove, there were the curious mud-lumps which, heaving up from the bottom outside the river's mouth, often caught ships in their sticky embrace. Southwest Pass was, however, the main channel, and the only practical entrance for craft larger than fishing smacks. South Pass had only six feet of water on its bar, and Pass à L'Outre and the old Belize had long been closed. The Government would not allow Captain Eads to work upon Southwest Pass, which, having by far the greatest volume of water, was most easily improvable. It was feared he would ruin the poor channel existing there, and so choke up the river completely. He had to take South Pass, and was compelled in order to get enough water in it, to throw sunken mattresses across the heads of the other passes. Then he had to conquer a shoal at the head of South Pass, and stop up an outlet through which a portion of the current escaped into the Gulf. All this was preliminary and additional to the real jetty work, which consisted in building two walls from the river's mouth straight out into the Gulf for a distance of nearly three miles, to the outer verge of the bar—a wall that would resist the force of the current and the buffetings of the sea.

Our readers have followed in the pages of the SCIENTIFIC AMERICAN the progress of this most useful work, from its inception to the successful conclusion recently announced. The river is now permanently open, and its currents are so controlled that the mighty stream will henceforth be the chief factor in keeping its channel clear of the barriers it naturally tended to build up against the commerce of the world. When the Mississippi valley harbors, as it soon will, a more numerous population than the whole country can boast of now; when its farms and factories are doing, as they soon will, half the productive work of the world—then it will be possible to form some adequate idea of the industrial and commercial benefit to flow from the unbarring of the outlet of what cannot fail to be the great artery of our national and international trade. It is a grand victory, and Captain Eads may be sure that popular appreciation of its grandeur will grow with the growth of the commerce it makes possible.

THE REFLECTING MAGIC LANTERN IN COURT.

During the recent trial of the Whittaker will case in Philadelphia, it became necessary to show the differences between a genuine signature and an imitation or forgery of the same. For this purpose Dr. Charles M. Cresson brought into court a powerful reflecting magic lantern. The room was darkened, and images of the two signatures, enormously magnified, were thrown side by side upon a screen before the judge and jury. The false signature was at once revealed. In the ordinary magic lantern, the object to be shown on the screen is photographed or painted on a slide of glass, and the light passes through the slide to the screen; in the reflecting lantern the light is thrown against the face of the

object itself, and as the reflected rays from the object appear on the screen, a stronger light is required for the reflecting lantern than for the ordinary instrument. In the present case the illumination of the writing was effected by means of two powerful calcium lights contained within the lantern.

A watch placed in the instrument and reflected on a finely ground glass screen leads the spectator to believe that he has suddenly come in contact with the city hall clock. The pores of the skin on the cheek or hand are shown with an unpleasantly magnified faithfulness, and to see the face of your dearest friend through the megascope almost moves you to tears, under the false impression that he has been riddled with bullets. A piece of writing which to the naked eye, or even under a strong magnifying glass, appeared as if each letter was made with simply one stroke of the pen, on being placed in the lantern was easily dissected. The work of the skilled penman in "painting" the letters was laid bare. The ragged edges where the heavy shading began and ended were as plain as were the letters themselves. Defects in the paper, though never so slight, by erasure or otherwise, and even the texture of the paper itself, were presented as clear as sunlight.

PROGRESS IN SPECTROSCOPY.

It is now seven or eight years since Professor J. W. Draper demonstrated the fallacy of the popular notion that the heating power of the sun's rays varied with their color, by showing the relatively high temperature of the red end of the spectrum to be wholly due to the unequal distribution of the ether waves by the prism. In other words, the "Matterhorn of Heat" (as Professor Tyndall styled it), which culminates just below the red of the spectrum, is an accident of the prism, and not due to any superior heating power of the rays of low refrangibility—a lesson, by the way, which too many of our text book writers have failed to learn.

In the July number of the *American Journal of Science and Arts*, Professor Draper similarly disproves the notion that the yellow portion of the spectrum surpasses the rest in luminous power. As he had already shown that the supposed superior actinic power of the violet end of the spectrum is due not to any preponderance of chemical power in rays of high refrangibility, but to a peculiar susceptibility of the salts of silver to them, these experiments complete the demonstration of his opinion that there is no inherent difference in the light, heat, and chemical power of the different rays. The different colors are equally warm and equally luminous, and though acting on different substances, are of equal chemical power.

The later researches of Professor Draper have been made with a new form of spectrometer invented by himself, the function of which is the measurement of the intensity or brilliancy of light waves of different lengths.

It depends on the well known optical fact that a light becomes invisible in the presence of another light about sixty-four times more brilliant, and is constructed as follows: Remove from the common three-tubed spectroscope its scale tube, and place against the aperture into which it was screwed a piece of ordinary glass ground on both sides. In front of this arrange an ordinary gas-light, attached to a flexible tube, so that its distance from the ground glass may be varied at pleasure. This extraneous light is called, from the function it has to discharge, the *extinguishing* light. On looking through the telescope tube the field of view will be uniformly illuminated, this being the use of the ground glass. The brilliancy of the field depends on the distance of the gaslight, according to the ordinary photometric law.

If, when studying a prismatic or dispersion spectrum, the extinguishing flame be at a suitable distance, the whole spectrum is visible on the illuminated field. As that distance is shortened, first the violet and then the other more refrangible colors in their descending order disappear, and at length in the steadily increasing effulgence the red alone remains. The yellow never stands out conspicuously, as it should were it the brightest of the rays, or even the brightest portion of the prismatic spectrum. The red is plainly perceptible long after the yellow has been extinguished.

It is proper to note that these results were obtained, first, with the apparatus above described, using the spectrum of the luminous flame of a Bunsen burner and an extinguishing gas flame, and afterward were verified by ingenious contrivances employing sunlight both for the spectrum and the extinguishing light. Prisms of different kinds of glass and other transparent substances were also tried, and in all cases the extinction began in the violet and ended in the red. The same was true when the effect was viewed by different persons, irrespective of age or the condition of their sight, the capacity to see color being normal. No opportunity offered for testing in a case of color blindness.

Thus it appears that, in the prismatic spectrum, the yellow is not the brightest color, brilliancy as well as temperature increasing continuously toward the red. The question at once arises: Is the observed effect due to any superior light-power in the red rays, or, as in the case of heat, to the circumstance that the prism throws a relatively larger portion of the ether-waves upon a given space in that part of the spectrum? Observation with the grating or diffraction spectrum supplies the answer. In this spectrum the colored spaces are arranged uniformly and equably in the order of their wave lengths, and if they are of equal intensity they must obviously appear and disappear together.

Having modified the common spectroscope by taking away its dark box, so that the slit tube and the telescope tube could be set in any required angular position, Professor Draper put in the place of its prism a glass grating inclined at forty-five degrees to rays coming through the slit, the ruled side next the slit. Now, when the extinguishing flame was properly placed before the ground glass, the plane side of the grating reflected its light down the telescope tube. In this, as in the former case, the spectrum was seen in the midst of a field of light, the intensity of which could be varied at will. With this apparatus Professor Draper was naturally delighted to find that, as the force of the extinguishing illumination increased, all the colored spaces yielded apparently in an equal manner and disappeared at the same moment; and on diminishing the illumination, all the colors came into view apparently at the same instant. This with sunlight the same as with gas-light. Hence the conclusion that, other things equal, all light rays of whatever color are equally luminous.

For another important advance in spectroscopy we are indebted to Dr. Wm. N. Jacques, of Baltimore, who has invented a form of spectroscope which enables the experimenter to study not only the rays of luminous gases, but also those emitted by incandescent solids and liquids, and to measure the relative intensities of the different physical rays. By a long series of measurements with this instrument, employing substances differing widely in physical and chemical properties, Dr. Jacques has determined their molecular weight and arrived at important conclusions as to the structure of their molecules. By processes totally different from those of Mr. Lockyer, Dr. Jacques finds strong evidences of the correctness of the English astronomer's opinion that all matter is essentially one, the observed differences arising from differences in molecular structure.

WHERE TO STUDY CHEMISTRY IN GERMANY.

It has become customary for young men who have graduated in the chemical department of any of our scientific institutions to turn their steps Eastward, so as to continue their studies in older or better endowed institutions. Some of our wealthy colleges furnish their brightest and most promising graduates with the means to continue their studies for three years longer. The advantages of taking a post graduate course abroad are quite numerous, but we can only briefly refer to them, without enlarging upon details. The benefits of travel, the change of air and scene, the opportunity of perfecting one's knowledge of a foreign tongue, are incidental but not unworthy incentives. To learn the methods of teaching in vogue there, to be raised out of the old ruts into which a student is too liable to sink, to make the acquaintance of other rising scientists, to come into contact with the men who have built up the science, and to feel the inspiration of their presence, to work side by side with these men, and seek to learn by daily observation the secret of their success, are advantages not easily over-estimated. To work by the side of the world renowned Bunsen, each step brightened by his genial smile, or to be directed in one's investigations by the celebrated Hofmann or Kolbe, to enjoy the acquaintance of Hübner and Fittig, are no small favors.

When a student has made up his mind to go abroad to study chemistry and its allied sciences, mineralogy and physics, he is often at a loss where to go, or how best to employ his time. To such we would offer a few words of advice. The science of chemistry as studied there may be divided into three divisions, inorganic, organic, and technical or applied chemistry. As the student ought to perfect himself in the first named before taking up the two other branches, he will do well to first direct his footsteps to Wiesbaden or to Heidelberg. At the former place Fresenius teaches most thoroughly his methods of analysis; at the latter place Bunsen teaches his methods of analysis, including the analysis of water and gas, the use of the spectroscope and his flame reactions, as well as the methods of separating and purifying the rarer metals, cerium, lanthanum, didymum, the metals of the platinum group, selenium, thallium, and other interesting bodies, by methods peculiarly his own. The well-known perfection of all Bunsen's methods, his great skill and dexterity of manipulation, his ingenious devices, and the great simplicity of the man as well as of his methods, recommend him especially to any one who is fitting himself for a teacher. From experience the writer can say that no man's education is complete without spending one term with Bunsen in his quaint old laboratory in picturesque little Heidelberg.

The student of organic chemistry has a much larger number of laboratories from which to select. The beginner, who has to learn organic analysis and the preparation of organic compounds, will find what he requires in nearly any of the larger universities. Berlin and Strassburg are both highly recommended for this purpose, nor is Bonn far behind them, so that the student may now allow himself to be influenced by other causes. Neither Berlin nor Strassburg is a healthy and agreeable place of residence in summer, yet in order to hear Prof. A. W. Hofmann's excellent lectures upon organic chemistry it is necessary to spend the summer in Berlin.

The advanced student who wishes to begin a research on some organic body may choose between Hofmann or Liebermann in Berlin, Kolbe in Leipsic, Hübner at Göttingen, Fittig at Strassburg, Bayer at Munich, Meyer in Zurich, Kekule at Bonn, or Wiselcenius at Würzburg. The first mentioned is to be preferred for a research upon the so-called aromatic group; the second for colors and dyes; the last named, as well as Prof. Ad. Wurz in Paris, devote their attention to the fatty bodies. Thus a man who has already selected his subject will select his professor accordingly. A man in search of a subject, and wishing to receive a large amount of personal attention, will not regret having begun his studies at Berlin. At Leipsic and Bonn the student gets but little attention from the professors.

For technical chemistry there are a large number of polytechnic schools in all parts of Europe. One of the best of these is at Würzburg, where Rudolph von Wagner is professor; another is at Zurich; a third at Berlin. This does not exhaust our list, but we mention these because at each of the above cities there are excellent universities, and a student may enjoy the advantages of both at the same time.

As most students of chemistry will wish to hear a few lectures on mineralogy we may state that no better professor can be found than Rosenbusch at Heidelberg. During the summer crystallography is very carefully taught at the same place by Prof. H. Kopp, while Prof. Quincke lectures on electricity and magnetism, and Prof. Fitzer on botany, making Heidelberg a very attractive place to spend the summer. Prof. Groth at Strassburg and Klein at Göttingen are also distinguished mineralogists.

Each of the above mentioned universities, of course, has its own professor of physics, the most celebrated being Helmholz and Kirchhoff at Berlin. The chemist, however, finds better facilities for the study of physics in Paris than elsewhere. The laboratory of Prof. Desains in the Sorbonne is fitted up with the best apparatus, and students may spend from four to eight hours per week there at the nominal charge of $4 per year.

In the German universities the division of time is quite unlike that in our colleges. The year is divided into two terms, called "semesters," one extending from November 1st to March 1st, the other from May 1st to August 10th, separated by long vacations. The student who leaves home in June may arrange to hear a few lectures in the summer semester at Heidelberg, in order to accustom the ear to the language. The long autumn vacation can be used for studying German (in Hanover) if the student is not already quite proficient therein, or for foot tours through Switzerland, the Black Forests, Tyrol, or Thuringia. As companion on a foot tour select, if possible, a German who does not speak English.

Owing to the large number of English speaking students in most of the German laboratories, especially Heidelberg and Bonn, an American has but little opportunity to practice speaking German. For this reason some prefer to spend a term at some less noted university, like Breslau or Tübingen.

An American can enter any German university upon showing his passport and paying a small fee. At Berlin men over 30 years of age cannot be matriculated, but can readily obtain a permit to attend lectures and enjoy other privileges of the university. The fees for the laboratory vary from $20 to $25 per term. Lectures cost from $5 to $10 each per term. The student may select such lectures as best suit his purpose, and pays only for those which he hears. In every respect perfect freedom is allowed the student, in striking contrast to the restrictions imposed in this country.

E. J. H.

Recent Decisions Relating to Patents.

BY THE COMMISSIONER OF PATENTS.

Mallett v. Cogger.—1. The question whether the embodiment of an invention in a construction capable of use, without actual practical use, will, of itself, secure to the inventor an indefeasible title, as against other applicants who subsequently invent and properly reduce to practice the same device, is still an unsettled question.

2. If upon the completion and actual use, either in public or in private, of a machine or article of manufacture the invention embodied therein becomes a successful experiment, so as to entitle the inventor to a patent and to defeat the claim of a subsequent inventor, without further action or diligence on the part of the first inventor, still the invention does not pass absolutely from the domain of experiment until it has been actually used in public. If forgotten before or after such public use, it may be reinvented and patented by a subsequent inventor. If abandoned before such public use, it is an abandoned experiment and may be patented by a subsequent inventor. If abandoned after such public use, it cannot be patented by a subsequent inventor, but becomes the property of the public.

3. The construction of a school desk or seat having slats keyed to the frames with square keys is not a reduction to practice of an invention for fastening the slats to the frames with dovetail keys.

Ex parte Bland.—1. The present practice of the Patent Office permits an application to be placed in interference with an unexpired patent which shows, but does not claim, the subject matter claimed in the application.

2. The possession by the applicant of a foreign patent prior in date to the unexpired American patent does not exempt his application from such an interference.

3. An applicant's invention must be decided to be patentable before his application will be placed in interference with an unexpired patent; but this proceeding is ex parte, and does not bind the grantee of the unexpired patent.

4. Priority of date of an English patent raises no presumption of priority of invention in favor of an application by the patentee, claiming the same device, as against an unexpired American patent.

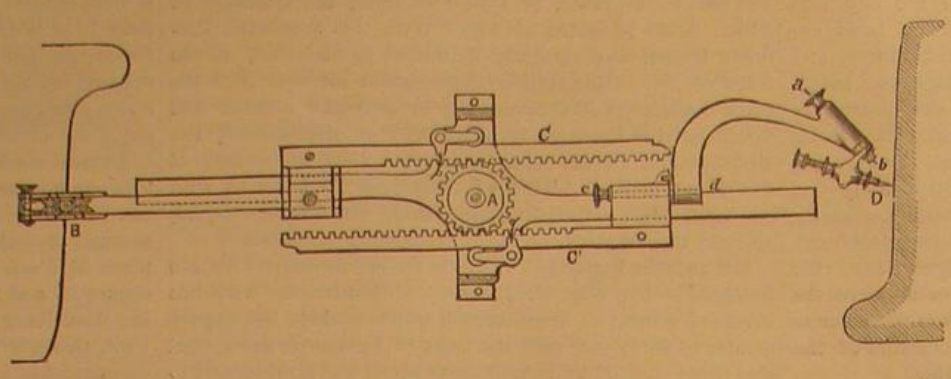
THE POLAR PANTOGRAPH.

The engraving represents an instrument by means of which an exact outline of the form of a body can be drawn on paper, and which is used for measuring the wear of bodies —as, for instance, that of the wheel tires. Its construction, as shown in the engraving, is very simple.

If a straight line of a variable length oscillates in a plane around its center, which is supposed to be fixed, its extreme points describe symmetrical and identical figures.

This principle has been applied in the instrument represented in the accompanying engraving, which consists of a frame pivoted at A. This frame carries two racks, C C', which gear into the pinion, A. A displacement of one of the racks will turn the pinion and move the second rack in the opposite direction an exactly equal distance. By attaching a pencil, B, at the end of one rack, and a pin, D, at the end of the other rack, in such a manner that the pencil and the pin are both in the same vertical plane, which also passes through the axis of the pinion, and that the pencil and the point are equally distant from this axis, the pencil will describe on paper the identical figure which is described by the point moving on the surface of a body. The point, D, is so arranged that it can revolve around an axis, *a b*, which axis can itself revolve around a second axis, *c d*, which is supported by the rack. The point of intersection between the axes, *a b* and *c d*, is also the extreme point of the pin. By this arrangement any shape of the surface of the body, even if it be concave, can be easily traced by the point.

This instrument is the invention of Mr. Napoli, the chemist of the Eastern Railroad of France.—*Railroad Gazette.*



THE POLAR PANTOGRAPH.

COMBINED FORK AND SPOON.

The device shown in the accompanying engraving is the invention of Mr. A. B. Nott, of Fairhaven, Mass. It is designed for culinary use, and it consists of a fork in the handle of which is pivoted a spoon bowl, which may be turned down against the fork tines for use, or it may be folded back against the fork handle out of the way when not in use. A spring contained in the fork handle holds the spoon bowl in either of its positions.

NOTT'S COMBINED FORK AND SPOON.

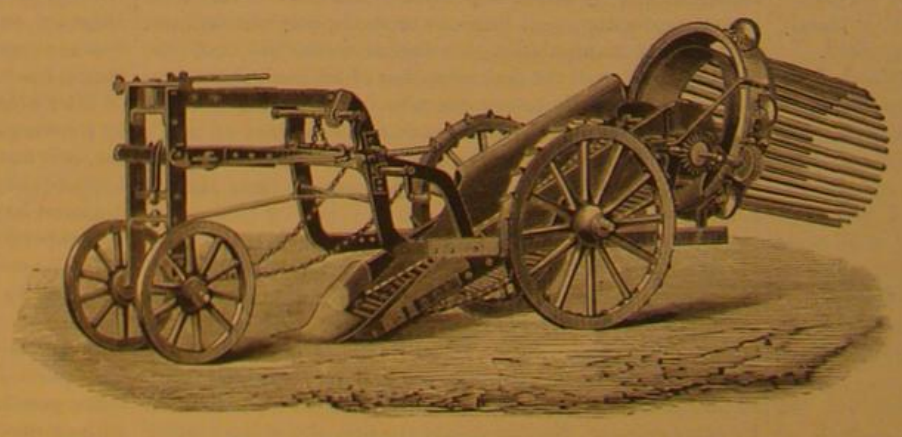
Telegraphic Ignition.

The telegraph wire as a fire risk has, perhaps, not received the attention it is entitled to. During a thunder storm which began at Council Bluffs, Iowa, soon after 11 o'clock, night of June 10, the freight office and warerooms building of the Chicago, Burlington and Quincy Railroad Company was burned to the ground, though most of the contents were saved. It was supposed that the fire was caused by a heavy charge of electricity entering the building along the telegraph wires. Probably all this loss would have been prevented had the ordinary lightning arrester been provided upon the posts near the building. The arrester is simply a wire that has one extremity placed very near but not in contact with the telegraph wire. The other extremity of the arrester terminates in the ground. When lightning gets on the telegraph wire it leaps to the arrester wire and passes into the ground.

AN IMPROVED POTATO DIGGER.

The potato digger illustrated herewith has been recently patented in Austria by the Messrs. W. Siedersleben & Co., Bernburg, Germany. It is claimed for it that it not only takes the potatoes from the ground, but also places them, freed from adhering vines and soil, in narrow regular rows, so that they may be easily picked up.

The front part is constructed like the steering apparatus on some kinds of sowing machines. The movable parts, consisting mostly of cast iron, are attached to a strong wrought iron frame. On the axle of the driving wheels revolves a toothed wheel acting on a shaft carrying two chain pulleys and a toothed wheel. The chains running over the pulleys operate two shafts placed between the extremities of two oblique iron plates; between the latter and over the shafts runs an endless chain, taking up the potatoes as they are brought to the surface by the share, and carrying them upward toward the cleaner placed in slightly inclined position at the rear end of the machine. Two persons are necessary for attending the machine, one for driving the team, the other for steering the apparatus. In this manner from three to four acres of ground may be gone over in a day.



NEW POTATO DIGGER.

Filaria Snake from the Eye of a Horse.

At a recent meeting of the New York Pathological Society, Dr. H. D. Noyes showed a filaria which he had removed from the anterior chamber of the eye of a horse on the day previous. The parasite was first seen in January, and was visible three days. It then disappeared from view for six weeks, and since then, while often visible, it would not be discoverable for several days or hours.

The creature, as seen by Dr. Noyes, was running actively about the anterior chamber, and the horse did not evince any consciousness of suffering. There was decided opacity of the cornea and some cerium-corneal hyperæmia. The removal was done to prevent increase of corneal opacity. The horse was supposed to be twelve years old. These filariæ were common in the peritoneal cavity of the horse, and occasionally appeared in the eye.

At the operation, which was done with the help of Dr. Liautard, at the American Veterinary College, the horse was thrown and etherized, the cornea punctured with a lance-knife, and the wound held open as the point was partly withdrawn, so as to cause the aqueous humor to spurt in a gush.

The parasite was thus driven out and lived for an hour after its extraction. It measured two and a quarter inches, or fifty-eight millimeters, in length. Its neck was curved into a spiral, forming one and a half turns, and at the extremity of the head was a minute papilla, from which the name, Filaria papilli fornix, was derived.

Dr. Noyes explained the disappearances of the filaria by supposing that he went through the pupil behind the iris, but did not penetrate into the deeper part of the eye. Since the specimen was presented, the horse had been heard from; the eye recovered from the operation, and the opacity of the cornea had begun to fade away.

A Finback Whale in New York Harbor.

Capt. Patrick Owen, of the sloop Storm Child, lately captured, off Sandy Hook, the finest finback whale ever taken in these waters. The whale was twenty-five feet in length. It was brought to Pier 22, East River, where it was visited by many curiosity seekers. The prize was promised to the Smithsonian Institution. The whale, when caught, was attended by a crow, which followed the carcass to the city.

RECENT MECHANICAL INVENTIONS.

An improved machine for separating perfect nails from headless nails, slivers, and dirt, has been patented by Mr. Moses A. Williams, of Knoxville, Tenn. It consists in one or more pairs of rotary disks or wheels, having curved or beveled peripheries forming a peripheral trough, the disks being placed a short distance apart so that headless nails, slivers, and dirt may escape between them, while the perfect nails are carried forward to a clearer, which removes them and delivers them to a suitable receptacle.

Mr. Vincent A. Menuez, of Michigan City, Ind., has patented an improved swinging cradle which may be readily taken apart and folded compactly together for shipment and storage.

Mr. J. R. Payson, of Chicago, Ill., has patented an improved bolt for doors, which can be applied to the jamb or frame of the door without injury to the finish. It fastens the door without sockets, and is not affected by the settling of the door or door frame.

Mr. William A. Yeatts, of Little River, Va., has patented an improved automatic brake for wagons, which consists in combining the brake bar, sliding hounds, and connecting rods attached to the brake bar and to the rear hounds, so that when the rear axle is forced forward the rods will rotate the brake bar and effect the lock.

A machine especially adapted for bottling liquids under pressure with Allison's suspender or gravitating stopper, has been patented by Mr. James J. Allison, of Nelson, Ill. The frame that supports the bottle is pivoted so that it may be inverted after the liquid is introduced into the bottle to allow the stopper to take its place in the neck of the bottle.

An improved attachment, by means of which the forward part of an ordinary buggy may be converted into a sulky, has been patented by Mr. Andrew H. Morse, of Norwich, Conn. It consists in a sulky frame adapted to the front running gear of a buggy.

An improved press for baling cotton, hay, and other substances has been patented by Mr. Frederick J. Gardner, of Washington, N. C. The follower block has a central opening, and a screw rod passes through it and also through the bed. The platen and bed are both concaved between the bale band grooves.

An improved device for tapping steam and water pipes, when under a full head of steam or water, without escape or leakage, has been patented by Messrs. James H. Chapman and Richard Hawthorn, of Peekskill, N. Y. The invention consists of a vessel to be clamped against the side of the pipe, and in drilling tapping devices and means for screwing in the valve.

Mr. Clarence J. Reynolds, of Poughkeepsie, N. Y., has patented an improved lemon squeezer, which consists of two cups, one inverted and having a convex bottom fixed to a handle, with a slot through it for a lever, which connects with the under concave cup, and has its fulcrum in the handle of the first cup. By means of this device a heavy pressure may be brought upon the lemon.

An improvement in felt guides for paper making machines has been patented by Mr. Jacob Peaslee, of Ashland, N. H. It consists in an upper and lower roller mounted on a pivoted frame, the upper roller having conical pressure surfaces that act in connection with the pivoted frame to retain the felt in a central position.

A wagon which may be used as a light road wagon or buggy, and which may be adjusted according to the work to be done, has been patented by Mr. James L. Phillips, of Lowville, N. Y. The joints of this vehicle are made so that they will not rattle.

An improved stovepipe coupling and brace has been patented by Mr. Wm. E. Hofman, of Fort Omaha, Neb. It consists of a strip of sheet iron about one and one half to two inches wide, with both edges turned up and bent toward each other, forming a brace which engages buttons riveted to the stovepipe lengths.

Mr. Julian Chase, of Pawtucket, R. I., has patented an improvement in whiffletrees, which consists in the combination of a lever trace holder and a spring with the whiffletree, the object being to prevent sudden jars or shocks on the traces or whiffletrees.

An improved machine for crosscut sawing logs has been patented by Mr. Thomas B. Fagan, of Van Wert, Ohio. It consists in the combination of a swinging bar, a curved lever, and a curved spring, with the saw and saw frame.

Mr. Nelson W. Brewer, of Williamsport, Pa., has invented an improved whiffletree, designed to equalize the draught and to prevent sudden strains on the harness or carriage. The whiffletree consists of two arms hinged on the whiffletree pin and connected to a common spring.

An improved fastener for clothes lines has been patented by Mr. John Bohlen, of Big Rapids, Mich. It consists of three pieces of cast metal, a support, a swivel piece, and a clamping lever. It may be secured to any suitable support and will hold the line securely.

A combination machine for blacksmiths' and carriage makers' use, has been patented by Messrs. Robert Bates and Joseph Wild, of Spring Valley, Ohio. It combines a drill, punch, shears, bender, upsetter, and lathe in a single frame.

Mr. Henry Parker, of Claiborne, Miss., has patented an improved baling press, which consists in a novel combination of a windlass shaft, pulleys, ropes, and bars for operating the follower block.

THE SUN A SOURCE OF POWER.

BY S. P. LANGLEY, ALLEGHENY OBSERVATORY, PA.

When we watch a gentle summer rain, does it ever occur to us that this familiar sight involves the previous expenditure of almost incredible quantities of energy, or do we think of a drizzly day as perhaps calling for a greater exertion of Nature's power than an earthquake? Probably not; but these suppositions are both reasonable.

Take Manhattan Island, for instance, which contains 20 square miles, and on which one year with another over 30 inches of rain falls. (To be within the mark we will call the area 20 miles, and the annual rainfall 30 inches.) One square mile contains 640 acres, and each acre 43,560 square feet. Multiplying by 640 and dividing by 12 we have 2,323,200 as the number of cubic feet of water on 1 mile in a rainfall of 1 inch, and as a cubic foot of water weighs $997\frac{137}{1000}$ oz. avoirdupois, and there are 35,840 oz. to the ton, this weighs $\frac{2{,}323{,}200 \times 997{\cdot}137}{35{,}840}$, or, in round numbers, 64,636 tons (to 1 mile and 1 inch of rain). As there are 20 miles and 30 inches, the annual rainfall on this little island is 1,393,920,000 cubic feet, or 38,781,600 tons. The amount of this may be better appreciated by comparison. Thus, the pyramid of Cheops contains less than 100,000,000 cubic feet and weighs less than 7,000,000 tons, and this water, then, in the form of ice, would many times replace the largest pyramids of Egypt. If we had to cart it away, it would require 3,231,800 cars carrying 12 tons each to remove it, and these, at an average length of 30 feet to the car, would make 6 trains, each reaching in one continuous line of cars across the continent, so that the leading locomotive of each train would be at San Francisco before the rear had left New York—a result which appears at first so incredible that it seems best to give the figures on which we rest the statement.

Now this is for a very small part of a single year's work of the sun in raising water to produce rain on the little spot of Manhattan Island alone—a spot, geographically speaking, hardly visible on the map of the country. Again, $\frac{1}{10}$ of an inch of rain spread over the whole area of the United States is not an extraordinary day's rainfall throughout its territory, but it will be found by any one who wishes to make the computation that such a day's rain represents a good deal over the round sum of ten thousand of millions of tons, and that all the pumping engines which supply Philadelphia, Chicago, and our other large cities, dependent more or less on steam for their water supply, working day and night for a century, would not put it back to the height to which it was raised by the sun before it fell. Every ton was lifted by the silent working solar engine, at the expense of a fixed amount of heat, as clearly as in the case of any steam pump, and this is the result of an almost infinitesimal fraction of the heat daily poured out from the sun! Now heat is something men have only in quite modern times learned to think of as a measurable quantity, and we must remember that we cannot even begin to have accurate knowledge of any form of force till we can answer the question, "how much" about it, not vaguely, but in figures.

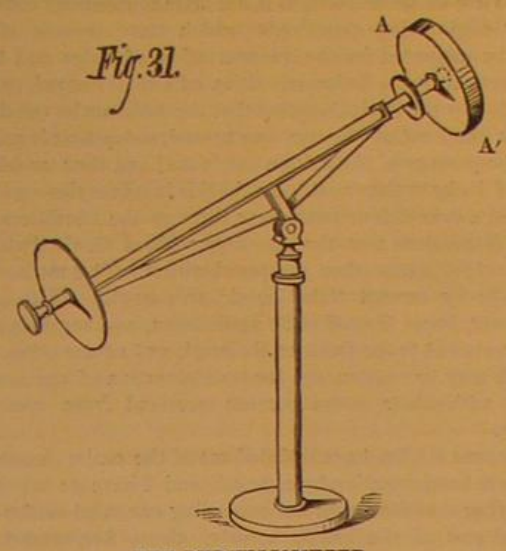
When we hold the right hand in warm water, the other in cold, for a few moments, and then plunge both in the same basin of tepid water, the two hands will give different reports; to the right the fluid is cold, to the left it will feel warm, though it is the same really to both, and we might vary the experiment by trying it with shade and sunshine. In either case the experiment would convince us that our sensations were very untrustworthy, and that if we were going to measure the sun's heat we must depend on some sort of instrument and not on anything that can feel. The first thing we have to do about the sun's heat is to measure it, not to guess at it; to measure it as accurately as we would anything which we could try with a foot rule or put in a pair of scales. When we have done this we have a solid foundation to work on, and the doing this has been thought a worthy occupation of a considerable part of their lives by many able men.

One of the first of these was Pouillet; others, such as Saussure and Herschel, had been at the problem before him, but his results were the most accurate until very recently, and even recent work has not materially affected his conclusions.

His instrument is easily understood with a little attention. We have it represented in Fig 31. Let us first remark, that what we want to get is the sun's direct or radiant heat, quite irrespective of that of the atmosphere around us, and that to get definite results, by our present method, we want to know how much of this radiant heat falls on a given surface of one square foot or yard. We may reckon it by any one of the numerous effects heat produces; practically it is convenient to let it warm water, and to see how much it heats, through how many degrees, and in how many minutes.

Pouillet's pyrheliometer is substantially nothing but a very shallow cylindrical box, A A′, filled with a measured quantity of water. It is mounted on the end of a hollow rod, having at its other extremity a metal disk of the same size as the water box. When the shadow of the box exactly covers the disk the instrument is pointed true on the sun. Held in the hollow rod is an inverted thermometer, whose bulb is within the water box, A A′. This enables us to read the temperature of the water from moment to moment. It is not enough to expose it for a time to the sun and read the thermometer—this would give too small a result, because the instrument as soon as it is warmed commences to radiate the heat away again, like any other hot body; and we would

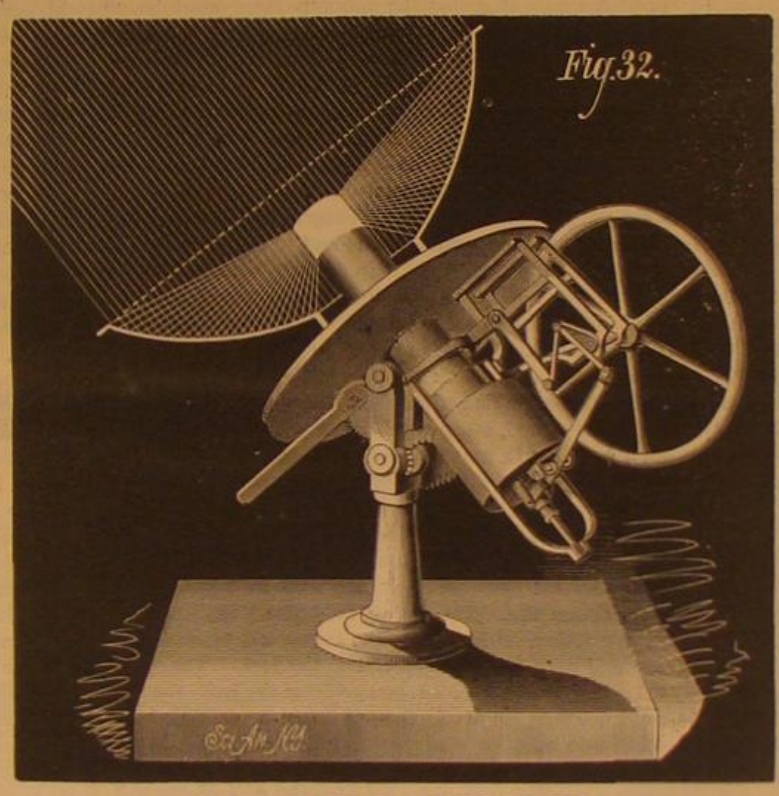
Fig. 31.



THE PYRHELIOMETER.

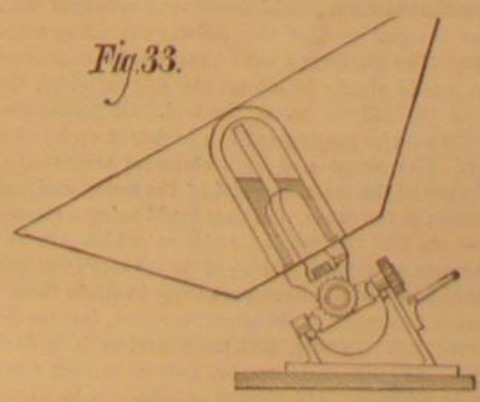
like, if we could, to keep all this heat in it to measure. As we cannot, we reach the same result by finding how much is lost, and allowing for it. Thus, the observer first leaves the apparatus in the shade (for instance) five minutes, and notices whether it loses or gains from its own radiation to surrounding objects. Then he leaves it directed to the sun, which shines full on it for five minutes more, the thermometer being read at the end of this exposure; and finally, at the end of another five minutes, during which the instrument has been left in the shade, it is read again. The half sum of the losses or gains in the shade is the radiation, and this added to or subtracted from the apparent gain in the sunshine is the actual number of degrees that the temperature of the water would have been raised, had all the solar heat been retained. Measuring in this way, we are independent of the temperature of surrounding objects.

Fig. 32.



ERICSSON'S SOLAR CALORIC ENGINE.

Fig. 33.



Mr. Ericsson, the celebrated engineer, who has improved on Pouillet's apparatus, has in fact shown that we do in accurate experimenting always get more heat (other things being equal) on a day in winter than in summer, as we should, if it is the direct solar radiation alone we are after; for that will be the greatest when the sun is nearest, as it is in our northern winter. Again, measuring when the sun is high, and at all altitudes down to the horizon, we find less and less heat, as the rays go through more of our atmosphere, and hence we can make a table showing how much this absorbs for every altitude, and consequently how much we should gain if it were taken away altogether. When this is done we find, according to Mr. Ericsson's late determinations (which we substitute for Pouillet's), that the direct heat of the sun on 1 square foot in March is competent to raise 7·11 pounds of water 1° Fah. in one minute. This is what it would do if we got outside of our atmosphere; but owing to the absorbing action of this, the radiation which actually reaches us, under a vertical sun, will so heat only about 5·6 pounds. According to the mechanical theory of heat this effect is that which would be required to drive an engine of $\frac{5{\cdot}6 \times 772}{33000} =$ 0·131 horse power. In other words, the heat of a vertical sun after absorption by our atmosphere represents rather over one horse power to each square yard. It is true that we cannot always have a vertical sun, nor clear sky, nor can we realize in actual work this whole effect by any form of engine, but when we have made the largest deductions, the statement of the sun's power, in this form, is calculated to excite astonishment. We have here, since there are 5,280 linear feet in a mile, $5280^2 \times 0.131 = 3{,}650{,}000$ horse power to the square mile (in round numbers); so that if we suppose in actual practice one horse power realizable to ten square yardsthe efficient working power of sunlight on an area much smaller than such a region, for instance, as the Adirondacks, is much greater than that of the computed actual steam power of the whole world. Upon the surface of the whole earth the heat at any time must be equal to that falling vertically on one of its great circles, which contain, roughly, about 50,000,000 square miles. Here, when we come to multiply the number of miles by the power per mile, we reach figures bewildering in their magnitude, but which are demonstrably correct. The only way this heat is utilized by conversion into power at present (steam power being dependent on coal made by the sun in past times) is by windmills and water wheels, both supplied by the sun, as in fact is every form of power, unless we except the insignificant one of tide mills, a kind only in a very remote degree dependent on solar action.

The student must be referred for the more indirect but equally certain action of the sun in providing the coal by which our engines are driven to special treatises (the popular one on "Heat" by Tyndall is a good introduction to the subject for the general reader), but this stock of coal is by no means unlimited, and in the course of a few centuries at most it will be exhausted in Great Britain, for instance, at the present rate of consumption. We may depend that long ere that time her engineers will with those of other countries, be turning to the immense source of power in the sun's direct rays, and that regions now barren under a tropical sun, where there is no fuel, water, or scarcely human life, will rise into new importance as the proper seats of industry, fed by the new power.

Engineers have hitherto done little for this, but we may be sure they will in the future do more. We are not writing a historical article, and, merely mentioning the curious fact that Solomon de Caus, the unhappy man of genius whose connection with the history of the steam engine is so well known, was one of the first to invent a solar engine, we pass over much that is historically interesting, to come to the present. Mr. Ericsson, whose work we have already quoted, is understood to have given a large part of his life, and particularly of his late years, to the problem. Fig. 32 is a drawing of a solar hot air engine of his invention, which is said to make 400 revolutions per minute. This is probably to be considered rather as an illustration of the feasibility of the instantaneous conversion of solar heat into power than as a useful form in practice, the circular mirror not being adapted for work on a large scale. The inventor, however, at present has not published the dispositions he is understood to have made for concentrating the heat in a larger working engine.

In France, M. Mouchot has, for many years, been pursuing similar studies; a section of one of his machines is shown in Fig. 33. This has the inconvenience of a very large heat reflector in a form which is expensive and liable to injury, but it must be remembered we are now feeling our way in the first steps of invention in his new field. Such things are, in one sense, but mechanical toys at present; but it was such toys as Hero's æolipile which preceded the steam engine. These are already more than mere toys, however, and in their promise, if not in actual performance, worth attention. If the reader wishes to know what is the best so far realized, or at least so far made public, we may refer to the *Comptes Rendus* of the French Academy of Sciences for October 4, 1875, where M. Mouchot states that he now employs a metallic mirror with a linear focus, in which focus is the elongated boiler he uses, and that he also makes use of a glass cover to let the solar radiation pass, but to retain the obscure heat re-radiated from the boiler. In the largest machine actually built, he employs, however, a mirror in the form of a truncated cone, Fig. 33, about 10 feet in diameter at its large, and 40 inches at its small section, looking like a mammoth lamp shade, with its concavity directed skyward. The material is copper, coated inside with silver leaf. A large bell glass covers the boiler, which is about 32 inches

long. The whole apparatus can be made to follow the sun. On May 20, in ordinary weather, 20 liters of water at 20° C. were let into the boiler at 8 : 30 h., and rose to 121° (two atmospheres) in 40 minutes, and then rapidly to 5 atmospheres, beyond which, owing to the slight nature of the apparatus, it was not thought safe to go. On the 22d July, at about 1 o'clock, under uncommon heat, the apparatus vaporized 5 liters of water per hour. The inventor claims that under favoring circumstances, he actually realizes about 10 calories per minute per meter, which is a trifle less than one horse power to ten feet square. Something exceeding this might probably be reached with the same apparatus in a drier air; upon the whole we are justified in speaking of one horse power to the square of ten feet on the side, as actually realized; one horse power to one square yard being about the limit of that which is theoretically realisable.

It must be remembered that, according to what has been stated, the sun offers us a source of power which is practically infinite both in amount and duration. According to what we believe we know with assurance, we can say that the sun is not a fire, fed by any fuel, but a glowing gas ball, maintained at an enormous temperature, and radiating enormous heat from a fund of energy maintained by the contraction of its volume, and by the impact of meteoric bodies. We can reckon with confidence that there will be no material diminution of its supply from these sources for a duration only to be reckoned by hundreds of thousands of years. As to the amount of heat supplied, it is inconceivable. The writer has made a computation of the time all the coal of the world would suffice to maintain the sun's radiation, were the actual source of it to fail, and were our whole supply of coal transported to its surface and burned there in its place. The result, otherwise stated, is that in any one second the sun radiates into space an amount greater than could be made good by totally consuming all the known coal beds of the world!

Something like 300 years separates the England of to-day, with her countless furnaces and engines, from the England of Elizabeth, in whose reign the spinning wheel was almost the most intricate piece of machinery on the island. Something like 300 years more, it is said, is all that separates the England of to-day from the future England whose furnace fires will have died out with the flame of the last bushel of coal under her surface; whose harbors send out only sailing craft; whose manufacturing population has gone to other lands, and whose "black country" is growing green again as Nature covers the ashes of her burnt-out mineral wealth with new verdure for the few who remain on the soil. We do not pretend ourselves to join in such pessimist views, or try to look into the future so far, though this is a very little way compared with what we know of the rise of man to civilization. To us, in this country, such a time, if it is ever to come, is immensely distant. But what is certain is that if some such change do not take place it will be through the discovery of a new source of power, for of the old, the coal, when our underground supply is used up we cannot get any more. Let us remember, then, in time, that though the stock be great there is no renewal.

For a journal counting among its readers so many interested in the applications of power as the Scientific American, I have thought, elementary as this presentation of the sun's claim to interest, merely as a source of mechanical power, is, it is better to offer it. We are, in closing, led back to the suggestion with which these articles began, of the sun's influence in altering the conditions of existence for the human race.

Future ages, it has been truly enough observed, may see the seat of empire transferred to regions of the earth now barren and desolated under intense solar heat—countries which, for that very cause, will not improbably become the seat of mechanical and thence of political power. Whoever finds the way to make industrially useful the vast sun power now wasted on the deserts of North Africa, or the shores of the Red Sea, will effect a greater change in men's affairs than any conqueror in history has done, for he will once more people those waste places with the life that swarmed there in the best days of Carthage and of old Egypt, but under another civilization, where man no longer worships the sun as his god, but has learned to make it his servant.

A SHIP RAILWAY AT PANAMA.

In a letter to the *Tribune*, Capt. Jas. B. Eads proposes a ship railway instead of the contemplated ship canal across the Isthmus of Panama. He says:

The Isthmus Canal Congress, recently held in the city of Paris, has presented to the civilized world all the results of the various surveys and estimates which have been thus far made. I believe in the effort to overcome the great barrier interposed by the American Isthmus to interoceanic navigation.

The fact that the congress comprised among its members many of the most able and distinguished engineers and scientists in Christendom is at once an assurance that its estimates and opinions are entitled to the highest respect. From these it appears that the most economic solution of this great question by means of a canal must involve the expenditure of at least $140,000,000, and possibly much more, and that the execution of the work will occupy from fifteen to twenty-five years from the time the work is commenced. These facts justify the conclusion: 1st, That the amount of capital required is so vast that it will not pay to execute the work with private means alone. 2d, That the amount cannot probably be obtained unless the governments of the several maritime nations directly interested in the work can be induced to contribute liberally in aid of the enterprise. 3d, That the time required for consummating the work is so great that the enjoyment of the completed canal must necessarily be reserved to the next generation.

In view of these facts, is it not wise to carefully consider other engineering expedients which have been or which may be suggested for the transportation of ships and their cargoes across the Isthmus? It is, as I am informed, recommended by the Paris Congress that the Isthmus be cut down below the level of the two seas to such a depth as is needed for the passage of ships from sea to sea, and thus avoid the use of locks in the canal. To do this involves the construction of a tunnel four miles long through the Cordilleras, of such dimensions that the one under Mont Cenis dwindles into insignificance when compared with it. This method has been justly termed "the heroic treatment." The term, however, is not limited in its application, and suggests similar treatment to the Panama Railroad, or to some other road which may be constructed for transportation of the largest ships with their entire cargoes overland from ocean to ocean.

My own studies have satisfied me of the entire feasibility of such transportation by railroad, and I have no hesitation in saying that for a sum not exceeding one-third of the estimated cost of the canal, namely, about $50,000,000, the largest ships which enter the port of New York can be transferred, when fully loaded, with absolute safety across the Isthmus on a railway constructed for the purpose, within twenty-four hours from the moment they are taken in charge in one sea until they are delivered into the other, ready to depart on their journey.

HOW SPEED MAY BE RAISED.

On such a railway across the Isthmus there need be no grades steeper than those on our chief lines of railroads, and the road bed need not be over forty feet wide, nor have more than eight or ten rails laid upon it to sustain the car or cradle upon which the ship is placed. The vessel should be lifted from the sea to the level of the road by a lock or by other well known hydraulic devices, and placed upon a car or cradle of ample strength to sustain the vessel with her cargo without the possibility of injury. The lock should be twice the length of the ship, and only one-half of its length should be deep enough to receive the ship from the sea. The bottom of the other half of the lock should be at the sea level, and on this the railway should commence. Into this upper part of the lock the cradle to carry the ship should be run, and the gates at the land end should then be closed. The ship should then be floated into the deep end of the lock and the sea gates closed, after which water should be admitted to fill the lock to a height sufficient to float the ship on the car in the upper lift, after which the water should be drawn off and the gates of the land end opened, and the car and its burden be then started on its journey by rail. At the other end of the road the car should be run into a similar lock, the gates closed over the track, and those at the sea end of the lock closed also. This being done the lock would be ready for filling, after which the ship could be floated off the car and moved to the deep end of the lock. The water would then be allowed to escape from the lock, the ship lowered to the ocean level, the sea gates opened, and the vessel would then be ready to resume her voyage in the other sea.

Another method of transfer between the sea and the railway, equally practicable and perhaps less expensive, would be to have a platform of iron of sufficient strength to support—first, a portion of the railway; second, the car or cradle to receive the ship; and third, the ship itself. This platform should be supported on each side by a row of large iron columns sunk into the bottom of the harbor and extending up above water to receive the hydrostatic cylinders with which the platform would be raised and lowered. By this hydraulic apparatus the platform should be lowered to a depth sufficient to permit the ship to be floated in over the railway car on the platform, after which the hydrostatic presses would lift platform, car, and ship, until the railway track on the platform would correspond in height with and form an integral part of the railway extending across the Isthmus. The platform I have thus briefly endeavored to explain would simply be a huge elevator on which the terminus of the railway would be laid. Of course such an elevator would be constructed in a harbor at each end of the railway. The purpose of such elevators would be to lift the ship out of the sea at one end of the route, and lower it into the sea at the other, and thus avoid using a steep grade into the sea like the marine railways which are seen in almost every navy yard. Many ships are very long, and any change of grade would have a tendency to strain them. Any perceptible change of grade must, therefore, involve devices to prevent such straining, and these devices it is desirable to avoid. For the same reason, curves in such a railway should be avoided. If a change of direction be absolutely necessary, it can be managed by a turn-table at the locality where a change of alignment is desirable. The avoidance of curves would greatly simplify the construction of the car on which the ship is to be transported. This car would probably be formed by joining several separate sections together, according to the length of the ship. Each separate section would probably be 100 feet long and be supported by about 200 wheels, some of which should be drivers, actuated by propelling engines. Rubber or steel springs should be interposed between the axles of the wheels and the car. Each section of the car or cradle that carried the ship would really constitute a locomotive. The propelling engines would be placed on each side, and at such a height as to prevent submergence when the car would be sunk on the elevators or in the locks. The weight of the largest merchant steamers and their cargoes would not exceed 10,000 tons, and such a one would be carried on a cradle composed of five such locomotives. These would have about 1,000 wheels, bearing on eight or ten rails with a pressure of about twelve tons to each wheel. This is only twice as much as the pressure on the rails under the driving wheels of the locomotive of an express train. The total weight of ship, cargo and cradle would be distributed over an area of road bed 40 feet wide by 500 feet long, and would be only 1,200 pounds per square foot, allowing 2,000 tons for the weight of the car. This is not half the pressure on the earth under each tie when each pair of the driving wheels of an ordinary locomotive passes over it.

GREATER SPEED THAN IN A CANAL.

On moderate grades an ordinary freight locomotive will pull about fifty loaded cars from fifteen to twenty miles per hour. The weight of the cars and their load is about 1,000 tons, and this is carried on about 400 wheels. Hence the largest ship and her entire cargo should not require more than the power of a dozen such locomotives to move it at the same speed over similar grades. From this it must be evident that the ship once safely placed on a properly constructed car, adjusted to the railway of a substantial and well-ballasted road-bed, can be moved with certainty and ease at a much higher rate of speed than would be safe in the very best canal that has been proposed. I would, however, not expect to use a higher rate of speed on a ship railway than eight miles per hour.

The practicability of lifting the heaviest ships out of water with perfect safety on cradles adjusted to receive them is illustrated in every dock-yard in the country, and one of the methods I have referred to as being a huge hydraulic elevator, has been put to a practical test. A dry-dock was constructed upon this principle in England a few years ago, and sent to the East Indies, by which ships placed over a platform sunk to receive them are lifted vertically out of water by hydraulic pumps.

Of course, the works and devices required for the successful operation of a ship railway should be of the most substantial character, and the elevating machinery should be of such strength and power as to make the transfer of the ship from the railway to the sea, and from the sea to the railway, a matter of perfect safety and dispatch.

The actual cost of operating such a railway would be, I think, considerably less in proportion to the tonnage moved over it than that of the most successful railway line in this country, for the reason that the tonnage carried would be handled by machinery exclusively, and the ratio of paying cargo to non-paying weight would be much greater. The cost of maintenance in proportion to the tonnage carried should be much less also. This result may be safely anticipated, because the railway would be very substantial and durable, and very short compared with the magnitude of the tonnage carried; the machinery would also be very simple in character, and the ratio of cost of maintenance to gross receipts would therefore be proportionately reduced. But even if we assume that the operating expenses and maintenance be equal to one-half of the gross receipts, it will be seen that a ship railway will be a much more profitable investment than a canal, even if it cost half the price of the canal, whereas it should not cost more than a quarter as much. The gross receipts must be the same in either case, and the railway can be completed in three or four years, while it is safe to assume that the canal will require five times as long. The interest on the canal investment before completion would therefore be enormously greater than that on the railway. A single track railway, with provision for side tracks to enable the cars to pass each other at proper points on the road, would, I think, be ample to meet the demands of commerce at the Isthmus for many years to come.

The California Codfish Trade.

The following facts and figures with regard to the codfish trade of the Pacific Coast are given by the San Francisco *Alta*. The four firms engaged in this industry employ nine vessels. An ordinary catch for this number of vessels is 1,000 tons, and they carry from San Francisco 800 tons of salt to pack the fish for the return voyage. The season commences about March 1 and closes October 1. The fish are caught off the Alaska coast and Choumagin Islands on the American side, and in the Ochotsk Sea on the Asiatic side, where the fish are taken with hand lines, while trawls are exclusively used on the banks near the Alaska shore. Each fisherman has a dory to himself, and tries hard to make the best catch in the fleet. The hand line fishing is quite exciting, and the men take to it like sport. When the fish are hauled on board from the boats they are at once cleaned and packed in frames in the vessel's hold, a thick layer of salt on each layer of fish. At the close of the season sail is made for San Francisco, and here the fish are washed, soaked in brine, and dried for market.

U. S. Fish Commission.—The headquarters of the U. S. Fish Commission for their summer work this year on the Atlantic coast is at Provincetown, Mass. Work was begun there about the middle of July.

SPAR TORPEDO VESSEL ACHERON.

About eighteen months ago the government of Sydney, Australia, voted £8,000 for the construction of two torpedo launches, and their design and supervision of construction were intrusted to Mr. Norman Selfe, of Sydney. As nothing over ten knots had ever been realized in launches there up to that time, Mr. Selfe sought for information in our own pages and those of our contemporaries; but editors are not at liberty to publish all they know concerning such craft for obvious reasons, so Mr. Selfe had to rely on his own resources. He had to begin at the beginning, and work the whole thing out. Since the boats have been in hand he has learnt a few particulars, but the original design has not been departed from in the slightest degree. One vessel is launched, and on a trial in a very heavy sea realized over fifteen knots; but Mr. Selfe is confident of getting thirty or forty more revolutions at the least, as he only had 330 revolutions, and steam blowing off abundantly. When he decided to use a balance rudder, he had never heard of a similar vessel being fitted with one. With regard to the air pump, he could not understand how an ordinary air or feed pump could work noiselessly at from 300 to 400 revolutions, so he designed special pumps, the air pump with two buckets in one barrel moving in opposite directions, and dividing the stroke between them. It has turned out a great success, works noiselessly at any speed, and Mr. Selfe informs us that he gets 26½ inches to 27½ inches of vacuum; the feed pump also works well. In the present case the blower is driven direct by friction rollers made of disks of leather, brought into contact with a large wheel or pulley on the engine shaft, and a small pulley on the fan shaft, by a pair of levers worked by a screw in such a way as to nearly equalize the pressure on the fan bearings. The fan is of a silent type, with gun metal frame and steel blades of No. 30 gauge, and works well. A turn of a hand wheel throws the leather pulleys out of gear, and stops the fan at once. The boiler is of the Belpaire fire box type, with Cudworth's mid-feather. The engine is all steel and wrought iron, except the cylinders. The crossheads and guide blocks are all forged of steel in one piece to save height, and few engines of 14 inch stroke with such long connecting rods have ever been made so low before. The steel plates were telegraphed for from England, but the steel for the engine and screw, copper for fire box, and other materials, had to be rummaged out from all over the colony, and Mr. Selfe had often to adapt what he could get. The propeller blades are of hammered steel on a wrought iron boss.

Our engraving below is from a photograph. The engine has two cylinders, 11 inches and 19 inches diameter by 14 inches stroke; the boiler has 300 1¼ inch tubes; the pressure is 140 lb.; the length of the boat is 80 feet; per beam, 10 feet 3 inches.—*Engineer.*

The Intravenous Injection of Ammonia.

Dr. Gasper Griswold, House Physician to Bellevue Hospital, of this city, states in the *Medical Record* that while serving as assistant in the physiological laboratory of Bellevue Medical College, in 1877–8, he made a number of experiments on dogs with reference to the action of intravenous injection of ammonia. For this purpose he used the ordinary aqua ammoniæ, diluted with an equal bulk of water. For his experiments he chose dogs in which the viscera had been exposed during vivisection, and which had become exhausted with loss of blood, etc. He waited in such a case until the heart had almost ceased to beat, and its inefficient contractions no longer deserved to be called pulsations. He then injected half a drachm of the ammonia solution into a convenient vein. After a period, varying with the distance of the vessel from the heart, and with the rapidity of the circulation in the particular case, a marked change was observable; the systole suddenly acquired new energy, which emptied the distended right ventricle into the lungs, and filled the aorta with fresh oxygenated blood; and the heart itself became bright red again as the new supply flowed in through the coronary arteries. The circulation was almost immediately re-established, and the animal, if anæsthesia were not complete, moved and showed signs of life.

Encouraged by these successes, Dr. Griswold has since frequently injected one drachm of ammonia solution into the veins of patients apparently moribund, and states that he has always succeeded in stimulating them much more powerfully than he could do by other methods; the prompt and marked effect in some cases being startling to those who have been accustomed to see hypodermic injections of whisky and ether, inhalations of nitrite of amyl, etc., employed to no purpose under like circumstances. From his experience with a number of cases, some of which are described in the article under consideration, the author believes that he has satisfactorily established: (1) That the intravenous injection of ammonia is a prompt and powerful means of stimulation, acting efficiently in cases where other measures are of no avail; (2) that no bad effects follow its employment. These deductions have a special significance in connection with those operations whose object is the removal of mechanical obstructions to respiration—particularly laryngotomy and tracheotomy.

These operations, performed in cases of croup, etc., generally fail to save life because done too late, the patient being too much exhausted to breathe in the air for which a new entrance has been made. The author asks: Would not the intravenous injection of ammonia, in connection with artificial respiration, save many of these patients? It being proved that the treatment is without danger, and followed by no bad effects, this question should not long remain unanswered.

Fusible Metals.

Under the name fusible metal or fusible alloy is understood a mixture of metals which becomes liquid at temperatures at or below the boiling point of water. There are several such mixtures known, some of which *New Remedies* has gathered from one source and another, and placed in convenient order, as follows:

1. D'Arcet's: Bismuth, 8; lead, 5; tin, 3 parts. This melts below 212° F.

2. Walker's: Bismuth, 8; tin, 4; lead, 5 parts; antimony, 1 part. The metals should be repeatedly melted and poured into drops, until they can be well mixed previous to fusing them together

3. Onion's: Lead, 3; tin, 2; bismuth, 5 parts. Melts at 197° F.

4. If, to the latter, after removing it from the fire, one part of warm quicksilver be added, it will remain liquid at 170° F., and become a firm solid only at 140° F.

5. Another: Bismuth, 2; lead, 5; tin, 3 parts. Melts in boiling water.

Nos. 1, 2, 3, and 5 are used to make toy-spoons to surprise children by their melting in hot liquors. A little mercury (as in 4) may be added to lower their melting points. Nos. 1 and 2 are specially adapted for making electrotype moulds. French cliché moulds are made with the alloy No. 2. These alloys are also used to form pencils for writing, also as *metal baths* in the laboratory, or for soft soldering joints. No. 4 is also used for anatomical injections.

Higher temperatures, for *metal baths* in laboratories, may be obtained by the following mixtures:

1 part tin and 2 parts lead melt at 441·5° F. 1 part tin and 1 part lead melt at 371·7° F. 2 parts tin and 1 part lead melt at 340° F. 63 parts tin and 37 parts lead melt at 344·7° F.

Hard vs. Soft Water.

It may be pleasant to those who live in a region of our country where nothing but hard water is to be had, to be informed, by so good authority as Dr. Tidy, the well-known chemist, of the results of his observations on the use of hard water for culinary and domestic purposes:

(1) Hard water is the best dietetically, because of the lime.

(2) It makes better tea, although not so dark colored, owing to the fact that soft water dissolves the bitter extractive matters which color the tea, but ruin the aroma.

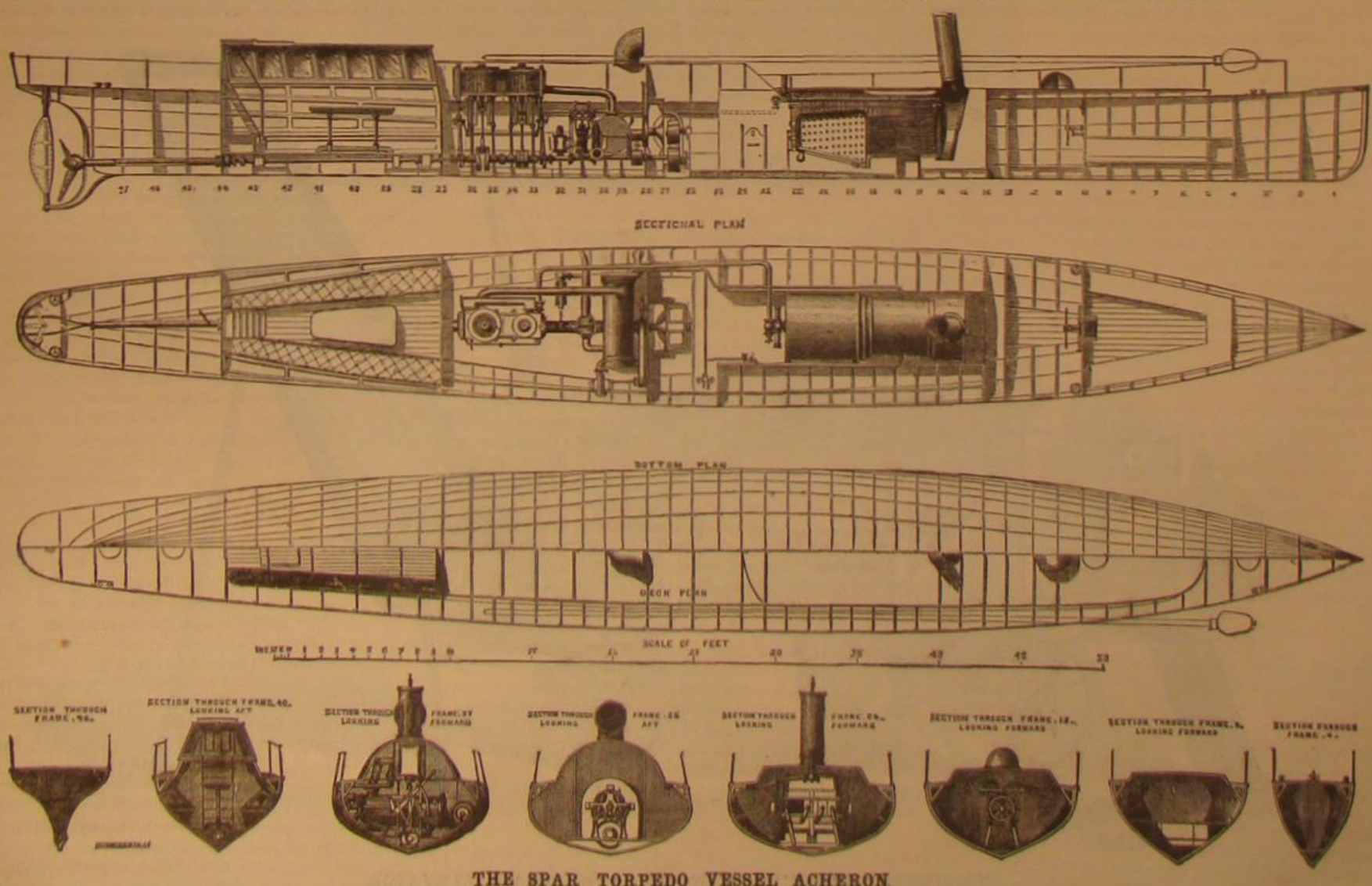
(3) It relieves thirst, which soft water does not.

(4) It does not dissolve lead or organic matter, which soft water does.

(5) It is generally good colored, soft water being as a rule dark colored and unpleasant looking; hence, in places like Manchester, supplied with soft water, they always put it (in hotels) in dark bottles, to hide the color. A soft water, however, is a better detergent, and requires less soap. For a residential town a water which has over ten degrees of hardness would be best. For manufacturing towns a soft water would be the most advisable, for commercial considerations only.

Life Time of a Locomotive.

The iron horse does not last much longer than the horse of flesh and bones. The ordinary life of a locomotive is thirty years. Some of the smaller parts require renewal every six months; the boiler tubes last five years, and the crank axles six years; tires, boilers, and fire boxes from six to seven years; the side frames, axles, and other parts, thirty years. An important advantage is that a broken part can be repaired, and does not condemn the whole locomotive to the junk shop; while, when a horse breaks a leg, the whole animal is only worth the flesh, fat, and bones, which amount to a very small sum in this country, where horse flesh does not find its way to the butcher's shambles.



THE SPAR TORPEDO VESSEL ACHERON.

PORTABLE FLOUR MILL.

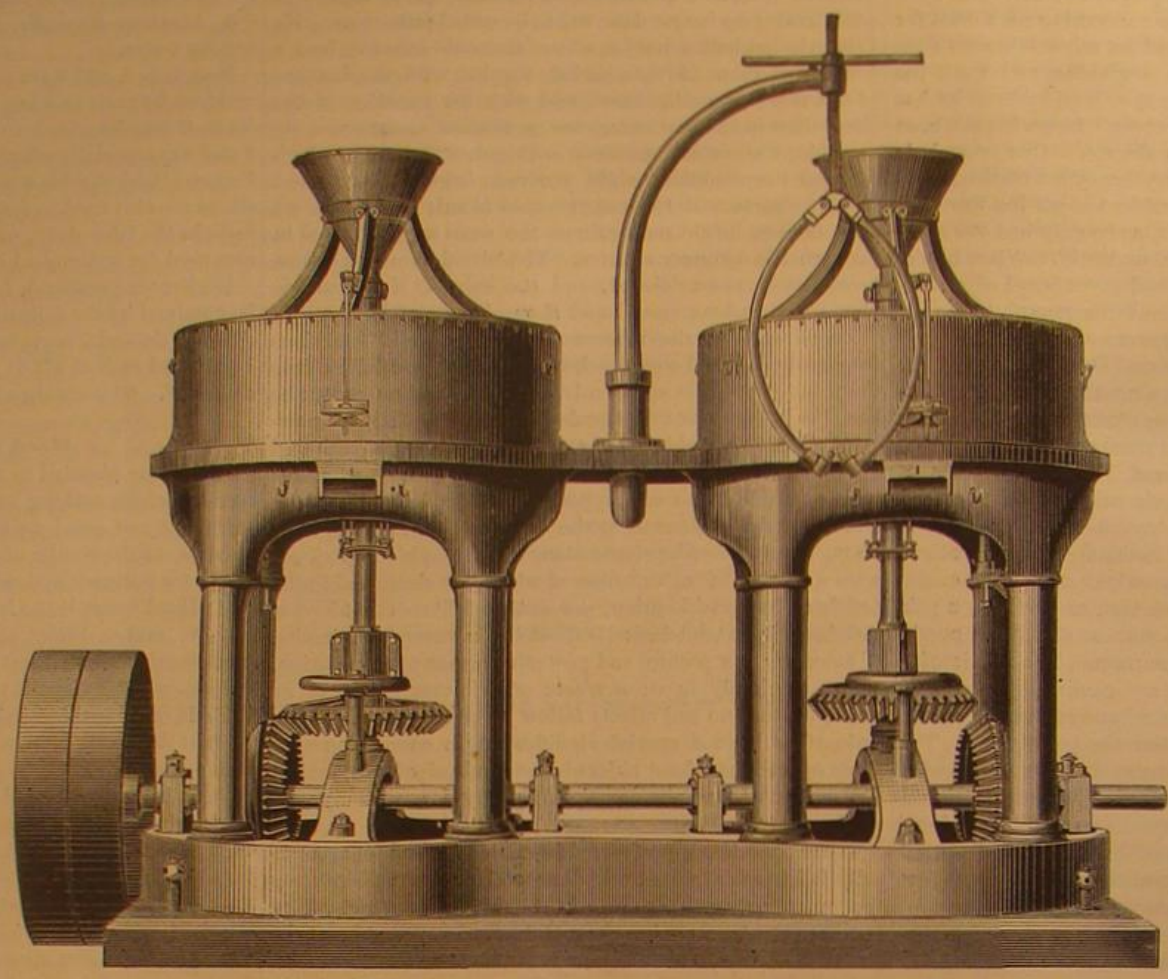
We illustrate on this page a portable mill, manufactured by Messrs. Clayton & Shuttleworth, of Lincoln, England. The framing is exceedingly strong and carefully designed. The mill may be regarded as an example of the best type of this class of machinery, and is far too simple to require description. We take our engraving from *Engineering*.

Electric Blowpipe.

At a recent meeting of the Academy of Sciences, M. Jamin submitted a new electric burner, which he also recommended to chemists and physicists as a blowpipe. Two carbons are supported vertically abreast, hinged below, and drawn together at the top by a spring. A current is sent up one, down the other, then round a rectangular circuit inclosing the two, and passing first round the first one by current attraction the carbons are drawn apart, and the arc appears at the top and descends gradually, consuming one or both carbons. When the action of the rectangle is sufficient, the arc driven beyond the points is like a gas flame, and M. Jamin receives it on a piece of lime, magnesium, or zirconium, getting intense light. It is also so hot as to fuse the lime. For the electric light this burner has considerable advantages, since it has no mechanism and requires no preliminary preparation beyond a support and the carbon points. The size of the flame is almost doubled and the light is augmented. The new foci are very powerful, and the quality of the light is far better, and the arrangement of the foci is more advantageous, the greatest quantity of light being directed downward, where it is wanted, instead of up into the air, where it is useless.

NEW THRASHING MACHINE.

We illustrate here a thrashing machine and straw elevator combined, made by Messrs. Nalder & Nalder, of Wantage, Eng. The prominent feature is the direct combination of the straw elevator with the machine, by which very important advantages are no doubt secured. The elevator will deliver the straw high enough for any ordinary straw rick; at the same time this rick can be placed in any desired position, either in a straight line with or at any angle on either side of the machine. But going further than this, the side or angular movement, too, as well as the raising or lowering of the elevator, can, one or both, be performed without stopping the working of the machine



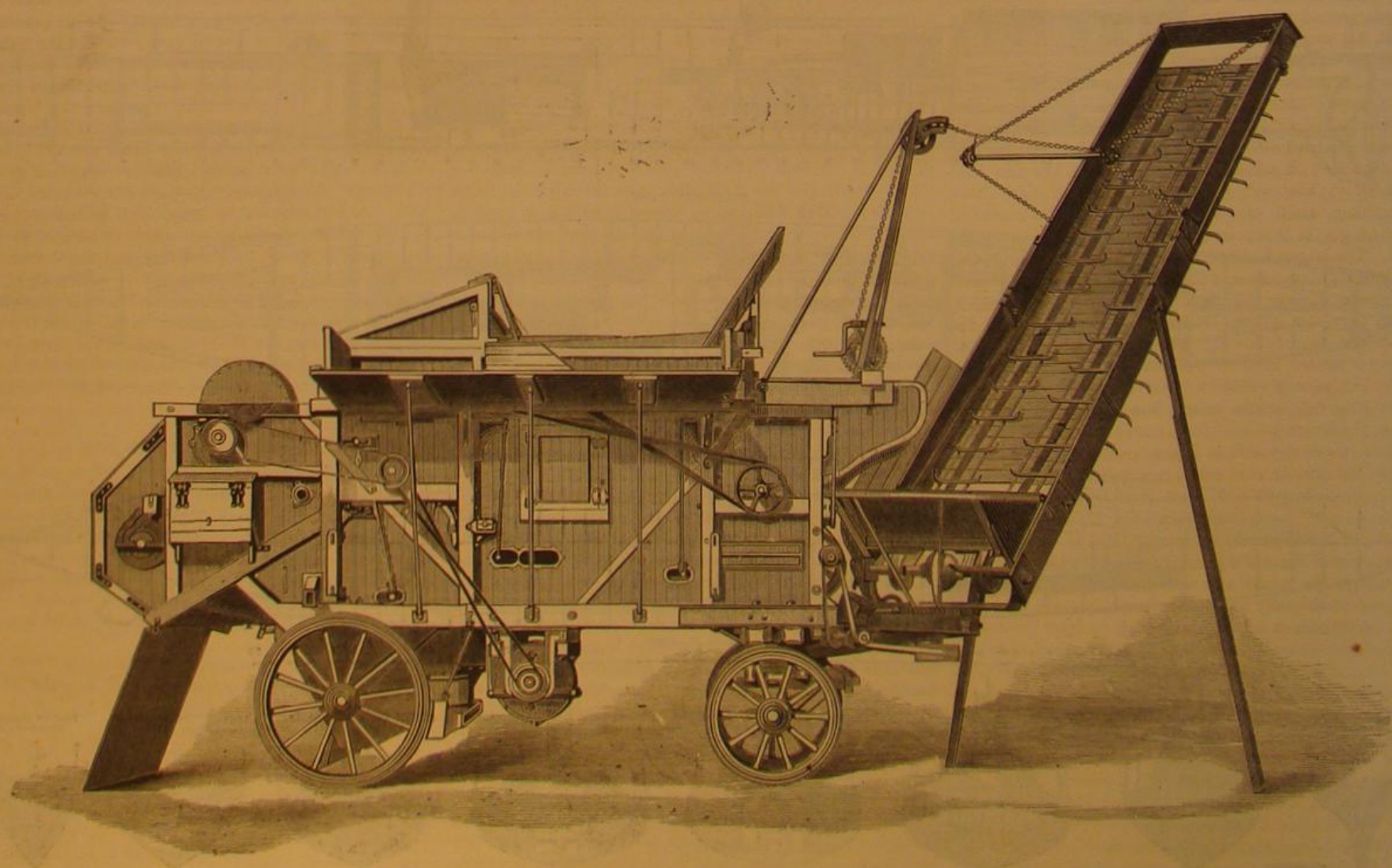
CLAYTON & SHUTTLEWORTH'S PORTABLE MILL.

Thus, the straw can be delivered from the elevator to any part of the rick that is required as the work progresses, and by this means is saved the labor of at least one man on the rick. Or a number of wagons placed in a line can all be loaded without any interruption to the work, or, if desirable, part of the straw can be built into a rick on one side, and the remainder on the other side of the machine, all without in any way checking the working of the apparatus. This is a decided advance on the ordinary separate elevator, and an improvement that will be appreciated.

The vexatious delay and time wasted in setting the ordinary separate elevator to the machine, especially on uneven ground, and more particularly for angle delivery, and stoppages from the driving straps coming off, as they readily do when the pulleys are not carefully put in line, are all got rid of by the arrangement we illustrate. When set up for work, the elevator is part and parcel of the machine, and so no trouble from the above causes can arise, and the unpacking and setting up of the elevator require little if any more time than the unfolding and raising of the ordinary separate elevator; a saving of time in getting ready for work may thus be fairly claimed for this machine.

In places where it is undesirable to use the elevator, the straw falls into the hopper and from there to the ground, this hopper always remaining in its place, so that although the owner has always the advantage of having the thrashing and elevating machine together ready for work, the latter need not be used if not required; it is simply not "set up." The weight of the elevator being about 8 cwt. only, one team of horses will draw the combined machine from place to place, whereas two teams are required when the machines are separate; and in the case of removal by a traction engine the men in charge have only one machine when traveling to look after—a great convenience in narrow roads and in turning sharp corners.

Our illustration represents the machine ready for work. It will be seen that the main frame of the machine is elongated at the upper and lower portion of the front or straw delivery end; on the lower part is fixed a turntable or platform, to the upper portion of which is attached the hopper and trough of the elevator, and on the upper portion of the frame is fixed a crane or winch. Through the axis of the turntable is passed a vertical spindle, geared into another spindle, placed horizontally, and on this latter is fixed the two pulleys for driving the two rake belts for conveying the straw up the trough. These belts are of India-rubber, on each of which are fixed separate rakes, the usual heavy chains being dispensed with. Motion is given to the vertical spindle by a belt driven from any convenient pulley on the machine. This vertical spindle passes through the center of the turntable, the upper part of which is capable of



COMBINED THRASHING MACHINE AND STRAW ELEVATOR.

movement, and it forms an axis on which the elevator trough, with the hopper, partially rotates, and, as the guides of the crane are also fixed in line with this axis, the lateral movement of the elevator is obtained, so that the straw can be delivered in any required place, either in a line with or on either side of the machine, having the full range of 180 deg.

The horizontal spindle may be said to form an axial line on which the trough is hinged at the lower end, thus allowing of the raising and lowering of the same by means of the crane before referred to; this is also done without stopping the work.

The taking to pieces of the elevator for packing up is a very simple process. The trough is lowered nearly to the ground, when the rake belts are taken off, rolled up, and put under the hopper of the elevator, as also the top roller and winch board. The two tightening chains under the floor are now unfastened, which allows of the floor, made in sections, to drop out by extending the sides outwards. These sides are now lowered quite down, and the suspension chains taken off and stowed away. The sides, after detachment from the turntable, are uncoupled at the middle, one being placed, as seen in the engraving, on each side of the machine; the sections of floor placed endways on the hopper, the crane in rods taken off, and the crane itself turned back on the top of the machine, and the entire elevator is so conveniently and compactly packed on the machine as to be hardly noticeable. We are disposed to regard this as one of the most important of the many improvements which have been effected during the last dozen years in the construction of thrashing machinery, and it does not appear that to secure the advantage any increased expenditure of capital is necessary.—*Engineer.*

Curious Facts about Ants.

Mr. E. Gittins, of Tivoli, Queensland, in a letter to the editor of the *Journal of Science*, communicates some interesting facts concerning ants. He writes:—"If meat shows the least possible tendency to decompose—and it will do so in the course of twelve hours in summer—the ants will find it, though suspended by a wire or string from the house-top or the top of a tent. The ant perceives decomposing animal matter at a long distance, and does not go exploring for such matter, but goes straight to it from the ant-hill. A snake killed in the bush is generally placed on the branch of a tree, so as to be seen by travelers, and as soon as decomposition sets in the ants find it, and the flesh is soon carried off to the ant-hill; even their own comrades, when killed, are carried off to the underground cells. They never stay to feed, but they take up the booty and off they go." The writer then describes a number of experiments, showing that portions of meat placed near ant-roads were overlooked till putrefaction set in, and were then eagerly carried off. He remarks that "ants that feed on saccharine matter are as difficult to keep off as the carrion-feeders; they smell the sugar, and endeavor to get at it wherever it may be placed. The largest kind of sugar-ants will feed until the cold air of night comes on, and then fall into a stupor and there remain during the day." We should feel much obliged, says the editor, if our correspondent would determine the two following points: Whether his meat ants prefer tainted meat to fresh when both are placed equally near, as, *e. g.*, close to one of their roads; and whether they will attack animal matter in an advanced stage of decomposition? It certainly seems that they occupy a more prominent place among "nature's scavengers" than has been hitherto supposed.

TORNELIA.—*Tornelia fragrans.*

TORNELIA.

This plant is indigenous in Mexico, and is cultivated in northern climes for its beautiful foliage. The fleshy spadices, bearing perfumed and well-tasted fruits of *Tornelia fragrans*, are habitually sold in Mexican markets, where they rival the pineapple as an article of food.

Progress in Fish Culture.

It is impossible to estimate the advantages which have already resulted from the efforts of our national and State fish commissions to restock our rivers with shad and other fish. This season alone 15,000,000 eggs have been hatched, and in the last eight years 48,000,000 young fish have been turned loose. It is noted that while formerly the fish were found rarely outside the rivers that empty into the Atlantic Ocean between Cape Cod and Florida, they are now in the Gulf of Mexico streams, the tributaries of the Mississippi, the California rivers, and those of Maine. They have increased in great numbers in Lake Ontario, although their growth is very slow. Several of three pounds weight have been taken this spring near Sackett's Harbor, and it is possible that they may mature there.

Rapid progress has been made in the propagation of fresh water fish. So nearly perfect is the process of hatching brook trout eggs at the State hatching house in Caledonia that more than 98 per cent become healthy fish. The same success attends the hatching of salmon, black bass, white fish, and other varieties. These results are so satisfactory that the commissioners are turning their attention toward cultivating food for fish, rather than seeking new methods of hatching. The object is to fill streams which hitherto have been barren of fish. There are many water courses in which the brook trout has not thrived, although the conditions of temperature and the quality of the water have seemed favorable. The reason was that the stream was wanting in food for the fish. The commission's investigations have proved that certain plants and shrubs attract insects which are the trout's natural food. The problem of how to raise the fish in barred streams was therefore successfully solved by planting in the streams the insect producing sedges and mosses. Once started, the vegetation increases of itself, bringing with it the animalcula. The learning of the botanist and the entomologist is thus brought to the aid of the pisciculturist.

If properly protected the food fishes of the State will swarm the waters in greater numbers ten years hence than they do at the present day. In many lakes and rivers there is already a noticeable increase. The black bass of the Delaware grow more plentiful every year. The white fish have appeared in increasing numbers in Cayuga and Seneca Lakes. The Mohawk River never contained more fish than now, the commissioners say, although it flows through a thickly populated part of the State, and is dragged with nets. Nearly every natural trout stream in the State has been replenished, and in many counties fishing has been prohibited for a certain number of years. In Central New York sportsmen's clubs are taking the protection of fish and game in hand, and for the first time in the history of the State the laws are being enforced. The State is the natural feeding ground for such a large variety of fishes, birds, and animals that under reasonable protection they will multiply rapidly.

NATURAL HISTORY NOTES.

The Wells of Prairie Dogs.—Some time ago the statement was made in the *American Agriculturist*, on the authority of Mr. M. T. Leech, of Nebraska, that the prairie dogs of the Western States dig wells, each "dog town" being provided with one. This statement has been widely copied, but has been denied by some persons, and among others by one of the professors at Yale College. Recently one of the staff of the *Agriculturist* has met Mr. Leech in Wyoming, where he holds a responsible position in the railway employ. This gentleman reiterates his original statements, and adds that if skeptics will come to Sidney, Nebraska, they will find convincing proof of the accuracy of what he says. There is a "town" of 25 or 30 pet prairie dogs about 5 rods from the track northwest of the Railroad Hotel. The owner of the dogs will show the visitor the well, and will inform him that the first move that the dogs made, after locating there, was to dig for water. At a point on the Kansas and Pacific Railroad, not far from Buffalo Station, the workmen in sinking a tank reservoir some time ago struck one of these prairie dog wells and followed it down to a depth of 200 feet. Mr. Leech's statements were verified by Prof. Aughey, the well known geologist at the Nebraska State University, who had also discovered such wells while making geological explorations along the Logan River in northern Nebraska.

Chemical Composition of Trees at Different Elevations.—MM. Ch. Naudin and Radlkofer have been making observations on the results of the growth of trees—their development and their chemical composition—according to their height above the sea level, and have calculated the dimensions that the leaves of the beech assumed at altitudes varying between 150 and 1,400 meters (500 and 4,600 feet) above that level. An abstract of the author's paper in the *Annales des Sciences Naturelles* is given in *Les Mondes*. At the lowest level it was found, at the beginning of August, that a thousand leaves of the beech covered a space of a little more than 4 square meters. At the greatest altitude, beyond which the beech is no longer found in cultivation, the same number of leaves covered a space of only a little more than 1 square meter. Between these two extreme points, the dimensions of the leaves varied pretty regularly with the degree of elevation. It was also found that the leaf varied in its composition. Some of the leaves of the gray beech gathered at the same time in different forests gave, when they were collected at an altitude of about 260 meters (850 feet), a little more than 7 per cent of ashes; those that came from forests situated at an elevation of 1,400 meters (4,600 feet) gave only about 4 per cent. This diminution indicates that the most important constituent elements of the leaves undergo an alteration dependent on phosphoric acid, and shows that this product diminishes in indirect ratio to the quantity of ashes.

As to the distribution of matter in the tree, the attention of the experimenters was directed principally to the incinerable constituent elements. These elements exist in small proportion in the wood of the trunk, but are found in greater quantity, on the contrary, in the wood of the branches, in the bark, and in the leaves—parts which contain the greatest proportion of cinerary matter. Thus, if we take the beech, we find that the wood of the trunk furnishes 45 centigrammes of ashes per 100 grammes of leaves, while the branches give 1·8 gramme, the bark 3·3 grammes, and the leaves (in May) 4·16 grammes per 100 grammes of whole material. As every portion of the tree enlarges with age, the leaf becomes the most productive part of it. The leaves, at first sight, seem to be an exception to the general rule, for their yield of ashes increases with age. This exception is due to the accumulation of lime and silica, which takes place in proportion as the phosphoric acid and potassa diminish. The fact that the young parts of the tree give a greater quantity of ashes than the old ones is of considerable practical importance. A copse, cut frequently, uses up more phosphoric acid and potassa (which are, pre-eminently, nourishing agents of the soil) than would a forest composed of large trees. A beech copse of a cubic meter in extent contains 1·6 per cent more ashes than the same extent of much more aged woods. A like quantity of twigs would equally give a yield greater by 2·3 per cent than that of the trunk. In the fir tree the difference is yet more marked, the figures being respectively 1·7 to 6·7.

An Electrical Railway.

Siemens & Halske, of Berlin, says the London *Echo*, have supplied a real novelty to the Exhibition held in that city. It is an electrical railway, with three carriages, capable of carrying twenty passengers. The road is about 220 yards long, and the train travels at the rate of ten feet per second—about seven miles an hour. A steam engine drives a dynamo-electric machine, and the current produced is transmitted to another machine which works the train. Deprez is exhibiting a model of his motor at Lille, and at the forthcoming Scientific Exhibition in the Palais de l'Industrie, at Paris, he will have a small train worked by a battery of twelve Bunsen cells. Deprez hopes to be able to work an aerial propeller by his motor.

THE PHYLLOXERA IN FRANCE.

ITS MARVELOUS REPRODUCTIVE POWERS—THE BEST MEANS OF CHECKING ITS RAVAGES—SUPERIOR RESISTING POWERS OF AMERICAN VINES—THEIR INTRODUCTION INTO FRANCE OFFICIALLY RECOMMENDED.

The following is a translation of the official report (in the form of questions and answers) recently made on the subject of the phylloxera by Dr. Menudier, of the Superior Commission appointed for that purpose by the French government. That portion of it which refers to the superior resisting qualities of American vines will be found of especial interest.

Whence comes the phylloxera? Even the oldest documents justify the assertion that the phylloxera had never existed in Europe, while, for a long time past, it has been found in the United States, causing all European vines to succumb to its attacks, after having been planted three or four years. The first points of attack in Europe have almost invariably had American stocks near at hand. Everything leads to the belief that the phylloxera was imported from America on American plants, and there are now scarcely any, save the importers, who will deny its American origin.

From what period does the phylloxera's invasion of France date? Its ravages began in 1863, at Pujaut, in the Department of Gard. Its invasion probably dates from about 1860.

At what period was the fact of its presence in the Charente Inférieure Department established? In November, 1873, at Montils, in the Arrondissement of Saintes; but the invasion must have taken place between 1868 and 1870, as some vines had already been pulled up on account of the phylloxera's ravages.

What is the phylloxera's line of march? Generally from south to north.

Is not the phylloxera's presence due to a diseased condition of the vine, superinduced by its weakened condition, or the exhaustion of the soil? No: for by placing this insect upon the roots of very healthy and vigorous vines in a region previously unattacked, all the external symptoms of the disease, and finally the death of the stock itself, result.

Is there not reason to hope that the phylloxera will disappear? Up to the present time, it is impossible to discover a single fact permitting a belief in a result so fortunate.

Have there not been instances where vines infected with the phylloxera have been left uncultivated, and have recovered by themselves? No; not a single vine really infected with the phylloxera has, without treatment, been restored to a complete state of health.

What is the extent of the ravages in this (Charente-Inférieure Department? Of 168,945 hectares planted in vines in 1875, 135,490 were overrun, or appeared to be, at the end of 1877, and later inquiries prove that the inroads did not end there. Several thousand hectares of vines have since been pulled up.

Is not the phylloxera found, and may it not subsist, upon other plants? It has been noticed that plants, the roots of which are mixed with those of a vine, sometimes carry phylloxera, but it has been established that it is upon the vine only that the insect subsists.

How is the phylloxera propagated? In the months of July, August, and September, it takes wing, and, either of its own accord, or carried by the wind, passes in swarms over a distance of several kilometers to attack some fresh point. It penetrates the soil through the fissures between the roots and the earth, and thus step by step passes from one root to another, abandoning each as it becomes exhausted. Tools which have been used in working vines infected with the phylloxera are also means of its propagation; so, also, are plants, whether with roots or without.

Is the phylloxera as prolific as is reported? And what are the conditions favorable to its reproduction? The higher the temperature, the greater the deposit of eggs. Entomologists estimate that, in a southern climate, a single laying female will, in the course of one spring and summer, make nine deposits, and, by successive hatchings, attain a product of between twenty-five and twenty-six million phylloxera.

Upon what parts of the vine does the phylloxera stay? On the roots, the bark, the wood, and the leaves.

Upon what parts is the winter egg deposited? On the bark, both new and old, on the under side of the leaves, and even on clumps of earth.

Has the winter egg been found in this department? All search for it has proved fruitless.

Has this winter egg the importance some have attributed to it? When it was first discovered, scientists asserted that phylloxera when underground could not reproduce for a longer period than one year without the intervention of the others coming from this winter egg; and that consequently, by destroying the latter, the destruction of those at the root would follow. It was upon this assurance that the idea of washing the vines was adopted. But unfortunately, it has been demonstrated that phylloxera underground can reproduce for three years without any assistance from those coming from the winter egg, and it takes less time than that to destroy the vine.

Are there any French vines that resist the phylloxera? No, but there are some it takes longer to destroy, such as the "Colombard" and the "Cabernet Sauvignon."

Are there not some soils on which the phylloxera does less damage than on others? On land of which ninety-five per cent is sand, the inequalities are so great that the phylloxera can only advance with great difficulty. Upon such soil consequently the vine can resist for a very long time.

Are not all other kinds of soil overrun? All without exception, from the poorest to the richest, whether calcareous, silicious, or clayey, are overrun by the phylloxera.

Upon what kind of soil is the phylloxera's advance the most rapid, and upon what kind the least so? All calcareous, light, and surface soils, and those in which the vine is obliged to put forth roots clearly traceable, are very unfavorable to resistance and defense. On the other hand, all compact, moist, deep, and rich soils, into which the vine pushes deep, are favorable to resisting the phylloxera.

Has the age of a vine any influence upon its resisting powers? The younger the vine, the less it resists; the older a vine is, and the better provided with roots, the longer does it resist.

Is it prudent, in proportion as vines are infected with the phylloxera, to replant in other soil the same stocks as those that have succumbed? Never up to the present time in a region infected with phylloxera has a planting of French stocks succeeded; by the third or fourth year they are overrun, and their destruction is very rapid.

How long after the vines are pulled up do the phylloxera remain in the soil? They maintain themselves three or four years, inasmuch as, when the vines are pulled up, there still remain in the earth a certain number of roots. It is consequently prudent to wait for that length of time before replanting.

By leaving a wide space between the rows of vines, may not their preservation be hoped for? In setting out the rows from three to six meters apart, the stocks spread out their roots further, and have at command a more abundant nourishment; and it in fact results in such cases that their resistance lasts longer, but they none the less succumb in the end to the phylloxera's attacks.

Is it not possible to oppose the phylloxera, and resist its advance by means of manures? When a vine has not been attacked, it is very certain that its system of roots can be augmented by means of manures, and that there results therefrom a great vigor, enabling the vine, when the attack does come, to defend itself for a longer time. But when a vine has once been attacked, and when the extremities of its roots, which are necessary to absorption, are partly destroyed, manures in such case will bring about no good results, unless accompanied by insecticides.

By what symptoms may persons unaccustomed to the phylloxera detect its presence upon a vine? In a region where the phylloxera's presence has been announced, it may be detected as soon as there are found to be some groups of stocks the shoots of which are shorter than those of others about them. By digging about the roots, if they are the least bit eaten away, there will be seen, in the latter part of April, some little yellowish spots, united by *plaques*, and easily visible without the magnifying glass, when one holds the roots up and looks at them with his back to the sun. By the aid of the magnifying glass the insects themselves can be readily distinguished, and, even if one does not find any, let the extremities of the roots but show signs of destruction, or little club-like swellings, and one may be sure the phylloxera is there, or has been. In winter, the insects are of a dark brown, and it requires great difficulty to detect them, but the ravages made at the roots attest their presence or their passage.

How much time elapses between the appearance of external symptoms of the phylloxera and its actual invasion? From one to two years may be counted on; less time in weak, surface soils than in compact, deep ones, where the external symptoms take longer to declare themselves.

Are not washing and stripping of the vines good methods of opposing the phylloxera? Washing with coal-tar, or thick oil, mixed with soap, and diluted with water, has been resorted to to destroy the phylloxera and what is called its winter-egg. But the penetration of the fiber of the stock by the impure phenic acid contained in the oil has often caused the death of the stock, a fact which has necessitated the abandonment of this method. The stripping of the stumps and branches with a knife-rasp, by freeing the stock of its old bark, upon which are the phylloxera and its eggs (as well numerous other insects, and especially the pyrale), gives the vine powerful aid in point of healthfulness. At high points, and those where vines do not usually suffer from frost, the stripping is practicable in November, as the vines are pruned. In localities subject to frost vines may be stripped, beginning from January 15. This work costs about 45 francs per hectare, and only has to be repeated every three years.

The phylloxera's presence being once established is there any practicable and effectual means for opposing it? Yes: M. Dumas, the learned Permanent Secretary of the Academy of Sciences, having determined that the quantity of air contained in 1,000 liters (one cubic meter) of earth is about 333 liters, has demonstrated by frequent experiments that five or six grammes of sulphuret of carbon introduced into this cubic meter of earth amply suffices by evaporization to poison the 333 liters of air so as to kill all the phylloxera inhaling it. Sulphuret of carbon is very powerful, and it can hardly be hoped any better agent will be found.

Is not some danger incurred in the use of this substance? It is, like alcohol, very inflammable, and great care should be taken not to bring a lighted match or anything burning near it; above all when it is shut up in a room, the latter should be aired before a light is brought in. The best way to keep it is under a shed in the open air and sheltered from the sun.

Has not an attempt been made to render sulphuret of carbon easier to handle and less volatile by mixing it with other substances? By making a heated solution of five parts black soap and ninety-five parts water, and then, after letting it cool, and at the moment when it is to be used, mixing equal parts of this soap-water and sulphuret of carbon in a can while stirring, a non-inflammable and much less volatile mixture is obtained. In the warm season, this is a good step to take, but in the cold weather it may be dispensed with.

How many holes per hectare must be made in order to thoroughly poison the soil, and what does it cost? The hectare containing 10,000 meters, about 20,000 holes should be made. As a workman can make from 1,200 to 1,500 holes *per diem*, the hand-labor costs 36 fr.; ten grammes of sulphuret of carbon to each hole, 200 kilos, at 60 francs, 120 fr.; total 156 fr. In the warm season, it is prudent to lessen the quantity of sulphuret of carbon by about one-third, but not the number of holes.

Are all the phylloxera killed by this plan? No, but when the application is well and timely made, a sufficient number of the insects are destroyed to enable the vine to sustain itself, and give a good yield.

Is it necessary to apply the treatment to an entire hectare when only a portion of it is infected? From the moment when a spot is discovered, dig around the roots that are infected, inclose them with stakes, and include in the treatment a certain number of healthy stocks; for instance, if 25 or 30 stocks are attacked, 100 or 150 about them should be treated. The expense for an entire hectare, considering the yield of the vines, and the prices of wines, would evidently be too great, but it should be remarked that the owner of a single hectare would at first only have to treat a twentieth or a tenth of his vines, and that if he can stop the phylloxera's propagation, and keep his vines some years longer, he will be doing well.

Does a single application of this remedy suffice? If the vine is but little infected, a single treatment may possibly suffice; but in cases where the wood of the vine is reduced to 50 or 60 centimeters in length, it is necessary to apply the treatment twice, once in the course of the winter after the vintage, and once in the spring.

Are there soils in which sulphuret of carbon is more or less active, and are there instances in which resistance is apt to prove so difficult that it would be more prudent not to attempt it? Experience indicates that in light calcareous soils, possessing a vegetal earth of 15 or 20 centimeters, with a rocky subsoil, sulphuret of carbon diffuses itself poorly and evaporates in part only, with so much pure loss, and affording no advantage. But in clayey, moist, and deep soils it diffuses itself quite regularly and effects good results, which is all the better, since it is upon such soils that are usually found the heavy-yielding vines, which will bear an outlay that the others would not.

Has temperature any influence upon the action of this remedy? Sulphuret acts with all the more certainty in proportion as the temperature is low and the soil moist.

What happens when insecticides are injected upon a plant in full vegetation? Usually there is a stoppage of vegetation for several days, and this is the more perceptible in proportion as the vine is severely attacked; beyond this, the good results of the application scarcely make themselves apparent before the following year, as the stocks have to renew their roots which have been destroyed.

How far apart should the holes be? Whether the vines be planted close together, or separated by passage ways of two or three meters, all the land attacked and a little more should be treated, and holes made for 65 or 70 centimeters in all directions, which would make about 20,000 to the hectare.

How deep should these holes be? From 25 to 40 centimeters.

How far does the vapor of the sulphuret deposited in the soil extend? Practical results indicate that the vapor does not remain confined about the holes; the scientific experiments of the Paris, Lyons and Mediterranean Railway Co., directed by Mr. Maurion, have demonstrated that under the most favorable condition it spreads nearly two meters in a horizontal direction, and downward to a depth at which it reaches nearly all the phylloxera.

Has not sulpho-carbonate of potash also been used against the phylloxera? And what is the method of using it? Sulpho-carbonate of potash, according to the learned M. Dumas, contains from 15 to 18 per cent. of sulphuret of carbon and the same proportion of potash. It is not inflammable, and is more easily handled than sulphuret of carbon. It acts not only by means of the latter substance, but also by means of the potash, which is the special manure of the vine. Its application by injectors involves the inconvenience of rapidly spoiling the instruments, and rendering them unfit for use. Messrs. Dumas and Monillefert employ it as follows: When the stocks are laid bare, about 50 grammes of sulpho-carbonate of potash are poured on; they are then watered with from 5 to 10 liters of water, and covered up again. In general, the results of this plan are very satisfactory, but the cost, by reason of the hand-labor, the carrying of water, and the use of sulpho-carbonate of potash, is much higher than that of sulphuret of carbon. The former, being much less easily evaporated than the latter, offers a certain advantage in the warm season, but not sufficient, perhaps, to compensate for its increased cost.

What is the cost of the sulpho-carbonate of potash treatment? For a single application there are required 50 grammes to the superficial meter, or 500 kilogrammes at 60 francs, 300 francs; water and hand-labor, estimated at 200 francs;

total, 500 francs. Or about five francs per are. By adding to these expenses the ordinary ones, it will be seen at a glance whether the yield of our vines is adequate to cover them.

Is it necessary to manure vines that have been treated by insecticides? The vine attacked by the phylloxera grows feeble and becomes diseased, and it is highly necessary to strengthen it by manures in which potash dominates, azote and phosphoric acid in the proportion of 2 and 3 per cent, sulphate of iron or green copperas about 5 per cent. As a potassic and phosphoric manure, cinders of Isle of Ré sea weed may be used in doses of 200 grammes per stock. Soot has also a good effect. Stassfurt salts, in which chloruret of potash predominates, may (in doses of from one to two hundred grammes) be placed around the foot of the stock to help the formation of the new roots. In this way insecticides and manures should go side by side, if it is sought to obtain a satisfactory result.

Have endeavors to fight the phylloxera by means of insecticides and manures been made to some extent in this department? Upon the Plaud-Chermignac property, about 6 kilometers from Saintes, there is a vineyard some 30 hectares and 50 ares in area, which for six years has been overrun by the phylloxera. The soil is very varied, in some places the calcareous and the plastic, clayey soils lie side by side, and it is very easy to observe the diverse results obtained according to the nature and depth of the different soils. All the patches of vines, without exception, have been attacked by the phylloxera, and have been treated with sulphuret of carbon and sulpho-carbonate of potash. In comparing the vines that have undergone treatment with the neighbors' vines that have remained without treatment, one cannot help seeing the good results of the use of insecticides in conjunction with manures.

Is not submersion a certain means of destroying the phylloxera? Submersion of the stocks for forty days is unquestionably a certain means of destroying nearly all the phylloxera on a vine. But to adopt this method the land must be low, pervious on top, impervious beneath, and located in the vicinity of water. In our climate, where in low lands vines very easily freeze, great care is taken not to plant them there, and consequently submersion can seldom be resorted to hereabouts. It should also be noticed that as soon as a proprietor submerges a vine he moistens the soil of his neighbor, who, in case he wants no water, has a right to complain, and may bring suit, as is at present the case near Libourne. Submersion, moreover, under very favorable circumstances involves an expense of about 150 francs per hectare. It should not be forgotten that to this expense, annually repeated, must be added the cost of manures, which are in such a case indispensable, as the soil is infused with lye by the use of the water.

Since French vines do not withstand the phylloxera's attacks, would it not be possible by sowing to obtain some new species that resist better, or to graft French cuttings upon French wild vines? All attempts of this character, made and repeated at various points, have caused nothing but disappointment and deception.

It appearing that the methods of fighting the phylloxera by insecticides, manures, and submersion are not attended with profit in this locality, except in case of vines planted in soil of considerable depth, can there not be found in the resistance offered the phylloxera by certain American stocks a more economical way to the preservation of our own? And, to begin with, is the resistance of these American stocks real? For fourteen or fifteen years past, in the Departments of Gard and Gironde, the stock called the "Jacquez" has resisted very well, in the midst of the phylloxera's ravages, and given good yields long after the native stocks have succumbed. The "Herbemont," the "Cunningham," the "Taylor," the "York Madeira," and the "Vitis Solonis," after being planted six or seven years in the very focus of the phylloxera's attacks, are resisting, and show a very handsome growth, while the other stocks have succumbed.

Will this resistance be permanent? A resistance which in the case of the "Jacquez" has existed for fifteen years, in the case of the others for six or seven years, and which has always existed in America, offers almost indisputable assurance for the future, and no argument or facts why it should prove otherwise can be discovered.

Is the "Clinton," which is quite widely planted, worthy of recommendation? When planted in rich, fresh soil it sustains itself passably well; but deprived of these conditions it does not resist the phylloxera. It gives, too, a poor wine, with a foxy taste. This stock has been abandoned by all good wine growers.

How is the resistance of American stocks explained? The fiber of American resisting roots is, according to M. Foex, much denser and closer than that of our European vines, and turns into wood (lignifies) much more quickly. So that in the American roots the phylloxera's puncture only attacks the outer bark, upon which it produces little excrescences which fall off like warts. In the case of French roots its puncture causes decay. Some stocks, such as the "Jacquez" especially, the "Herbemont," and the "Cunningham," can be planted and will yield wine without being grafted. They possess a resisting power equal to every test. The "Jacquez," when cultivated in this locality, blooms and ripens at the same time with the wild grape; it produces a good red wine of a very dark color, and is highly valued by the trade. It is not difficult of cultivation as regards choice of soil. Its grapes, when ripe, keep for a long time without decaying. Up to the present time it is a stock against which nothing can be said. The "Herbemont" yields a fine red wine, not very dark in color. It blooms six or seven days later than the "Jacquez," and at the same time with the "Balzar;" we shall know this year whether it ripens in this climate, which, however, is probable. It would be a very good vine to plant in our dry, calcareous, and stony soils, in which it flourishes and grows extremely vigorous. The "Cunningham" produces at once, and quite a good wine, something like Madeira. In 1878 it bloomed in this locality ten or eleven days later than the "Jacquez." We shall not be decided until the fall as to its period of maturity. Other American stocks yielding wine at once are under trial.

Is there not some difficulty about the "Jacquez," the "Herbemont," and the "Cunningham" taking root? In 1877, in this locality, the "Jacquez" and the "Herbemont," being placed in nursery and in fresh soil, yielded a return of 70 per cent. The "Cunningham" yielded less. The "Riparia," the "Wild Cordifolia," the "Taylor," the "York Madeira," and the "Vitis Solonis" have great powers of resistance to the phylloxera, but yield so little wine that they should be used only to bear graftings from French stocks. They have the advantage of taking root very easily.

What is the best method for grafting French vines on the American ones? Joining a French and American slip, by means of the "English graft," and placing them in the nursery for the winter and spring. In the following year those that have been successful are carefully taken up and set out, either with slats or in pots. Another good way is this. The American cuttings, after having been put in the nursery in winter or spring, are taken up, the French slips are then grafted upon them (by the English plan), and they are then set out. Success in this way is almost certain. A third way consists in planting the American slips permanently in the vineyard, and then, in the second year, grafting the native cuttings upon them, whether by slitting or by the English plan.

Is there not some danger that French stocks grafted upon American ones will yield an inferior quality of wine? Experience has already pronounced in favor of French fruit trees and vines; and the wines coming from French stocks grafted upon American ones are absolutely the same as if they had not been grafted.

What, in short, is the best course to follow when a vineyard is attacked? If the vineyard is on surface soil, and the spots on the vines not very numerous, try to oppose the phylloxera in favorable weather by sulphuret of carbon or sulpho carbonate of potash, so as at least to retard its inroads and damages. If the vineyard is on deep, moist, and compact soil, struggle perseveringly and incessantly. The outlay will be repaid with interest; for those who are able to preserve their vines longest may be sure of being largely remunerated for their advances and labor. On surface as well as on deep soil do not hesitate to establish at once nurseries of American resisting vines, whether for the purpose of producing wine from them at once or for use in bearing grafts of French stocks.

What should be done in a section not yet overrun? Manure the vines and cultivate them carefully; and if there is any ground not in use *sow the grape stones of American stocks*, so as to be ready to start a second vineyard, and thereby not be taken unawares. In sowing grape stones there is absolutely no risk whatever of introducing the phylloxera, while, on the other hand, it would be extremely imprudent to introduce into any non-infected section in this locality, either American or French stocks coming from regions already infected.

NEW BUBBLE BLOWER.

The accompanying engraving represents a simple device for blowing and holding soap bubbles, recently patented by

GREENWALT'S BUBBLE BLOWER.

Mr. Daniel Greenwalt, of Millersville, Pa. It consists of a hollow standard supporting a small bowl for holding the soap solution at the top, and having a flexible rubber tube provided with a mouth piece at the bottom. The bowl being filled with the soap solution a small bubble is formed over the end of tubular standard that projects above the bowl by placing over it the end of the curved tube, shown on the table, and then removing it. The bubble is then enlarged by blowing through the flexible tube.

This apparatus is not only of interest as a toy for children, but it is also of value in physical experiments.

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 AUGUST, 1879.

Mercury.

Mercury should be looked for after sunset in the first half of August, setting earlier than Venus, and at a point of the horizon north of Venus.

On August 1 Mercury sets at 8h. 12m. P.M.; on the 15th at 7h. 10m. P.M., and on August 31 Mercury rises at 4h. 31m. A.M., and sets at 5h. 49m. P.M.

Mercury's motion is direct among the stars from August 1 to August 9; after August 9 it is retrograde.

Venus.

Venus and Mercury can be seen after sunset in the first half of August. Venus increases in brilliancy until August 19, when it is at its maximum.

Venus sets August 1 at 8h. 57m. P.M. On August 31 at 7h. 9m. P.M.

Venus is near the crescent moon on August 20.

Mars.

Nearly coincident with the setting of the smaller planets is the rising of the larger planets.

On August 1 Jupiter rises as Venus sets. Saturn follows Jupiter after about an hour and a half, and Mars, having moved away from Saturn toward the east, follows Saturn.

On August 1 Mars rises at 10h. 55m. P.M. On August 31 Mars rises at 9h. 38m. P.M.

The color of Mars makes it easy to find it, and it can be known by referring it to Jupiter and Saturn; it follows them in rising, but is much farther north.

Jupiter.

The brilliancy of Jupiter in the eastern skies will be as noticeable as that of Venus in the western.

On August 1 Jupiter rises at 8h. 42m. P.M. On August 31 Jupiter rises at 6h. 36m. P.M.

If we take the hour from 9 to 10 P.M. for observations of Jupiter, the most marked changes in the positions of the four moons of the planet will be on August 13.

At 9 P.M. Jupiter will be seen with only one moon, and that one the most distant. About 10 P.M., almost at the same minute, the largest and the smallest moon will come out from behind Jupiter, and another will leave the face of the planet, having been moving across the disk, so that three moons will seem to be clinging to the planet at the same time.

Saturn.

On August 1 Saturn rises at 10h. 6m. P.M. On August 31 Saturn rises at 8h. 6m. P.M.

We are now in such position relatively to Saturn that we see the ring more opened, and a small telescope will show the projection of the ring as handles extending beyond the ball of the planet.

Uranus.

Uranus will not be likely to be seen during August.

This planet rises on the 1st at 7h. 1m. A.M., and sets at 8h. 20m. P.M.

On the 31st Uranus rises at 5h. 12m. A.M., and sets at 6h. 28m. P.M.

Neptune.

On August 1 Neptune rises at 11h. 8m. P.M. On August 31 Neptune rises at 9h. 10m. P.M.

According to the Nautical Almanac Neptune is in conjunction with Mars August 14, at 3h. 31m. A.M., Washington time, Neptune being south of Mars 15m., or one half the diameter of the moon.

Occultation.

The beautiful star Antares, in the constellation of the Scorpion, will be occulted by the moon on August 24.

The American Nautical Almanac gives 10h. 35m. as the time when the star will disappear behind the moon, as seen at Washington.

An ordinary glass will show the phenomenon, and probably the companion stars of Antares may be seen.

An Aged Turtle.

About the middle of June, a turtle was taken in the St. John's River, Florida, with the Spanish coat of arms and the date 1700 engraved upon his back. There was also inscribed in Spanish the sentence: "Caught in 1700, by Hernando Gomez, in the St. Sebastian, and was carried to Matanzas by Indians; from there to the Great Wekiva." The "Great Wekiva" is the name by which the St. John's River was formerly known. The turtle was put back into the river with the added inscription: "*Eastern Herald*, Palatka, Florida, 1879."

THE American Watch Tool Company, Waltham, Mass., sends us a sample of a screw having 375 threads to an inch, size at bottom of thread $\frac{1}{1000}$. They have just completed the lathe for such work.

FUTURE OF AMERICAN ENGINEERING.

The following are extracts from an interesting address delivered before the Engineers' Club of Philadelphia, by its President, Thomas C. Clarke, Esq. The author of the paper is a successful practical engineer, and therefore his predictions on future American engineering and his suggestions to young engineers carry with them more than ordinary weight:

The numbers of our profession are increased every year by hundreds of graduates from the technical and scientific schools, and by others who rise from the ranks of the great army of labor to become its leaders. All of them expect to make engineering, in some of its various branches, the profession and occupation of their lives; and all are interested to know whether there will be room and work for all.

One's first demand of his profession is that it shall give him an honest living.

His next strongest wish is to find an opportunity to execute some work that shall fully call out his abilities, and give him some measure of that fame which we all prize.

Finally, he ought to wish to "pay the debt which every man owes to his profession" by making some permanent addition to knowledge, either in engineering itself or in some of its kindred sciences.

If a man succeeds in but one of these three things he may be thankful; if in all, he may justly claim the title of an "eminent engineer."

The broadest and at the same time most concise definition of engineering is "scientific construction." If this be true, engineers have existed from the days when the early kings of Egypt reared the first pyramids a thousand years before Abraham was born, down to the generation which has seen the achievements of Stephenson, of Morse, and of Eads.

But while engineers have lived and labored for so long a time, it is only of late years that they have become a distinct guild and profession. The name was first applied to the makers of canals, aqueducts, dikes, jetties, and other hydraulic constructions. Then it was extended to the makers of railways, and now it takes a much wider range of operations. It will be attempted to show that on the breadth and inclusiveness of this classification depends the solution of the problem of the future success of our profession.

The first question is: What preparation and education will best make a man a scientific constructor?

A great deal of discussion has taken place during the last year or two on the education of engineers. It is not intended to enlarge upon this here. Suffice it to say that we are now all agreed that education is of two kinds—that derived from books, and that obtained from actual practice and from contact with men.

One tells us what to do, the other how to do it.

Both kinds are absolutely necessary.

The more of the first kind an engineer has, or in other words, the broader and deeper the foundations of his knowledge are laid, the more readily and intelligently will he acquire the second, and the more satisfactory will be the results of his practice.

But in order that his learning may be of practical use to him, he must also have experience.

The young engineer of the present day comes to his work with a much better preparation than those of the generation before him. He must not, however, make the mistake of supposing that the eminent engineers of a past generation, who never enjoyed the privileges of the schools, were deficient in scientific knowledge. They had it, but they got it from actual experiment, and went beyond the books of their day, and were in many cases the original discoverers and investigators, the fruits of whose labor every school-boy can now enjoy.

The weak point of the old system was, that while it produced many great men, yet the average did not stand as high as now; and the expenditure of much capital had to be intrusted to ignorant persons, whose blunders led to enormous waste, and whose names are now happily forgotten together with their mistakes.

The young engineer of the present day should also remember that now, as in the past, there is but one road to success. He who wishes to command must first learn to obey. He must show his superior officers that he is perfectly reliable and faithful. A man who has his mind occupied with the direction of large interests appreciates fully the wisdom of the saying, "Never do yourself what you can get any one else to do for you." But this cannot be carried out unless he feels perfectly sure that his assistants will not deceive him, that they will report things exactly as they are and will carry out his instructions to the letter.

After a young man has shown that he can always be depended upon, he will soon be promoted into a higher rank, where the orders are more general and where more is left to his discretion and judgment. If to faithfulness and energy he adds good judgment, and to good judgment tact, and the power of managing and controlling men, he may rest assured that before very long he will have gained the first requisite, material success. He will probably find that soon an opportunity will offer to carry out some work which will insure him a measure of reputation. Finally, his early scientific training having taught him to observe facts and draw deductions therefrom, he will probably, sooner or later, make some contribution to science. Even if not a writer, he will furnish some of the material of which books are made.

We have thus briefly traced the career of a successful engineer in the present condition of the profession, or rather in the immediate past. But it will be said: "The ranks are already too crowded. More and more men are coming in every day. Although we admit the truth of Webster's saying, 'There is always room at the top,' yet what shall we do who are men of only moderate abilities? We do not ask or expect the great prizes of the profession, but we cannot help thinking that in America engineers are less esteemed and less paid than in any other civilized country of the world. Shall we be better or worse off in the future? Are we going up grade or down?"

These are very pertinent questions, and a true answer would be of the highest interest. I will endeavor to give you my views, always bearing in mind the modest epitaph of the old surveyor, "His hindsight was better than his foresight."

It has been previously stated that on the breadth and inclusiveness of the classification of engineers depends the solution of the problem of their future success.

If we bear in mind that while an engineer is, unfortunately, not always a scientific constructor, yet a scientific constructor must be an engineer, we shall see how numerous are the paths open to us to follow and how soon the crowd will be relieved. Let us see how the number of these paths has increased during the last half century. Before the year 1828 an engineer meant a man who knew how to make canals and waterworks. But when George Stephenson created the modern railway, an engineer soon came to mean a man who could build railroads. The construction of the 85,000 miles of railroads in the United States, costing over $4,500,000,000, has naturally given employment to the largest number of engineers in taking care of them and of operating them.

Within the last dozen years the substitution of iron for wood, first in railway bridges and viaducts, and afterward in structures of all kinds, has developed another class of special engineers, who, being of a pushing and energetic disposition, have perhaps monopolized rather more than their share of public attention. The development of our mineral wealth, in which it is estimated that over $400,000,000 have been invested during the last thirty years, may be seen reflected in the list of the Society of Mining Engineers, which numbers 734 members. Then we have the engineers of the waterworks, drainage, sewerage, and of the streets and structures of our large cities. The city of Boston is now expending some $5,000,000 in its improved sewerage, surpassing in some respects even the gigantic works of London itself. Mr. Chesbrough, city engineer of Chicago, was once introduced to one of the European engineering societies as that daring engineer who had raised a city of 300,000 people ten feet up in the air above its original position.

Allied to the preceding class we have the sanitary engineers, specialists whose duty it is to apply scientific principles to the construction of our dwellings, too long left in the hands of ignorant plumbers and builders. Then we have the honorable body of architects, who all ought to be engineers, that is, scientific constructors; for if they are not, so much the worse are their buildings. The great gas companies now almost always employ men of scientific attainments as their engineers, the result of whose labors may be seen rather in the increase of dividends than in the lower price of gas.

But another school of specialists is coming on whose labors will correct all this—the electric engineers—whose skill has already enabled us to light our workshops more brilliantly and at less cost than the gas engineers have been able to do it. The future of electric engineering includes not only the vast fields of electric lighting and of the telegraph, but all means of transmitting signals and perhaps of power.

Another class of specialists has an enormous future before it in this country, I mean agricultural engineers, who, as a separate body, have existed for some years in England. When one considers the great savings that are capable of being made by the application of correct scientific principles and practice to farming operations, which are now done so loosely and by rule of thumb, who will not say that here is not a great opening for engineers in the near future?

Then there is a class of engineers whose services are more and more in demand every year, I mean the engineers employed by large contractors. Some of the ablest men in England are contractors' engineers.

You will observe that for a man to succeed in any of these newer branches of our profession he must be much more than a mere surveyor or designer and measurer of masonry and earthworks. He must be, first and foremost, a mechanical engineer, as it is termed. He must understand dynamics as well as statics, and must be practically familiar with the construction of machinery and machine tools.

In Europe no man can attain eminence as a civil engineer who is not well versed in the mechanical part of his profession. Hence, we find them constantly called upon to design, construct, and report upon paper mills, cotton factories, sugar machinery, iron and steel works, and such things, which in this country are intrusted to manufacturers rather than to engineers. I do not mean to say that this country is behind others in mechanical engineering; the names of Fritz and Griffen, of Sellers and Holly, forbid that; but I do mean to say that if American engineers, as a class, were better versed in the mechanical part of their profession, they would not see themselves laid on the shelf by the capitalists who throw away their money on Keeley motors.

It was one of the traditions of the elder school of engineers that they should carefully abstain from taking part in matters of business. Architects and civil engineers were formerly either government officials or, as professional men, they held the same social position, which they feared would be lowered if they became business men, skilled in prices and sharp at a bargain. This was merely a survival of the old feeling of contempt which the governing classes—the men of the sword—felt for the men of affairs. The effects of this mischievous tradition has descended to our own day with unhappy results to the profession. I need scarcely tell you that an engineer is only half fitted for his work unless he is able to hire men and buy materials and execute his own designs, if occasion calls for it. It may seldom be necessary for him to do it, but the ability of so doing makes him a better judge of the value of a contractor's work, and a far safer estimator of the probable cost of public works.

European engineers profess to be able to do this, and this is one reason why they command their five per cent commission on the cost of their works, and attain wealth and position, while in this country engineers are too often paid the salaries of second rate clerks.

It has sometimes happened that, in looking for the engineer of some railroad, I have been disgusted to discover him at last hidden away in a dusty office on the upper story of a building, ignored by almost everybody; while the ticket agents, and the fast freight agents, and the palace car agents, and all their tribe, sit downstairs in splendid apartments, drawing large salaries and commissions, and evidently people of the highest consideration. This is because they are first class business men, while the poor engineer is not.

Let the engineers of the future, if they wish to prosper, learn to be men of business and control the check book and the ledger. We shall then hear less of public works frightfully overrunning the original estimate of cost, and the whole profession will stand higher in public estimation. Pardon me if I say that I feel sure that whatever reputation I myself have is due to the fact that the public feel confident that I can and will execute my own designs within my estimates both of cost and time.

From what has been said you will see that my views of the future prospects of engineering in America are not gloomy. The truth is, that it is by engineers, whether called by that name or not, that America has been made what she is to-day. The Fultons, the Morses, the Ericssons, the Howes, the McCormacks, and the Edisons are engineers, although their names may never have been enrolled on the lists of learned societies; while among those whose names are to be found on such lists, who is there in any country who ranks above Jervis, Latrobe, and Eads?

Follow, therefore, in their footsteps. The field is vast, for it covers the whole area of scientific construction, while the laborers are even yet but few. From the brilliancy of the past we may predict the greater glories of the future. Some of us who are passing off the stage may not live to see them, but there are young men in this room who may one day behold greater triumphs of engineering than the world has yet seen.

A Natural Soap Mine.

On Smith's Creek, Elko county, Nevada, there is a most remarkable stratum of steatite resting horizontally in a steep bluff of volcanic matter which flanks the eastern side of Smith's Creek valley. The stratum of steatite is from three to ten feet in diameter. It is easily worked and is a veritable soap mine. In fact the farmers, cattle men, and sheep herders in that region all use the natural article for washing purposes. Chemically considered this peculiar clay is a hydrated silicate of alumina, magnesia, potash, and lime. When the steatite is first dug from the stratum it looks precisely like immense masses of mottled Castile soap, the mottling element being a small percentage of iron oxide. The Virginia (Nev.) *Chronicle* says that a firm in Elko have undertaken to introduce this natural soap into the market. It is similar in appearance to the Castile soap sold in large bars. Nothing is added to the mineral but a trifle more alkali and some scenting extracts. Its detersive qualities are as powerful as those of any manufactured soap.

The Great Tornadoes.

Sergeant Finney, of the Signal Service Corps, who left Washington about the 1st of June to investigate the terribly destructive tornadoes which occurred in Kansas, Nebraska, and Missouri, on the 29th and 30th of May last, visited over thirty cities and towns in the States named. He surveyed the entire ground over which the storm passed, and states that there was a general storm area in Northern Kansas, Southeastern Nebraska, and Northwestern Missouri, and that he discovered traces of eleven distinct tornadoes, two of which prevailed on the 29th and nine on the 30th of May—all originating in that one storm area.

An Alleged Cure for Rattlesnake Bite.

Myron G. Collins, of Tennessee, claims to have discovered a cure for rattlesnake bites. Drs. Eve and Shacklett, of Nashville, according to the *American*, made a test of the medicine. Collins let a rattlesnake bite him on the wrist, and at once applied to the wound and took inwardly a decoction of mosses from oak and hickory trees. He suffered from nausea, and his pulse and temperature were excited, but within an hour he had completely recovered. The bite of the same reptile speedily killed a dog.

THE first death from genuine yellow fever was reported at Memphis, July 9. Great efforts have been made to put the towns and cities of the Mississippi valley in wholesome condition; and it is to be hoped that, in spite of the early outbreak of the disease, no general epidemic may prevail.

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.

NEW BOOKS AND PUBLICATIONS.

AMERICAN HEALTH PRIMERS. Edited by W. W. Keen, M.D. Sm. 12mo, cloth, 50 cents. Philadelphia: Lindsay & Blakiston.

Promises to be a useful series of simple and sensible volumes on subjects pertaining to sanitary science and the preservation of health, mostly written by well known Philadelphia physicians. Judging from the two volumes already printed—"Hearing, and How to Keep it," by Dr. Ch. H. Burnett, and "Long Life, and How to Reach it," by Dr. J. G. Richardson—the great aim of the series will be not to make every man his own doctor, but to put within the reach of all such practical sanitary knowledge as may prevent in a large degree the necessity of calling in the doctor, and increase the efficiency of his services when unpreventable sickness does come.

OUTLINES OF FIELD GEOLOGY. By Archibald Geikie, LL.D., F.R.S. London: Macmillan & Co. 12mo, cloth, pp. 216. Price $1.

A revised and enlarged edition of Professor Geikie's admirable lectures on the means, methods, and enjoyments of outdoor work in geology. Whether the nature student intends to become a geologist, or only seeks to acquaint himself with so much of the geologist's field work as may increase the intelligent enjoyment of his everyday rambles, this little work cannot fail to be instructive, suggestive, and useful.

THE ELECTRIC LIGHT IN ITS PRACTICAL APPLICATION. By Paget Higgs, LL.D., D. Sc. London and New York: E. & F. N. Spon. 8vo, cloth, pp. 240.

A simple matter of fact review of what has been done in the way of electric lighting, with illustrations of the principal lamps and machines in use or proposed. Considerable attention is given to the question of cost. Those who have followed the recent history of the electric light, in the SCIENTIFIC AMERICAN and SUPPLEMENT, will find little that is novel in the book; still it sums up fairly well the chief results thus far accomplished, and will be useful as a handy book of reference. To such as wish to learn the present condition and immediate prospects of electric lighting, without entering into elaborate or abstruse discussions, the work can be safely commended.

NEW ENCYCLOPEDIA OF CHEMISTRY. Philadelphia: J. B. Lippincott & Co. 40 parts. 50 cents each.

Parts 36 to 40 of the new encyclopedia of chemistry, as applied to the arts and manufactures, cover the important subjects, quinine, silver, soap, soda, steel, sugar, sulphur, tin, wine, water, and zinc. The work now completed forms two handsome volumes, with numerous wood cuts and many full page plate engravings of manufacturing processes. Though based on Dr. Muspratt's well known work, the new encyclopedia is essentially new, and aims to be an improvement on its model.

THE AMERICAN BICYCLE. By Charles E. Pratt, A.M. Boston: Houghton, Osgood & Co.

The author describes his little book as a "manual for the observer, the learner, and the expert" at bicycle-riding; an art that promises to become with time and the improvement of our roads a practical and useful art, not a mere pastime, as most people now regard it. The manual is well written, and contains much that bicyclers and those interested in bicycling will find useful and entertaining.

ENCYCLOPEDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Edited by George G. André. New York: E. & F. N. Spon.

This encyclopedia is intended to give an account of new manufactures and those modifications of older arts due to recent progress in industrial science and invention. Subjects will be treated mainly from the manufacturing and commercial points of view, by manufacturers and producers, or by men familiar with the processes of manufacture and the details of production. Especial attention is to be given to waste products. The work, in super royal 8vo, will be published in about 30 monthly parts of 64 pages each, with numerous illustrations. Parts 1 to 4 discuss acids, alcohol, alcoholic liquors, and alkali. Price 75 cents a part.

THE ETCHER'S GUIDE. By Thomas Bishop. Philadelphia; Janentzky & Co.

The author believes that any one who can make a fair pen and ink or pencil drawing can master the art of etching with little difficulty. He describes the tools and processes of the art with simplicity and directness, with so much of practical instruction and illustration as will enable the beginner to prove what artistic stuff there is in him. Natural capacity and perseverance, of course, must ultimately determine whether pleasure or profit is likely to come from the study.

SOME FACTS ABOUT THE GREAT TIDAL WAVE OF MAY, 1877. By J. P. Josephson. Sydney, N. S. W.: Thomas Richards.

A paper read last winter before the Royal Society of New South Wales, bringing together the more important observations and incidents attending the great tidal wave which swept across the South Pacific, after causing so much destruction along the South American coast, May 9, 1877.

THE NEW CARPENTER'S AND BUILDER'S ASSISTANT AND WOODWORKER'S GUIDE. By Lucius D. Gould. New York: Bicknell & Comstock.

A revised and enlarged edition of Mr. Gould's practical handbook. It is illustrated by twenty-seven plates, contains several useful tables and a full vocabulary of the terms used in carpentry.

AMES' ALPHABETS. By D. T. Ames. New York: Bicknell & Comstock.

Mr. Ames is one of our most accomplished penmen, and all his alphabets show an artistic sense as well as a skillful hand. Several of his designs are novel, and all seem well adapted to the use of architects, engravers, engineers, artists, sign painters, and draughtsmen.

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 not 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) A. J. R. writes: In the South, when pine woods are cut down oaks invariably grow up and take their places, and when oaks are cut down pines alone will grow up. Why is it? A. The pines exhaust the soil of certain elements that are necessary to their growth, while they do not take the elements required by the oaks. Therefore when the ground is cleared and the seeds of the two kinds of trees are sown, the tree that the soil is best adapted to will survive. The case is similar when oaks are cut down.

(2) H. J. W. asks: What kind of lime water is it which is to be used with milk in the treatment of nervous diseases, as noted several issues ago in your paper? A. The lime water is made as follows: Place hydrate of lime in about 100 times its weight of water; in a short time a saturated solution, known as lime water (liquor calcis, B. P. and U. S. P.), results. It contains about 16 grains of hydrate of calcium (Ca^2HO), equivalent to about 11 or 12 grains of lime (CaO) in one pint.

(3) "Spring" asks: 1. Is there a less expensive method than the steam or caloric engines by which the screw in a boat 18 feet long by 3½ feet wide and 13 inches deep may be propelled? A. No. 2. Have springs of sufficient power to run two or three hours been used, and with what success? A. Not with success; you had better apply the power required to wind up the springs, directly to the propulsion of the boat.

(4) E. B. R. asks whether there are any steam engine governors made that will feel a change of one revolution a minute over the given speed of the engine? If not what is the least number of revolutions of the engine over the regular speed that a good governor will feel? A. Any sensitive governor will feel a change of one revolution, but not so as to affect any change on the engine, as the lost motion and friction of the connections must be overcome. Many, we believe, do affect the engine by a change of 2 or 3 revolutions.

(5) A. P. asks: 1. How many valves does the water pass through from the time it leaves the boiler in the shape of steam until it enters it in the shape of water again? A. Ordinarily 3 steam and 3 water valves. 2. Which travels through more space, the crank or the piston, and why? A. The crank pin; in the proportion of 2 to 3·1416; the piston travels twice the diameter of the circle, while the crank pin travels the circumference. 3. How will I find the dead center of a crank? A. Key up all joints close, place the crank on the center by the eye; then travel the crank so as to move the crosshead, say 1 inch, or any other given distance, on the slides. Note the position of some point on the fly wheel and mark; then turn the crank back till the cross head has reached the same position on the slide and mark on fly wheel. Again reverse the movement of the crank, until it has traveled back one half the distance between the two marks—it is then on the center.

(6) R. K. asks: 1. Has the art of tempering steel practiced in Damascus years ago and supposed to have been lost, been recovered? A. Steel is still worked in Damascus as it was years ago; but the secrets of the art are well kept. It is said that the kind of steel used has more to do with the quality of the work than the process of working. 2. Are there any books relating to experiments connected with it? What books treat of hardening, case hardening, and tempering? A. "The Manufacture of Steel," by Overman.

(7) J. H. A. asks if the strength of ropes can be computed so as to give one a satisfactory result. Nystrom says a rope 2 inches in diameter will break at 20,106 lb.; Haswell, 31,938; Jones & Laughlin, 18,651; Frank Van Ceeve, 25,536; and Haswell says the U.S. Navy test is 14,000 lb. to 1 square inch area, which would give for a 2 inch diameter rope 43,982 lb. The extremes vary 25,331 lb. on a 2 inch diameter rope. A. Much depends upon the quality of the hemp and the mode of manufacture. The best authorities give for strength of 2 inch diameter hemp rope 10 to 12 tons, and working load 30 to 36 cwt.

(8) G. J. asks if a boiler, 54 inches in diameter, with 55 tubes 4 inches diameter outside, head ⅝ inch thick, plates ⅞ inch thick, is any stronger than a plain cylinder boiler. I have a table for the strength of cylinder boilers, and would like to know if it can be trusted for flue and tubular boilers.

Factor of safety for ⅞ inch iron.

Ex. A boiler, 54′′) 6·250 (115·74
54
85
54
310
270
400
378
220
216
4

The safety valve should not be loaded over 115·74 lb. to the square inch. The figures are one third the bursting pressure. Will that hold good in all cases? A. The rule applies to the cylinder part of all boilers. By the rule of the government inspectors, a cylinder 54 inches in diameter, made of iron ⅞ inch thick, and having a tensile strength of 55,000 lb. per square inch, would only be allowed a working pressure of 88 lb. per square inch.

(9) C. F. writes: You say the power of the steam engine is calculated by multiplying together the area of the piston in inches, the pressure in pounds per square inch, the length of the stroke in feet, and the number of strokes per minute, and divide by 33,000. Is the following correct, according to the above: Cylinder, 10½ diameter, 2 feet stroke (that is, the cylinder is 2 feet long), 60 pounds of steam, 80 revolutions per minute.

Area of cylinder, 86·5937
60 lb. steam.
5195·6220
2 feet stroke.
10391·2440
80 rev. per minute.

Divided by 33,000)83129·95300(25·190
66
171
165
62
33
299
297
29

Answer: 25·190 horse power.

A. No; 80 revolutions is 160 strokes. Your result should be doubled.

(10) W. H. S. P. asks for the number of threads on machine taps running from ¼ of an inch up to 1 inch, varying ⅛ in size, and from 1 inch up to 3 inches, varying ¼ in size, that is, standard thread. A.

STANDARD AMERICAN THREADS.

Diameter in in..	¼	5/16	⅜	7/16	½	9/16	⅝	¾	⅞	1
Threads per in..	20	18	16	14	13	12	11	10	9	8
Diameter in in..	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2¼	2½
Threads per in..	7	7	6	6	5½	5	5	4½	4½	4
Diameter in in..	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5
Threads per in..	4	3½	3½	3½	3	3	2¾	2¾	2¾	2¾
Diameter in in..	5¼	5½	5¾	6						
Threads per in..	2½	2¾	2¾	2¾						

Angle of threads, 60°; flat surface at the top and bottom—⅛ of the pitch.

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

H. A. W.—Magnetic iron pyrites—pyrrhotite, with quartz. It is not auriferous.

COMMUNICATIONS RECEIVED.

On a Monster Gar Fish. By H. N. G.

On Hydraulic and Fireproof Inside Walls and Ceilings. By J. D.

Where does the Sun get His Power. By P. B.

On Croton Oil for Skin Diseases. By A. K.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

June 24, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Axle boxes, die for making, D. Dalzell..... 216,837
Axle skein and box, vehicle, N. L. Holmes (r)..... 8,766
Bale ties, device for forming, T. J. Torrans..... 216,912
Band tightening and tying apparatus, S. H. Gilman 216,841
Beer, fining shaving for, A. Lachenmeyer..... 216,869
Belt fastener, Budlong & Talcott..... 216,827
Belting, round, F. H. Underwood et al..... 216,916
Bit stock wrench, Q. S. Backus..... 216,776
Boiler furnace, W. Scully..... 216,900
Book, blank, A. J. Maxwell..... 216,759
Boot and shoe soles, machine for shaping, J. B. Johnson (r)..... 8,776
Boot and shoe uppers, etc., crimping machine for, Stoddard and Fifield..... 216,769
Bottle, nursing, S. W. France..... 216,734
Bottle washing machine, Schulz & Nagel..... 216,899
Box, A. Wuensch..... 216,927
Brick, etc., kiln and shed for burning and drying, W. Mansfield..... 216,743
Button, S. W. Shorey..... 216,811
Can filling and soldering apparatus, W. A. Wicks 216,924

Cane shaving machine, G. S. Colburn 216,729
Car coupling, H. L. Preston 216,889
Car coupling, O. Retan 216,891
Carbureting apparatus, air, R. R. Moffatt 216,879
Card punching machine, Jacquard, Crompton & Wyman 216,782
Chuck, lathe, J. N. Skinner 216,706
Churn, E. Caldwell 216,780
Churn, H. C. Horsey 216,739
Churn, M. C. Pennock 216,885
Cigar box, C. Heylmann 216,737
Cigarette making device, G. H. Backmire 216,817
Clipper and sheep shearer, horse, E. W. Noyes 216,882
Clutch, friction, T. Powell 216,758
Coal breaking machinery, W. H. Richmond 216,897
Coat and vest hanger, F. H. Zahn 216,938
Cock, steam gauge, T. Shaw (r) 8,773
Coffeepot, T. Keys 216,861
Coffin, R. E. McAlister 216,749
Coin package, O. A. Dennis (r) 8,769
Compass, mariner's, J. F. Watson 216,919
Cop tube, J. Essex 216,839
Copying presses, blotter bath for, B. B. Hill 216,738
Cotton chopper, I. F. Bobo 216,835
Cotton gin rib, J. A. Smiley 216,903
Cotton press, J. J. Stopple 216,908
Curtain cord fastener, E. W. Folsom 216,733
Desk, portable writing, C. C. Shepherd 216,810
Detergent compound, H. A. S. Park 216,805
Disintegrating grain and distilling spirits, apparatus for, E. Fox 216,841
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Fence, portable, W. G. Poston, *et al* 216,757
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Fence twister, metallic, J. & W. M. Brinkerhoff 216,779
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Fire extinguishing apparatus, C. Barnes 216,821
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Fruit can, W. Collings 216,831
Furnaces, dumping dead plate for, N. W. Pratt 216,888
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Gate, J. S. Noyes 216,883
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Governor, engine, S. Whinery 216,922
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Hedge trimmer, H. Unkrich 216,915
Hinge, spring, W. G. Barry 216,777
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Plow, E. Ward 216,772, 216,773
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Padlock, C. L. Bellamy 11,256
Padlocks, J. Gerard 11,259
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

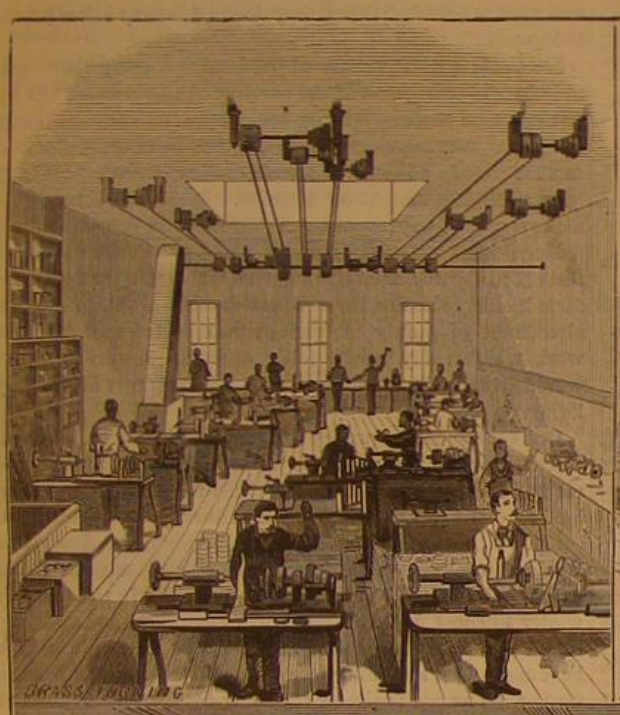
Vol. XLI.—No. 6. [NEW SERIES.] NEW YORK, AUGUST 9, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

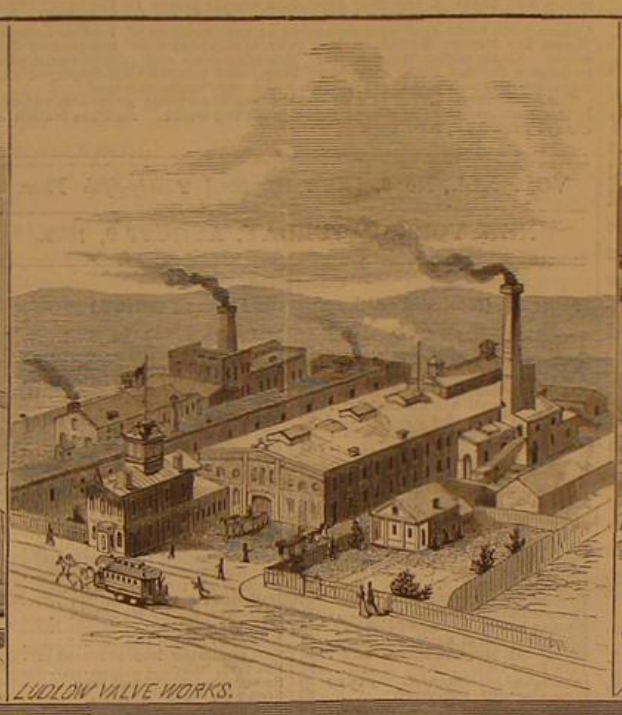
THE MANUFACTURE OF VALVES.

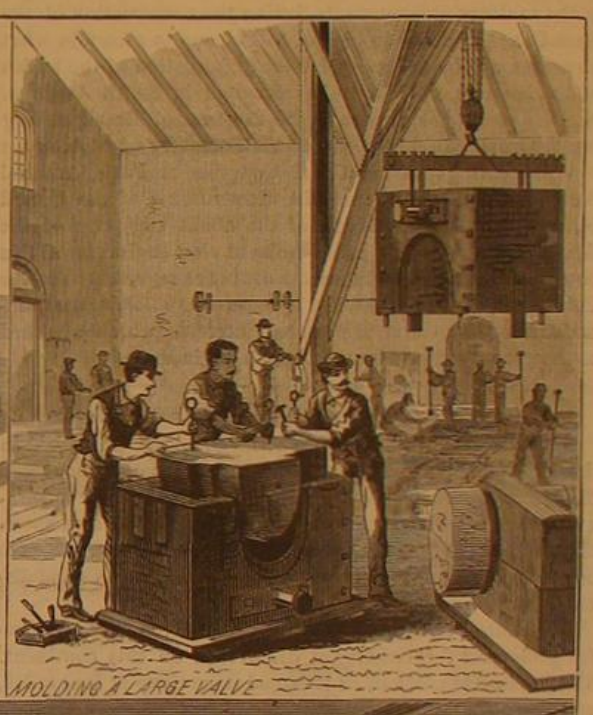
The introduction of water and gas into all cities and towns of any note throughout the country, and the constantly increasing use of steam, both as a motor and for heating purposes, have given rise to several distinct branches of industry in the manufacture of the required apparatus and appliances. The most extensive establishment in the United States devoted exclusively to the manufacture of brass and iron valves of all descriptions, and the latest improved style of fire hydrants, is that of the Ludlow Valve Manufacturing Company, of Troy, N. Y., which is illustrated in our engraving. This business originated eighteen years ago, at Waterford, near Troy, and met with such speedy success that the present company was soon after organized with ample capital for the prosecution of the enterprise upon an enlarged scale. When this company commenced the manufacture of valves there were no straightway valves in the market except those having a solid gate in one piece; and the introduction of the double valves, for which they have several patents, also their single adjustable gate valve, was a very important innovation. The double iron gates, from 1¼ inch upward, and the single ones, from 10 inches upward, move closely between parallel faces, rendering them self-clearing from any foreign matter that may become attached to them. Gas and water companies find this a feature of decided importance. The double water valves possess a marked advantage over other forms of gate valve, from the peculiarity of their construction, the gate being kept in line by the parallel seats.

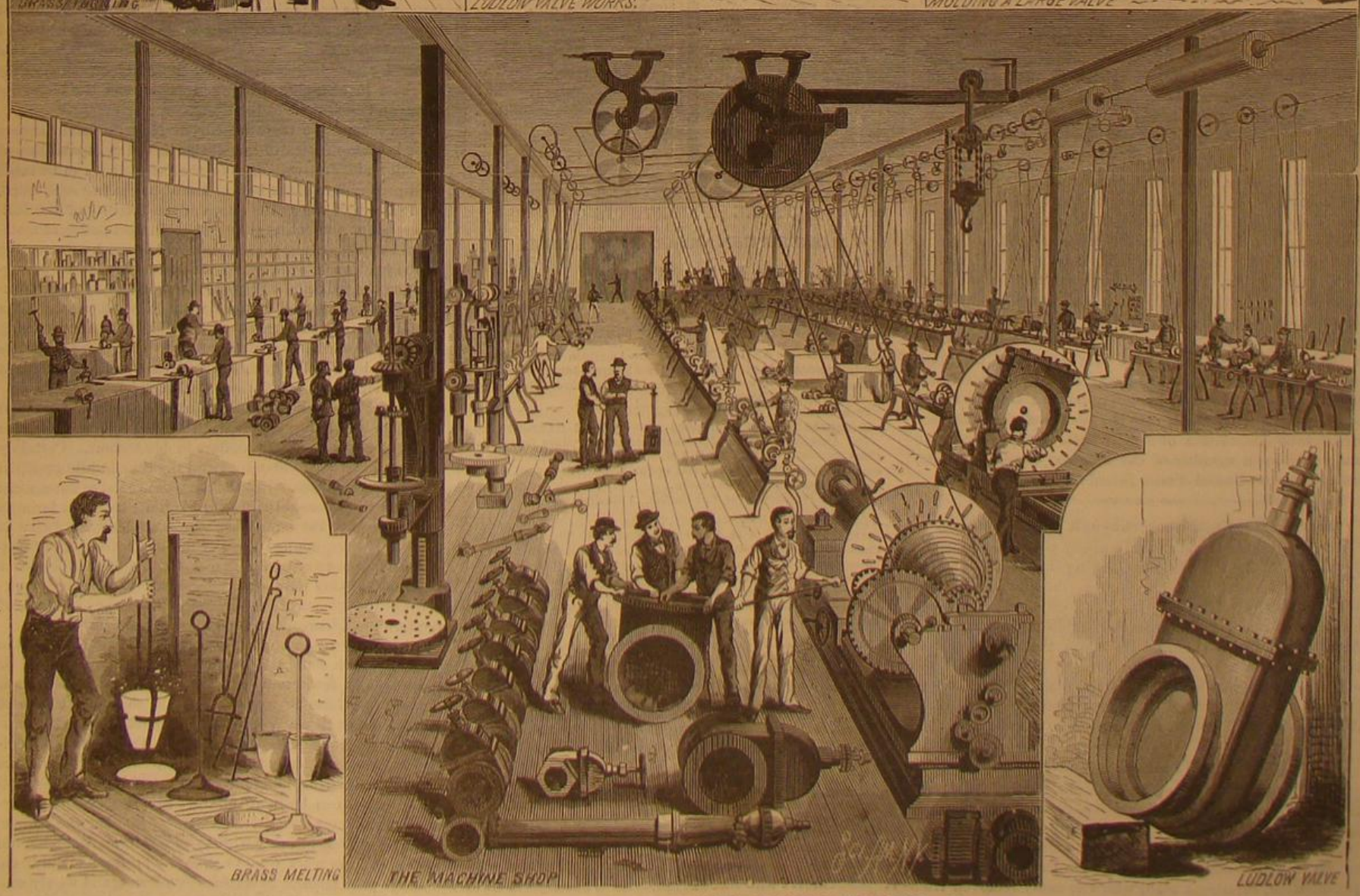
The factory premises comprise an area of 270x325 feet, with substantial brick machine shop, iron foundry, brass foundry, pattern shop, store houses, offices, etc. Brass valves are made from ½ to 8 inches inclusive, and larger if required, all having double gates. These valves are made of the best steam metal and well finished. The iron valves range from 1¼ to 48 inches inclusive. They are made either with double or single gates, all iron or mounted with steam-metal, screwed socket, flange, hub, spigot, or any two on the same valve, also with screwed stems, or with a quick moving slide stem and lever. This last has a patented arrangement by which the gate is fastened instantly at any desired position.

Before leaving the works, every valve is carefully tested under heavy pressure to ascertain if it is perfectly tight and in good working order. The company manufacture for


BRASS FINISHING


LUDLOW VALVE WORKS.


MOLDING A LARGE VALVE


THE MACHINE SHOP

BRASS MELTING

LUDLOW VALVE

FACTORY OF THE LUDLOW VALVE MANUFACTURING CO.

attachment to the larger valves, when desired, indicators of different kinds for showing the exact position of the gate. We understand they also make to order any special size or pattern of brass or iron valves with extra finish. The company's goods are largely used by water and gas companies and steam fitters in all parts of the United States and Canada, and also to a considerable and increasing extent abroad, and these goods are everywhere regarded as the standard. Making the production of valves and hydrants a specialty, the company have brought their manufacture to such perfection that they can successfully compete with any similar concern in the country. As an evidence of the high appreciation in which the goods of this company are held we may say that even during the four years of great business depression throughout the country, each year has shown marked success in their business. The officers of the company are as follows: H. G. Ludlow, president; D. J. Johnston, vice president; M. D. Schoonmaker, treasurer. Possessing large means, long practical experience, excellent manufacturing facilities, and having great energy and enterprise, the Ludlow Valve Manufacturing Company cannot fail to retain the leading position which they have so worthily won.

The Darien Canal.

AT a recent meeting in Bordeaux, M. De Lesseps said that American support had been secured for the Darien Canal project. Nine of the principal financial establishments in Paris had promised their aid for a small commission.

Dr. Campany, the military physician, who was engaged in the sanitary arrangements during the construction of the Suez Canal, is about to be sent to Panama to ascertain what measures will be necessary for the preservation of the health of the laborers, who are to be recruited in South America. M. De Lesseps has written to the Emperor of Brazil asking for laborers. In his report to the Secretary of State upon the proceedings of the Canal Congress at Paris, Admiral Ammer recommends that the Government of the United States form a commission of the ablest engineers of the Army, and invite the most eminent civil engineers of this country and of those European countries represented in the Paris Congress to meet and discuss the whole matter, unembarrassed by the rival personal interests which attached to the grants secured by the French engineers.

Geological Specimens from Luray Cave.

Our readers will remember a series of letters published in these columns not long ago describing a recently discovered cave in a beautiful valley in Virginia, about 80 miles southwest from Washington. Our correspondent was sent specially to investigate the wonders of Luray Cave, and he gave our readers an interesting account of his adventures and discoveries.

This Luray Cave undoubtedly possesses the most wonderful geological formations yet discovered on this continent. The accessible portions of it extend some three or four miles, and there are other parts still unexplored. Messrs. Tiffany & Co., of this city, have just received and placed upon exhibition a beautiful collection of specimens of water crystal of calcite, nodular stalagmites, calcareous tufa, crystalline pavement, cave pearls, and several varieties of stalactites, taken from this remarkable cave.

Thomas N. Dale.

Thomas N. Dale, one of the pioneer silk manufacturers of Paterson, N. J., died suddenly of heart disease, at that place, July 17th. After a successful career as a merchant in this city, Mr. Dale went to Paterson, in 1862, and soon after erected the large silk mill known by his name. Until recently Mr. Dale ranked among the largest silk manufacturers in the country. He was specially noted for his high personal worth, his great interest in matters relating to industrial art, and his active efforts for the promotion of the welfare of silk operatives. He was one of the State commissioners for the establishment of industrial schools in New Jersey. In 1876, he was appointed United States Centennial Commissioner. He has been first vice-president of the Silk Association of America for many years. He was a prominent member of the Paterson Board of Trade, and also of the United States Board of Trade.

Hearing the Lightning through the Telephone.

Referring to the accounts we recently published concerning the use of the telephone for hearing the electrical action of supposed earth currents during thunderstorms, Mr. Wm. S. Aldrich, of Burlington, N. J., calls our attention to his observations, of similar character, published in SCIENTIFIC AMERICAN, August 3, 1878. He states that he connected one pole of the telephone with the gas pipe, and for the other earth terminal he placed a small piece of sheet copper in moist earth surrounded by broken pieces of gas carbon. A wire extended from the copper plate to the telephone.

The Ammonia Bath.

A correspondent residing at Honolulu, Sandwich Islands, says that a good health preservative, especially in summer, is to sponge the body with cold water, containing a small percentage of some alkali, such as ammonia. The ammonia combines with the oil or grease thrown out by the perspiration, forming a soap, which is easily removed from the skin, leaving the pores open, thus promoting health and comfort.

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VOL. XLI., No. 6. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, AUGUST 9, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 188,

For the Week ending August 9, 1879.

Price 10 cents. For sale by all newsdealers.

WHAT TO DO NEXT WINTER.

A "country clergyman" sends a timely and suggestive communication, from which we quote the following:

"Among your forty thousand subscribers, all of whom it is presumed are specially ingenious persons, there must be very many who are disposed to exercise their talent, philanthropically, and without hope of reward. I am desirous to learn in what way to utilize an immense amount of unemployed power, which might be made a source in the aggregate of immense wealth. It is, however, human power that I mean. We have just passed through our winter season, and there is now a call for all the labor that the market affords. But during several months of the winter usually many farmers, or more especially laboring men, hired men, young men, and boys that work for a living, are very much at a loss what to do with idle time. Will you, or some of your correspondents, publish a few lines on this most important subject? What indoor work can be done by people of very little education, in order to keep the pot a-boiling, to help pay the rent, and otherwise make both ends meet? Of course the work must be something that is not usually done in large factories or by machines. One would think there must be a great variety of articles required by the public that shall come under this class of work. Even there might be some kind of work that should be done partially in a factory, the rest of which should be done by hand in the homes of the people. A proper answer to this question, as I suppose it might be answered, would make farming more profitable, tend to keep young men on the farm, save many unwilling idlers from congregating at the store or saloon, and give, what of all things they desire, to many idlers profitable work."

No doubt a great variety of productive employments suitable for different parts of the country can be pointed out by our practical readers, employments which do not require any particular manual dexterity, which can be taken up at odd moments and, however unremunerative, would be vastly more profitable than sheer idleness. We shall be happy to make a note of any suggestions that may be submitted.

Meantime it may not be out of place to consider whether there is really any need of new occupations for farmers and farm hands; whether there is not already on the farms an abundance of purely manual as well as intellectual farm work which sadly needs doing, and which, were it done, would greatly increase the profit and comfort of country living.

Our correspondent writes from a historic town in Massachusetts, and has in mind the wants of New England farmers and farm hands. Time was when the average New England farmer was a man of more than average intelligence and thrift. Now it may be questioned whether the average New England mechanic is not his superior in these particulars. And the difference is shown not so markedly in the farmer's winter idleness as in his unthrifty laboriousness at all seasons. The characteristics of the Yankee mechanic, which have made him king of artisans, are not those of the Yankee farmer. The one is alert, ever ready to discover and adopt improvements, and always bent on making the best use of the materials at his command. The other is remarkable rather for plodding industry, for unthrifty economies, for slowness in changing his practices to meet the changing wants and conditions of the times.

Even among the more intelligent New England farmers there is a serious lack of knowledge as to the capabilities of the soil under cultivation, as to the crops that can be made most profitable, and the best means of producing such crops, not to speak of the preservation of the fertility of the soil; of means for preventing the ravages of insect pests; of methods of supplementing garden and field crops by the rearing of fine grades of fowls, sheep, and other live stock; of augmenting the bulk and variety of the food supply by restocking useless ponds and streams with fish, and so on. In a thousand ways the farmers of New England are pursuing unthrifty methods, by which they lose every year as much as they win, by which they miss possible advantages that might increase enormously both their wealth and enjoyment.

No doubt it would be an immediate benefit to many a poor farmer to be told how by indoor industry in rough weather he could add a hundred dollars to his income. Certainly that would be better than to spend the time in idle gossip at the cross-roads store. But the chances are ten to one against the farmer, who could so waste his time, having a farm so well kept that the same labor would not be worth twice as much if it were applied directly to the clearing up of neglected corners, to repairing fences, out-buildings, tools, and machinery, to say nothing of efforts to gain a higher knowledge of the science of farming, to improve the condition of the farm, and increase its productive capacity.

It is safe to say there is not a farm in New England the value of which could not be advanced—perhaps doubled or trebled—by a few years of intelligent effort. It is certain that not one farm in a thousand is in so perfect a state of cultivation, or its capacity so widely developed, that its products might not be greatly increased in a single year by cultivating in the best way the crops best suited to it and the nearest market, avoiding products for which it is ill-adapted or which can be more cheaply raised elsewhere. Accordingly it may be fairly questioned whether the supplementing of poor farming with some sort of manual labor not related to farm work would not be less profitable than to encourage poor farmers to become intelligent and wisely economical farmers. Trying to compete with skilled labor and machinery by hand work cannot be other than discouraging,

even to save otherwise idle time; to do it when the time can be put to better use, more especially when the main business of life demands all of one's time and thought, is certainly not the height of wisdom. Shiftless farming, even when allied to winter thrift, can never accomplish as much as skillful farming fostered by winter study and perennial intelligence and thoughtfulness. New England needs good farmers, rather than any hybrid class of unskilled farmer-mechanics.

And what is true of farm owners is equally true of farm workers. There is no way in which young farm hands can employ their spare time so profitably as in studying to become intelligent farmers. And the best work that can be done for the young people of our rural districts lies, it seems to us, in the direction of encouraging among them, especially in winter, studies calculated to make their summer work more intelligent and more profitable to themselves and to the community as a whole.

PROBABLE OPPORTUNITIES FOR NEW DISCOVERIES IN ACOUSTICS.

The heretofore received theory of hearing by the telephone was that the thin diaphragm of metal, like that of the phonograph, served as a sort of artificial ear drum, which was vibrated to and fro by the electrically produced magnetic attractions and repulsions of the iron core. The most recent experiments, by observers such as M. Du Moncel, M. Ader, and H. Wildbrand, show that this explanation is incorrect, because the magnetic intensity of the telephone is found to be altogether too feeble to move or overcome the inertia of the metallic diaphragm.

The corrected theory now is, that the sounds heard in the telephone are due to a movement of the molecules composing the iron core of the telephone, induced by the electrical current. These molecular movements are conveniently transmitted to the ear by the iron diaphragm; but paper or glass may be substituted for the iron; indeed, the diaphragm may be altogether removed, and the sounds will then be transmitted to the ear through the wooden case or handle of the telephone.

M. Du Moncel has made a telephone receiver, consisting merely of a piece of board having a magnetized watch spring fastened thereto by one end, and a fine helix secured to the board under the free end of the spring.

In this device only molecular vibrations can take place; but when the board is applied to the ear speech can be heard more clearly than with an ordinary telephone, or even the speaking microphone.

The results of these new experiments and observations seem to indicate that molecular vibrations must hereafter be taken into account in things relating to acoustics, and that a broad field for new discoveries in connection therewith is now opened to the student.

THE NEW BUREAU OF NATIONAL SURVEY.

The organization of the new system of national survey, under the directorship of Clarence King, has been completed, and the scope of the coming summer's work has been announced. The great central mineral belt, extending through Colorado, Utah, Nevada, and California, will be studied first, the main purpose in view being to find out what minerals there are, and where they are.

Mr. King says that in view of the practical questions which affect so many millions of national wealth, little attention comparatively will be bestowed on purely scientific questions. In other words, as he expresses it, "We will allow the fossils to rest quietly in their beds and permit the rocks to 'dip' as they please, until we have settled some of the more important questions relating to economic geology." The precious metals alone, however, are not to engross attention. The plans include a thorough investigation of the coal, iron, and lead deposits of the United States, which will be conducted concurrently with that of the gold and silver deposits.

The field-work of the present summer will be occupied with "The Metallic Wealth of Colorado," centering at Leadville; "Lead Silvers of Nevada," centering at Eureka; "The Great Comstock Lode;" "The Central Gold Field of California."

The Leadville division will be under the charge of Mr. S. F. Emmons, geologist, and Mr. A. D. Wilson, topographer. In charge of the Eureka division will be Professor Becker, geologist, and Mr. F. A. Clark, topographer. Mr. King himself will supervise the work at the Great Comstock and in California.

Professor Raphael Pumpelly, so well known by his scientific researches in this country and in Asia, will, it is hoped, take charge of the investigation of the coal and iron deposits. Mr. Arnold Hague, late Imperial Expert of China, Mr. C. K. Gilbert, late of the Powell Survey, and Dr. F. V. Hayden, will be engaged in the work.

Major Powell's connection with the survey and with the Land Commission will not interfere with the work of ethnographical and ethnological research in which he has been so long engaged. The field work in this direction during the present summer will be devoted to completing the investigation of the architecture, the manufactures, and the family and tribal characteristics of the Pueblo or Village Indians of New Mexico and Arizona.

The very important work of classifying the public lands will be advanced as rapidly as possible. Notwithstanding the enormous industrial and financial interests which center, at present and prospectively, in our Western mineral lands, and the national importance of the scientific exploration of them, the new Bureau enters upon its work sorely hampered by the meagerness of the appropriation made for its support.

HOW TO PRESERVE CIDER.

A pure, sweet cider is only obtainable from clean, sound fruit, and the fruit should therefore be carefully examined and wiped before grinding.

In the press, use hair cloth or gunny in place of straw. As the cider runs from the press let it pass through a hair sieve into a large open vessel that will hold as much juice as can be expressed in one day. In one day, or sometimes less, the pomace will rise to the top, and in a short time grow very thick. When little white bubbles break through it, draw off the liquid through a very small spigot placed about three inches from the bottom, so that the lees may be left behind. The cider must be drawn off into very clean, sweet casks, preferably fresh liquor casks, and closely watched. The moment the white bubbles, before mentioned, are perceived rising at the bunghole, rack it again. It is usually necessary to repeat this three times. Then fill up the cask with cider in every respect like that originally contained in it, add a tumbler of warm sweet oil, and bung up tight. For very fine cider it is customary to add at this stage of the process about half a pound of glucose (starch sugar), or a smaller portion of white sugar. The cask should then be allowed to remain in a cool place until the cider has acquired the desired flavor. In the meantime clean barrels for its reception should be prepared, as follows: Some clean strips of rags are dipped in melted sulphur, lighted and burned in the bunghole, and the bung laid loosely on the end of the rag so as to retain the sulphur vapor within the barrel. Then tie up half a pound of mustard seed in a coarse muslin bag, and put it in the barrel, fill the barrel with cider, add about a quarter of a pound of isinglass or fine gelatine dissolved in hot water.

This is the old fashioned way, and will keep cider in the same condition as when it went into the barrel, if kept in a cool place, for a year.

Professional cider makers are now using calcium sulphite (sulphite of lime), instead of mustard and sulphur vapor. It is much more convenient and effectual. To use it, it is simply requisite to add one-eighth to one-quarter of an ounce of the sulphite to each gallon of cider in the cask, first mixing the powder in about a quart of the cider, then pouring it back into the cask and giving the latter a thorough shaking or rolling. After standing bunged several days to allow the sulphite to exert its full action it may be bottled off.

The sulphite of lime (which should not be mistaken for the sulphate of lime) is a commercial article, costing about 40 cents a pound by the barrel. It will preserve the sweetness of the cider perfectly, but unless care is taken not to add too much of it, it will impart a slight sulphurous taste to the cider. The bottles and corks used should be perfectly clean, and the corks wired down.

A little cinnamon, wintergreen, or sassafras, etc., is often added to sweet cider in the bottle, together with a drachm or so of bicarbonate of soda at the moment of driving the stopper. This helps to neutralize free acids, and renders the liquid effervescent when unstoppered; but if used in excess it may prejudicially affect the taste.

CHANGES IN PHOTOGRAPHY.

The substitution of dry sensitive plates for the common wet plates has made great progress during the past year or so; the old cumbersome method of dipping a collodion covered glass plate into water containing nitrate of silver, then taking the picture before the plate has time to get dry, is becoming obsolete both for indoor and outdoor work.

Dry plates, having a sensitiveness equal to or exceeding of wet plates, are now easily prepared, and their convenience and economy have been fully demonstrated. The traveling photographer no longer needs to load himself down with water bottles, liquids, and bath apparatus. He simply provides a few slips of prepared dry glass, with which and a light camera he climbs to the difficult places and secures the views he wants. The gallery artist is no longer obliged to waste his business time in waiting for the preparation and development of wet plates after his customers have come; but he may now both prepare and develop the dry plates out of business hours, and thus attend to two or three times as many sitters as heretofore. These dry plates may be kept on hand ready for use for an indefinite period.

At the present time gelatine is the base used as the skin with which to cover these plates. The gelatine is dissolved in warm water, bromide of ammonium is added, and the mixture is digested with heat. A solution of nitrate of silver is then added, and the mass is thoroughly mixed and cooked, being kept at a uniform moderate temperature for four or five days continuously. The mixture is then poured on the surface of the glass plates, dried in the dark, and the plates are ready for use. Such plates require an exposure of only two to three seconds in the camera in order to take the picture. If greater sensitiveness is wanted, then the gelatine-silver mixture must be kept under heat for seven or eight days instead of four or five. This is a very curious fact. Why the sensitiveness is increased by prolonging the time of cooking has not yet been ascertained. The development of the picture is effected by the use of a solution of pyrogallic acid followed by a solution of ammonia and bromide of potassium. The results produced are said to be in all respects excellent.

SPIRIT PHOTOGRAPHS.

For some time a certain class of newspapers have abounded in marvelous tales of spirit photography, the work of a lady photographer of Rochester, N. Y., assisted of course by the ghosts of her clients' ancestors and departed friends.

Recently two lady sitters were impressed by the old fashioned yet familiar costume and aspect of the spirits attending them in their pictures; and set to work to trace their probable pre-spirit history in the pages of an old magazine for ladies. The search was successful, the original of one of the spirits proving to be an engraving entitled "Nourmahal" and the other "The Last Rose of Summer." No doubt the spirits can give good reasons for masquerading in those particular costumes, but as yet they have failed to do so.

The photographs and engravings fell into the hands of a representative of the Rochester *Union*, who, in order to ascertain the process by which the ghostly picture was printed beside the sharply defined portrait, submitted them to a photographer who does not deal in spirits. The process was practically illustrated and explained as follows: A negative is first taken of the engraving. When the sitter comes for a picture the negative is turned the other side, the collodion put on and the glass put in the camera. In this manner the portrait of the sitter is on one side of the glass and what is intended for the spirit on the other. When the negative comes to be printed the paper is placed against the side of the glass having the portrait of the sitter and exposed to the light. The spirit being on the other side of the glass has to strike through it, which gives it the hazy appearance, while the portrait, being on the side next the light, comes out clearly defined. Any one who is desirous of doing so can test this for himself, and the illustration shown by the photographer explained the matter fully to the eyes of the inquiring newspaper man. The more artistic a photographer is, of course, the more unearthly he can make the work, and the gentleman in question said he could produce a picture of the most ghastly description.

THE ELECTRICAL ALARM COMPASS.

A short time since Mr. Henry A. Severn, of Herne Hill, England, brought out an ingenious compass alarm for use on shipboard. Its purpose is to make the compass signal automatically any considerable deviation of the ship from a desired course. Over the compass card are placed two index hands which can be adjusted to any angle; and these hands are so connected with an electric alarm that the moment the compass needle passes the limit of variation prescribed an alarm bell will ring in the captain's office, and continue ringing until the ship's proper course is restored. In this way any departure from the ship's course, as ordered by the officer in command, whether due to the steersman's inattention to duty or to a misunderstanding of the orders given, will be instantly made known. Of course when the officer gives his orders to the steersman he sets the index hands to correspond, and after that he is relieved of the necessity of constant observation of the compass to be sure that his order is strictly carried out.

This invention is just now receiving much attention in the scientific and other journals in England; and it is currently described as novel as well as likely to be useful. Its novelty, however, is open to question. In principle, and apparently in mechanical construction, it is substantially identical with the electro-magnetic attachment to ship's compasses patented in this country by Alfred Foucaut, July 19, 1870.

The essential part of the claim for this patent was the construction and arrangement of a compass, so that, by reason of any material variation in the route of the vessel, the needle of the same would close an electrical or magnetic circuit and sound an alarm.

The apparatus used in demonstrating the practicability of this system was made in this city by Mr. William F. Holske, model maker, now at No. 33 Park Row. Why the invention has remained so long undeveloped is not known.

New Bridge Over the Missouri near Omaha.

The Burlington and Missouri Railroad Company in Nebraska are about to build a new bridge across the Missouri River at Plattsmouth, about one mile below the mouth of the Platte River and 22 miles below Omaha.

The entire bridge will be about 3,000 feet in length, about 1,000 feet being over the present bed of the Missouri River. The bridge is in the charge of Mr. George S. Morrison, chief engineer, who will personally attend to its construction. The contract for the beton and concrete work has been given to the New York Stone Contracting Company, and will be done under the supervision of Mr. John C. Goodridge, Jr., president of the company. The other contracts are not yet made. The foundation in the river bed will be 55 feet below low water mark; the bottom of the bridge 55 feet above high water mark. It will take about a year to complete the structure. The Union Pacific bridge at Omaha cost over $2,000,000. The bridge at Plattsmouth is expected, from superior engineering, to cost much less. The Missouri River in the vicinity of Omaha is noted for its shifty character and treacherous quicksands. The river is now a mile further away from Omaha than it was last year, and has formed a new channel or cut off through the Oxbows, making the river about six miles shorter in length.

MR. ALVA CLARK, the famous telescope maker of Cambridge, Mass., was for forty years a portrait painter. He is now, in the 76th year of his age, hale, hearty, and energetic in his business.

IMPROVED PRESSING MACHINE.

Mr. J. W. Jones, of Harrisburg, Pa., has invented a machine which will probably work a revolution in the dry-pressing of printed sheets. It is in practical use in the Government Printing Office at Washington, and in the State Printing Office at Harrisburg, and also at the bindery of Mr. John Mills, 14 Vesey street, New York. This machine will press printed and folded sheets, without set-off, and without fuller or glazed boards being interposed between them.

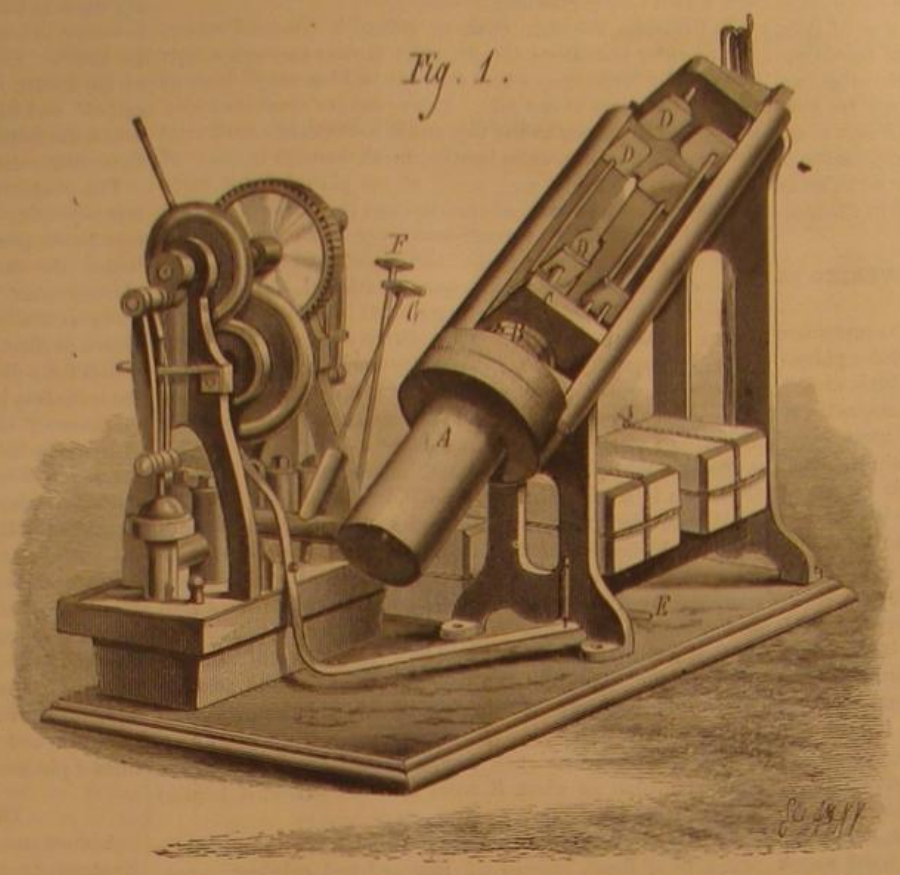
When the form is being printed it is usually done in this way: the paper is first printed on one side, making the indentations all one way; it is then turned and printed on the other side; this operation is called backing up. It makes the same number of indentations as the first impression, and carries with it nearly all of the indentations made by the first impression. These indentations are concavo convex. The sheets now being printed on both sides are folded. The first fold makes the indentations opposites—concave against concave, or convex against convex, depending on which half of the whole sheet it is. The sheets, being usually of double size when printed, are cut before folding; one half of each sheet, when cut, will have the indentations on one side, while the other half will have them on the opposite side. The sheet receiving the second fold, the opposites are multiplied; when it receives the third fold, they are again multiplied; and this multiplication is continued with every fold the sheet receives. The indentations are more easily removed when the sheets are folded than they could be if they were placed from two to six or more between fuller or glazed boards and subjected to great pressure. It will be readily seen that by placing the sheets in the press, flat, the indentations form, to a great extent, a mould or counterpart for each other, consequently requiring more pressure to remove them.

The sheets being folded, and the indentations being opposed to each other, as described, about 500 are placed in the trough of the machine, with end boards to secure an even pressure over the entire surface, and also to prevent the marring of the outside sheets by the cords, and hydraulic pressure is applied, which is so regular that it causes no heat or friction on the sheets being pressed, consequently there is no set-off. The sheets, while under pressure, are tied with cord around the bundles endwise. The machine is then opened, and the bundle removed and set aside, with the pressure retained by means of the tie, until the sheets are wanted for gathering. The bundles are more easily ranked up, take up much less room than is required when they are piled up loose or bundled by hand, and being more compact there is less fire risk. While pressing them as smoothly as the cumbersome hydraulic press, it breaks their backs as effectually as a crushing machine, and takes out all the "kinks," which are wont to bother a binder. After passing through it, the work is more readily handled through all the stages a book has to pass during the process of binding, and is more firm and solid when finished.

It is impracticable to state all the advantages that this new process has over the ordinary methods of dry pressing. The machinery employed will be understood by reference to the engravings. The press is supported in an inclined position for convenience in arranging the sheets to be pressed, and the frame in which the platen moves forms an angular trough for receiving the corners of the sheets to be pressed; the arrangement obviates the necessity of arranging the sheets, and saves a great deal of time, besides insuring accuracy in the position of the sheets.

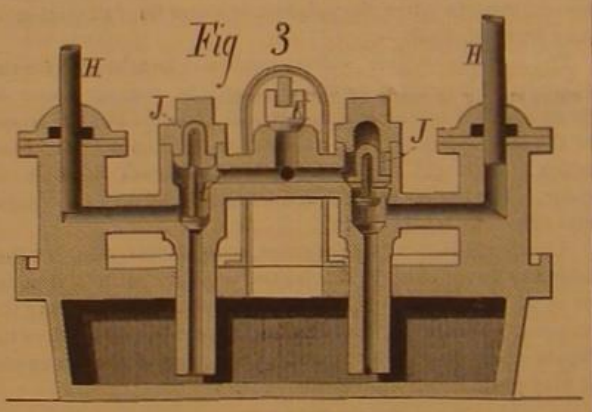
The cylinder, A, contains the plunger, B, having the head, C, which supports the four sections, D, of the platen by means of the short stout standard. The stationary end of the press is similarly arranged, and the sides of the press frame are slotted to permit of tying the bundles pressed by the machine. Before placing the sheets in the press a strong board having beveled edges is placed upon the platen, then as many sheets as are to be operated on are placed in the trough and another board is placed above them. The pressure is then applied by means of the hydraulic pumping machinery, which is set in operation by touching the foot to the pedal, E. The water supplied to the hydraulic cylinder, A, passes through a valve, F. An electric alarm is provided which sounds when the limit of pressure is reached. The bundle is then tied with a strong cord which passes around it in two directions.

Fig. 1.



JONES' PRESSING MACHINE—FRONT.

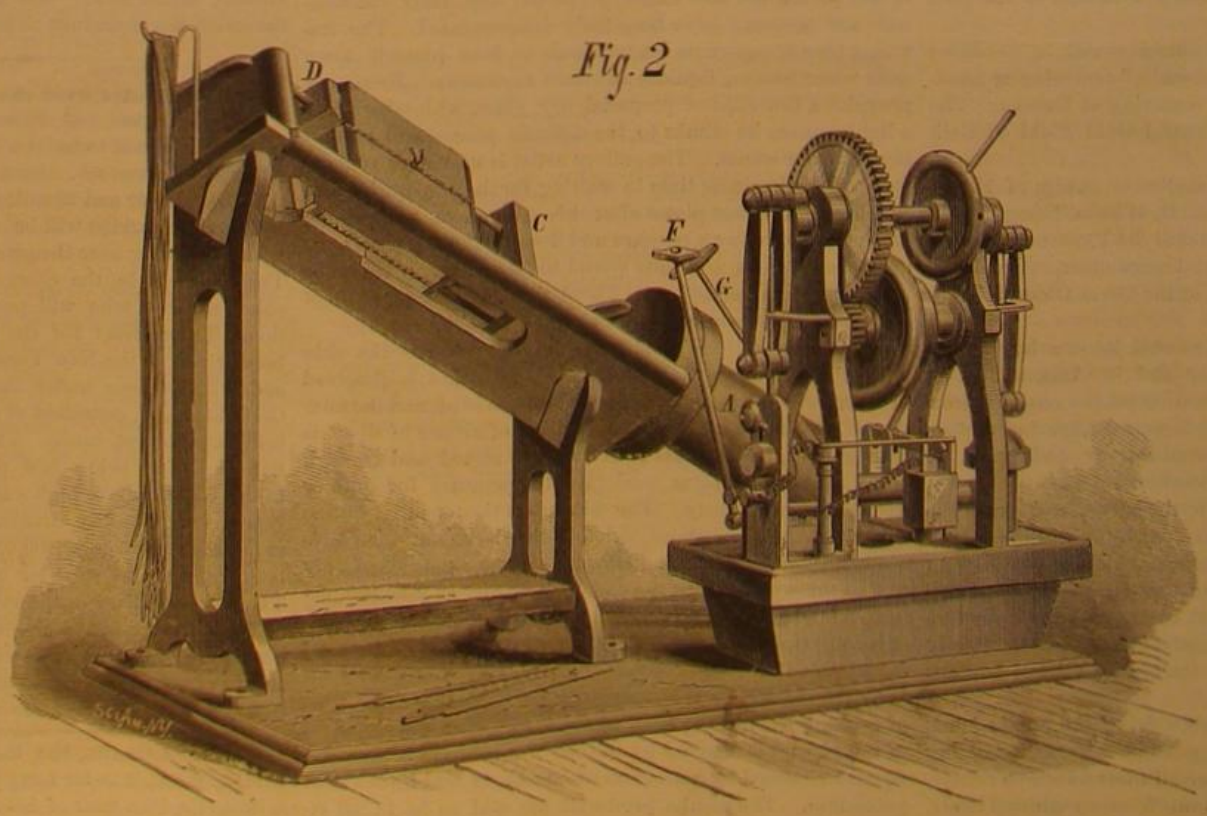
Fig 3



By turning the valve, G, the water in the cylinder, A, is allowed to escape to the cistern beneath the pumps, and the bundle is removed to give place to another. The sheets thus placed under pressure and tied are retained under pressure as long as may be desired independently of the press. The time required is from 10 to 24 hours. The time required to place the sheets under pressure is less than five minutes. The arrangement of valves and pump plungers is shown in Figure 3—H H, being the plungers; I I, the induction valves; J J, the eduction valves, and K, the safety valve. The pumps are mounted on a small cistern, which contains the water supply.

Any further information regarding this invention may be obtained from its inventor, whose address is given above.

Fig. 2



PRESSING MACHINE—REAR VIEW.

Wild Animals in Algeria.

Wild animals are rapidly disappearing from Algeria. The French Government pays ten dollars for every lion or panther that is killed, and about forty cents for every jackal. Last year rewards were paid on 53 lions, 49 lionesses, 9 cubs; 530 panthers, 45 young pathers; 1,072 hyenas; and 14,784 jackals.

How to Print Several Copies of a Letter.

A new process, by M. Chardon, is as follows: Make a zinc tray about a quarter of an inch in depth, and pour into it a warm solution made as follows: Water, 4 ounces; sulphate of baryta, 2½ ounces; sugar, 1 ounce; gelatine, 1 ounce; glycerine, 6 ounces. Write whatever is required to be printed upon a sheet of white paper, using instead of ordinary ink the aniline color known as "violet of methylaniline;" as soon as the writing is pretty dry lay it upon the gelatine surface and rub the back of the paper with the palm of the hand. The ink will be absorbed by the gelatinous product. All that is to be done in order to obtain a *facsimile* of the writing is to lay a sheet of paper upon the writing on the gelatine and rub the back with the hand. From forty to fifty can thus be drawn off in a few minutes. We find that in warm weather plates thus prepared remain too soft and adhesive to work satisfactorily. Better results are obtained when a larger proportion of barium sulphate—say 3½ instead of 2½ ounces—are used and the mixture is heated for an hour on the water-bath.

San Francisco's Big Ferryboat.

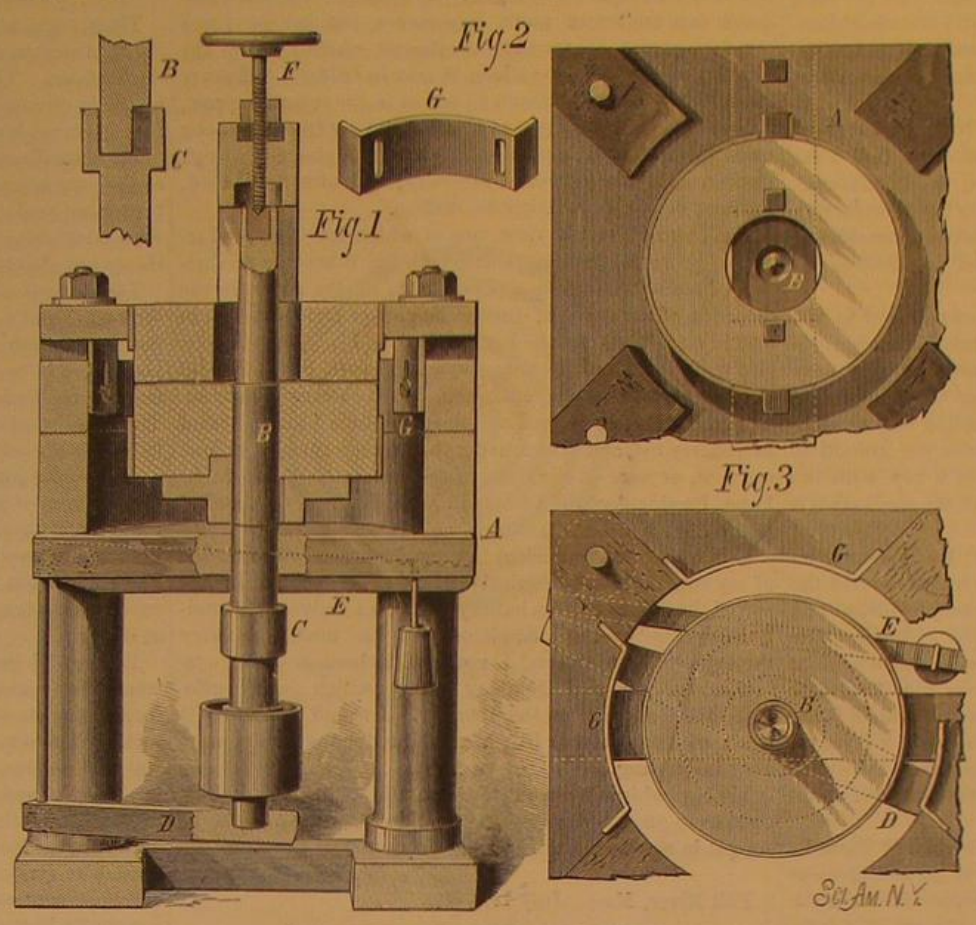
The Central Pacific Company's new ferryboat, Solano, measures as follows: Length, 424 feet; height of sides in center, 18 feet 5 inches; height at ends, 15 feet 10 inches; width over guards, 116 feet. The Solano will have two vertical beam engines of 60 inch cylinders and 11 foot stroke. The wheels are 30 feet in diameter, with buckets having a face of 17 feet. Eight steel boilers, each 28 feet in length, will be provided, and will be made in pairs. Four Pratt trusses give a longitudinal stiffness, and connect the deck and bottom of the boat in true bridge style. She is a double-ender, and has four rudders at each end, worked by a hydraulic steering apparatus operated by an independent steam pump. The engines work independently, each moving one wheel, which revolves independently of the others. The boilers are placed upon the deck to prevent the escaping steam from rotting the wood. The hold is divided into eleven watertight compartments, which render her less liable to sink and also strengthen her. Four tracks will be placed upon her decks, which will accommodate 48 freight cars or 24 passenger coaches. Her slips will be provided with aprons 100 feet in length, which will admit of cars being taken aboard without uncoupling from the engine. The Solano is intended to run between Martinez and Benicia, where slips are being built for her. By this route the distance between San Francisco and Sacramento will be but 85 miles, instead of 140 miles by the way of Livermore, and 151 by the way of San Pablo.

Sign of Prosperous Times.

The President of the Board of Emigration in this city informs us that emigrants, at the rate of 3,000 per week, are arriving at this port. A noteworthy feature is the large proportion of Germans and Russians among them, all of whom immediately push westward. He states, moreover, that the arrivals this season are a very superior class, and as such the Western States are to be congratulated in having them added to their permanent population.

IMPROVED GRINDING MILL.

We give herewith engravings of an improved grinding mill recently patented by Mr. Stephen P. Walling, of South Edmeston, N. Y. The improvement relates to means for adjusting the stones and to the general construction of the mill. Fig. 1 is a central vertical section, and Figs. 2 and 3 are plan views. The mill represented in the engraving is a horizontal mill of the portable class, but the improvements may be applied to vertical and stationary mills.



WALLING'S IMPROVED MILL.

The husk frame, A, supports the stationary stone and contains the spindle, B, upon which is mounted the running stone. The spindle rests in a step in the lever, D, fulcrumed in the lower part of the frame, A. This lever is connected with the shorter arm of the lever, E, which is weighted sufficiently to overbalance the weight of the spindle and running stone. At the upper end of the spindle there is a hardened steel plug that receives the end of the adjusting screw, F. This screw is prevented from becoming accidentally loosened by a packing of flexible rubber which takes the place of a jam nut. The spindle is held up against the adjusting screw by the counterweight on the lever, E, which keeps the running stone up to its work and at the same time allows it to yield whenever a hard substance chances to get into the mill, and brings it back into its normal position after the hard substance is discharged from between the stones. The adjustable plates, G, fill the spaces in the casing between the pillars and prevent the escape of flour dust. The spindle, B, is made in two parts, which are connected by the coupling, C. This coupling is capable of yielding so that a slight lateral motion in one part of the spindle does not affect the other part. The spindle is provided with means for continuous lubrication, and if by any means it becomes slightly heated the expansion tends to relieve the stones rather than to cause them to bind, as in the ordinary construction. In addition to these advantages the mill can be readily taken apart and the stones conveniently removed for dressing.

Further information may be obtained by addressing the inventor as above.

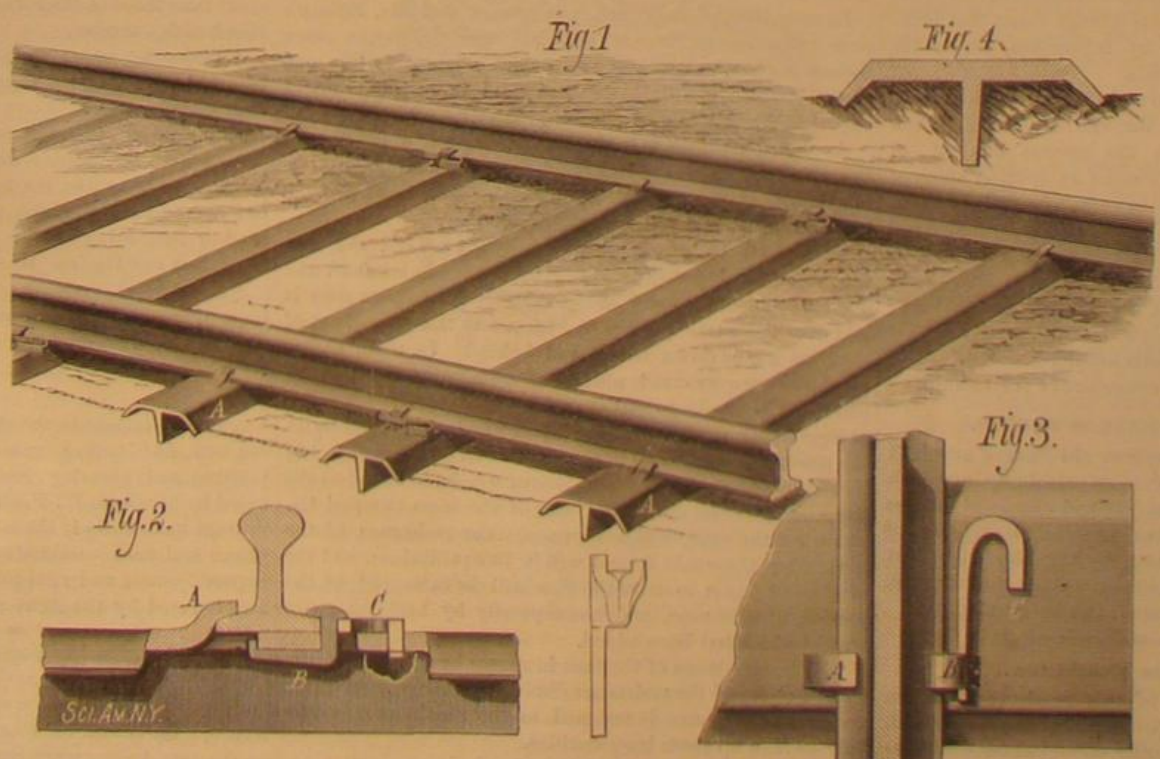
A NEW RAILROAD TIE.

The enormous consumption of timber for railroad ties, especially in this country, where we do not take time to use things to the best advantage, is making the right kinds of wood for the purpose more and more scarce every year. The *Lumberman's Gazette* estimates that as we have now about 90,000 miles of railroads the annual consumption of ties or sleepers alone is 40,000,000, or thirty years' growth of 75,000 acres. This tremendous destruction of cross-tie timber, only certain kinds and sizes of which can be used for the purpose, is using up the stock within reach so fast, and good ties are in consequence becoming so hard to get in many quarters, that railway managers are seriously turning their thoughts toward some substitute. Of course the only available rival of wood is iron, and the price of that article from various causes is, and is likely to be for a long time to come, so low that the difference in price between it and wood as a material for the purpose is not the insuperable objection to its use that it was only a few years ago. Indeed many of the European government railways, notably those of Belgium, have decided to lay only iron ties in the future. The German railway management have also advised the same, and it will doubtless soon be adopted. Some of the English railways are also trying them on a large scale. Taking a series of years, iron, from its almost endless durability, is so much cheaper than wood that it must eventually take its place, not only for railroad ties but for many other structural uses now monopolized by wood.

The accompanying engravings illustrate a new wrought iron cross-tie patented in the United States, May 11, 1875, and April 8 and May 20, 1879, by Mr. Henry Reese, of Baltimore, Md., and for which patents are now pending in England, France, Germany, Belgium, Austria, Italy, and Spain. This tie is claimed to meet fully all the requirements of simplicity, cheapness, strength united with elasticity, ease of construction and of laying in track, and to be in all respects a practical solution of the question.

The large illustration is a perspective view of a section of track laid with this tie. Fig. 1 is a plan view of one end of a tie with the rail fastenings and a section of the rail. Fig. 2 is a side elevation of the same, with part of one flange of the tie and of the vertical web broken away to show the shape, situation, and arrangement of the fastening parts. Fig 3 is a cross section of the body of the tie, and Fig. 4 is an elevation of the spring, made of flat steel, as shown in the perspective view; the dotted lines in the same figure show the same spring as made of round steel.

A, Figs. 1 and 2, show the permanent lug, which is turned up from the upper plate of the tie, and against and under which one base flange of the rail is firmly held, while the other flange is held in the same way by the movable clamp, B, which is pressed firmly against (embracing both) the flange and the top plate of the tie by the spring, C. The part of the clamp, B, which goes under the tie has at its end an upturned toe which rises into the opening left by turning up the lug, A. The object of this toe is to prevent the removal of the clamp from its place in case of the malicious or accidental removal of the spring, C, as the clamp is pressed up to the tie by the ballast and can only be taken out by its removal. The spring, C, rests at its free end under a shoulder of the clamp, B, and its fast end is socketed in a slot in the top plate, and has a hook or projection, shown at *a*, Fig. 4, to go under the top plate and keep the spring in position. The object of reversing the alternate ties end for end, as shown, is to bring the permanent lugs, and also the movable clamps, on both sides of the base flanges of the rails. The effect is obvious. The springs by their reaction against the tie draw the permanent lugs with force against the rail base, and as these lugs alternate on opposite sides of the bar at short distances apart, the effect is to hold the rails firmly to the ties and make a solid substantial superstructure, at the same time allowing the rails to expand and contract with summer's heat and winter's cold.



REESE'S RAILROAD TIE.

Further information may be obtained from the patentee at 209 W. Pratt Street, Baltimore, Md.

ENGINEERING INVENTIONS.

An improved governor for marine and other engines, in which the speed is controlled by centrifugal balls, has been patented by Mr. Samuel Whitney, of Wheeler, Ala. In this device a worm gear is acted upon by a pinion in such a way as to rotate the governor spindle when the engine runs normally, but when the speed is suddenly increased, it will lift the valve stem and check its engine.

A meter for measuring the amount of steam consumed for heating purposes in stores, houses, etc., has been patented by Mr. Joseph A. Cook, of Auburn, N. Y. It consists of a reservoir for receiving water, and a float placed in the reservoir and moved by the water, so as to operate a pair of arms that move the registering mechanism. The same inventor has patented a self-adjusting valve for regulating the pressure and supply of steam for heating purposes.

An improved railway gate, constructed so that it will be opened by an approaching train and held open until the train passes, has been patented by Messrs. Lewis C. Pope and Obed N. Tencher, of Paola, Kan.

Mr. Samuel G. Martin, of South Amboy, N. J., has recently secured two patents for steam steering apparatus for vessels. By the use of two separate piston heads, in a single cylinder, the rudder can be held centrally or to either side. For double-ended vessels two steam cylinders are used, and chains pass to both rudders from the pistons, so by the movement of the pistons the rudders will be turned.

Mr. Horatio Nelson, of New York city, has patented an improved enameled screw propeller which will not corrode, and works in the water with less friction than the ordinary wheels.

An improved balanced steam engine has been patented by Mr. James O. Baird, of Brooklyn, N. Y. This engine has three cylinders, with pistons working alternately upon diametrically opposite cranks. The engine is provided with a balanced steam valve of peculiar form.

An improved dynamometrical governor has been patented by Mr. Ernest A. Bourry, of St. Gallen, Switzerland. In this device, by suitable appliances, the variations of the power load, or resistance, are utilized directly to operate the throttle valve.

Mr. John L. Custer, of Bonaparte, Iowa, has devised a machine for excavating ditches to a true water line and finishing them for the laying of drain tile. The construction of the machine cannot be readily described without an engraving.

Mr. Paul S. Forbes, of New York city, has invented a steam boiler provided with serpentine fire flues, so arranged that their bends or coils may pass alternately through the upper part of the water space and the lower part of the steam space. It is said that with this construction steam will be generated faster and with less quantity of fuel than when boilers of the ordinary construction are used.

Mr John H. Fairbank, of McKeesport, Pa., has invented an improved balanced valve for steam engines. The advantages of this valve over others lie in its cheapness and simplicity, its fewer number of parts, and the ease with which it can be adjusted or loosened or tightened upon the valve seats.

An improved dredging apparatus has been patented by Mr. John Grant, of New Orleans, La. This invention is an improvement upon the dredging apparatus for which letters patent were granted to the same inventor, July 18, 1876. The present invention consists in a vertically adjustable deflecting plate extending throughout the broadside of

the boat, and mounted upon a framework which is sustained upon two sliding spuds, and is made vertically adjustable as a whole. It also consists in combining with the deflecting plate a longitudinally reciprocating rake, which is made adjustable with the deflecting plate, and which is used to stir the bed whenever it is of such a nature as not to be easily disintegrated by the unassisted action of the water.

An improvement in brakes for wagons and cars has been patented by Messrs. Mathew C. Franklin and Nathaniel Landrum, of Prairie Lea, Texas. The invention consists in a peculiar arrangement of the brake bar, a cam bar, and a foot lever, which insures a powerful action.

Mr. James Montgomery, of Jersey City, N. J., has invented an improved car wheel, which consists in providing a car wheel with slots which radiate from the eye, and in reinforcements around the edges of said slots; also in the construction and application of an elastic packing to inclose three sides of the tread piece of the wheel and form a bed for the tread in the peripheral groove of the wheel.

An improvement in car couplings has been patented by Mr. Milton Logan, of Foxburg, Pa. The invention is an improvement upon letters patent granted to the same inventor, July 30, 1878, and relates to means for operating the hook-ended draw bars shown in that patent. The coupling may be readily operated from either the platform or from the ground at one side of the car. It is also connected by a rod with the short arm of the lever pivoted on the top of the car, so that it may be operated from the top.

Mr. William Loudon, of Superior, Neb., has patented an improvement in pumps, the object of which is to prevent the accumulation of sand around submerged pump cylinders and the stoppage of the inflow of water to the cylinder. The cylinder is provided with a cylindrical shield, placed so as to leave a space between it and the cylinder, so that the water can pass to the cylinder and enter the same, said shield being composed of foraminated cylindrical shells, with a layer of wire gauze between, which offers a free passage to the water, but prevents the sand from coming in contact with the cylinder.

An improved railroad switch, patented by Mr. William L. Potter, of Mechanicsville, N. Y., consists in an arrangement of movable guide bars that cause the wheels to take the track for which the switch is set and permit the passage of a train from either direction or upon either track without danger of the wheels leaving the rails and without jolt.

Mr. Joseph W. Riley, of Hollidaysburg, Pa., has patented an improvement in side trusses for bridges. The trusses are formed of the longitudinal bars, cross bars, cross rods or bolts, studs, and elliptical braces, arranged so as to secure the greatest possible rigidity and strength with the smallest expense.

An improved device for cutting railroad rails, patented by Mr. John M. Peterson, of Michigamme, Mich., consists of two arms, pivoted together at one end, and the opposite free ends adapted to receive cutters, which are applied to opposite sides of the rail, and forced against the same by a ratchet lever screwing a nut upon a shaft joining the ends of the arms, whereby the knives or cutters are made to cut through the rail.

Recent Decisions Relating to Patents.

BY THE U. S. CIRCUIT COURT—EASTERN DISTRICT OF VIRGINIA.

Sayles v. Richmond, Fredericksburg and Potomac Railroad Company.—1. Where a patent has been granted for fourteen years and extended for seven years, a suit may be brought against an infringer for profits that accrued at any time during the twenty-one years, if brought within six years after the extended patent expires.

2. The United States circuit court has jurisdiction of suits in equity relating to patents between citizens of different States. It is doubted whether the circuit court has jurisdiction in patent cases, except by injunction, where the parties are citizens of the same State.

3. Where it is sought to recover in equity profits resulting to the defendant from using, through a series of years, a mechanical invention without the owners' consent or authority, which profits do not consist in specific sums of money received by the defendant in so using the invention, but simply consist in the advantage and convenience derived from using them, and such advantage is a matter to be estimated as a whole, it is not a matter of accounts, and, therefore, a bill cannot be sustained for an account. Where there is an adequate common law remedy, equity cannot take jurisdiction of a bill for profits arising from the use of a patent solely on the ground of constructive trusteeship.

BY THE ACTING COMMISSIONER OF PATENTS.

Ex parte Holcomb.—Even though an old form of article is much improved and rendered far more salable by a certain method of making it, yet, as that method consisted in the employment of means within the knowledge or grasp of those acquainted with the business, such method does not constitute an invention within the statutory enumeration of inventions for which letters patent can be granted.

American Institute Exhibition.

The forty-eighth exhibition of this Institute will open September 17th, in this city. Parties having novelties which they intend to bring to public notice should at once address the General Superintendent for blanks and information. The medals, it is said, have been increased, and special awards will be made upon a number of articles.

Correspondence.

Magnetization of Molten Iron.

To the Editor of the Scientific American:

In your issue of July 5th I notice a report of "Magnetizing Molten Iron," the experiment having been made by Mr. Chernoff and reported by Dr. C. W. Siemens. I do not know that it is a matter of much importance, but believe I was the first person to try the experiment, which I did in the foundry of the Fall River Iron Works in 1872. I had never thought it important enough to report in the scientific press, though I at the time reported it to some of my friends, among them Prof. John H. Appleton, of Brown University; Prof. Barker, of Pennsylvania University; and afterward Prof. Farmer, of the U. S. Torpedo Station.

I had two objects in view, one of which was the production of powerful permanent magnets, the other the production of malleable iron by a polarization of the atoms in the direction of the current, during the change from a molten to a solid condition. In the first I failed, as I believe every one else will; for, since heat destroys a magnet, heat will also prevent permanent magnetization. In the second I succeeded to a certain degree, and samples of the iron I made, heated to a cherry red, and drawn under the hammer to chisel points, are now, or were at one time, in the possession of Mr. A. A. Pope, President of the Cleveland Malleable Iron Co., and of Dr. W. W. Keen, Philadelphia.

If it would be of sufficient interest, I will send you a sketch of my apparatus and description of my experiments. I made use of the 60 cup Bunsen battery, of Brown University, kindly loaned me by Prof. Appleton, and was unable to carry the experiment to the end I would wish, because of the evolution of nitrous acid from my battery, which nearly suffocated the workmen at the foundry. I would like to try it again with a powerful Brush machine, for the results were very interesting.

My bars of iron came out of the mould solid, and if hollow ones were produced by some one else, the reason must be sought in some defect of making the mould or pouring.

SPENCER BORDEN.

Fall River, Mass., July 11, 1879.

Edison's Dynamometer.—An Improvement Suggested.

To the Editor of the Scientific American:

Noticing in your last issue the dynamometer invented by Mr. Edison, it occurred to me as rather odd for him to adopt such coarse devices for measuring power, however effective they may be. Why did he not apply the principle of the tasimeter to this purpose? It seems feasible enough to a layman. Suppose the driving and driven shaft to be placed axially in line, but not connected; provide each with an arm, allow the arms to overlap each other at the ends, and place between the ends of the arms a carbon button having electrical connections as in the tasimeter. The button would be pressed more or less, according to the power consumed by the driven shaft, and its electrical conductivity would be changed with every variation of pressure.

To insure accuracy in the indications of the galvanometer, another tasimeter arranged to receive a variable amount of pressure should be connected with a switch, so that it could at any moment be thrown into the electrical circuit in place of the button carried by the arms.

If the tasimeter is so sensitive and so accurate for exceedingly small pressures, why should it not be more accurate in indicating heavy pressure? X.

The Edison Dynamometer.

To the Editor of the Scientific American:

In your issue of July 26th, you remark that Mr. Edison's new dynamometer is "in principle something like other dynamometers." Are you aware how much it is like one devised by Mr. Horatio Allen and used in the government experiments on steam expansion in 1865?

As described by Prof. Fairman Rogers, at a meeting of the Franklin Institute, March 16th, 1865, and published in my report as secretary, it appears as follows (see *Journal of the Franklin Institute*, vol. 49, page 281):

"The shaft being cut between the engine and the first fan, a grooved pulley is keyed upon the engine shaft and one exactly similar upon the fan shaft. An endless rope is laid over these two pulleys in such a way that the bight of the rope hangs down before and behind. In these bights are hung two grooved pulleys of a diameter equal to the distance of the large pulleys apart, and to these smaller pulleys equal weights, so that the rope is held tightly in the grooves of the large pulleys. The engine pulley being turned by the engine, sufficient extra weight is added to the hanging pulley on the driving side of the rope to equal the strain on the rope, which represents the resistance of the fans, when the whole system will be in equilibrium, and the amount of power to drive the fans will be measured by the tension of the rope, and consequently by half the extra weight which has been added.

"If the resistance of the fans increases by any means, the weight rises; if the resistance diminishes, the weight falls, and a spring balance is fastened to the weight and to the floor to take up these irregularities.

"A rod attached to the weight and carrying a pencil, moving over the surface of a cylinder running from the shaft, serves to register the power required to run the fans.

"By the apparatus the friction of the fan shaft can be measured and any change in the resistance from varying density of the air is immediately indicated."

HENRY MORTON.

Stevens Institute of Technology,
Hoboken, N. J., July 18, 1879.

Ocean Currents at St. Paul's Rocks.

These rocks are about 540 miles distant from the coast of South America, and 350 miles from the island of Fernando do Norhona. The group of rocks is scarcely more than half a mile in circumference, and their highest point is only 64 feet above sea level.

Their smallness is the striking feature in their appearance as they are approached. They show themselves as five small projecting peaks, which are black at their bases and white with birds' dung on their summits. A yellowish white band shows out about tide mark.

The sea was dashing up in foam at the southeast end of the rocks, and a long line of breakers stretching from the opposite end marked the course of the equatorial current. The birds were to be seen hovering over the island in thousands. Only three kinds inhabit it—two noddies and the booby. The noddies (*Anous stolidus* and *A. melanogenys*) are small terns or sea swallows, black all over, with the exception of a small white patch on the head. The booby (*Sula leucogaster*) is a kind of gannet. The full grown birds are white on the belly, with a black head and throat, the black ending on the neck, where it joins the white in a straight conspicuous line. The back is dark. The younger birds are brown all over. Some few of both birds soon came off to have a look at the ship.

We moved gradually up to the islands, sounding as we went; the Captain and Lieutenant Tiyard mounted into the foretop and steered the vessel from thence, looking out for rocks. The water is deep right up to the rocks, and a hawser was sent on shore in a boat and made fast round a projecting lump of rock, and the ship was moored by means of it in about 100 fathoms of water, although not more than 100 yards distant from shore.

Such an arrangement is only possible under the peculiar circumstances which occur here. The wind and current are constantly in the same direction, and keep a ship fastened to the rock always as far off from it as the rope will allow. I never properly realized the strength of an oceanic current until I saw the equatorial current running past St. Paul's Rocks.

Ordinarily at sea the current, of course, does not make itself visible in any way; one merely has its existence brought to one's notice by finding at midday, when the position of the ship is made known, that the ship is 20 miles or so nearer or farther off from port than dead reckoning had led one to suppose she would be, and one is correspondingly elated or depressed.

But St. Paul's Rocks is a small fixed point in the midst of a great ocean current, which is to be seen rushing past the rocks like a mill race, and a ship's boat is seen to be baffled in its attempts to pull against the stream.—*Mosely, Notes by a Naturalist.*

NEW AGRICULTURAL INVENTIONS.

Mr. Joseph S. Noyes, of Ransom Center, Mich., has patented an improved gate, which is supported on a hinged bar, so that it may be raised or lowered by the simple movement of a lever. It is also provided with a peculiar arrangement of latches.

An improved implement for leveling and smoothing the ground in preparing it to receive seed, has been patented by Mr. Charles A. Meeker, of Green's Farms, Conn. The invention consists in the combination of two sets of rollers and disks, the disks of the rear set being placed at a less distance apart than those of the forward set. The implement is provided with a scraper.

A device by which the sides and tops of hedges can be trimmed accurately and quickly, and with much less labor than by other trimmers now in use, has been patented by Mr. Henry Unkrich, of Fairfield, Iowa.

An improved machine for trimming hedges, which is so constructed as to trim the top and one side of the hedge at one operation, and which may be adjusted to work upon level or inclined ground, is the invention of Messrs. Albert G. Rogers and Harlow M. Freeman, of Lathrop, Mo.

Mr. Morris C. Pennock, of Alliance, O., has invented an improvement in churns, which is provided with a novel form of rotary dasher, and with slotted journal bearings and other new points, which render it convenient and efficient.

An improvement in the class of machines that are adapted for both distributing guano, or other fertilizer, and depositing and covering seed simultaneously, has been patented by Mr. John W. F. Gilreath, of Cassville, Ga. The improvement consists in the arrangement of parts by which the guano and seed conducting tubes or sprouts, and also the furrow-openers and seed-coverers, are simultaneously raised and lowered by the same means.

M. DE LESSEPS has issued the prospectus of the Darien Canal Company. The capital is fixed at 400,000,000 francs. Only 125 francs per share will be called up in the first instance. Interest at the rate of five per centum will be paid on the actual money received during the course of construction. M. De Lesseps estimates an income of 90,000,000 francs from the canal.

The Future of Texas.

A recent traveler in Texas, after visiting every section of the State reached by railroads, comes to the conclusion that the possibilities of the State have been vastly overrated. Toward the end of a very intelligent series of letters to the *Tribune* he says:

Texas contains 274,356 square miles. It would make five States as large as Illinois, but no just inference can be drawn from its size alone as to its capacity for sustaining population. Illinois contains fully as much first-rate agricultural land as Texas. The whole of Eastern Texas, embracing a territory larger than Ohio, consists of pine barrens, with a little arable land along the valleys of the streams. Out of the valleys the soil is sandy, and would not pay to clear and cultivate. This region will never be thickly settled. It now supports a scanty population of lumbermen and very poor farmers, who cultivate little patches along the creek bottoms. The larger streams are bordered by narrow tracts of good soil where there are some large cotton plantations. This part of the State is not a new country, and except on the opening of the lumber industry by the building of railroads, it has had no growth in recent years. Something might be done with fruit culture—a few peach orchards at Palestine have proved remarkably profitable, their product bringing high prices in the St. Louis market; but the population lacks enterprise to develop any new branch of industry.

West of the pine barrens is a broad belt of rich, black, rolling prairie country, stretching from the Red River southward almost to the Gulf, and having an average width of about 200 miles. This region may be roughly compared in area to the State of Illinois. It contains some scrub-oak forests, where the soil is poor, but fully nine-tenths of the surface is first-rate land, as good as the best prairie land in the Northwest. Rich and inexhaustible as is the soil, however, this section shows little tendency toward dense settlement. The northern portion is being subdivided into small farms, and is filling up with a good, industrious white population, but the central and southern portions naturally run to large cotton plantations. Cotton is the best crop in this whole region. Central Texas is the best cotton country in the south, and is now producing one-sixth of the whole cotton crop of the United States. It is not nearly as good a corn country as Illinois and Kentucky; and for the production of wheat, no part of it can compare with Minnesota, Iowa, and Kansas. Root crops do not succeed, the tubers being large, coarse, and watery. Some fruits do tolerably well, particularly peaches and pears, but little attention is given to raising them. Apples are brought from the north.

Further west is a broad belt of hilly or rolling country, consisting of prairies and post-oak or black-jack openings, that is too dry for agriculture, but is well adapted for grazing. This is the great cattle region. It stretches from the Red River to the Rio Grande and the Gulf. Some portions of it may eventually be cultivated, if the rain-fall should increase by climatic changes which are said to be going on along the eastern border of the whole arid region from Montana down to Mexico, but nine-tenths of its surface will always be devoted to pasturage, and will consequently support only a scanty population of herdsmen. Still further west is an immense arid region, comprising about three-fifths of the whole surface of the State. Some of it is valuable for grazing; a little, lying close to streams, can be cultivated by irrigation. A great deal is absolute desert, growing nothing but cactus and chaparral. Veins of copper and iron have been discovered in the mountainous districts, and when they are opened, as they will be when the Texas Pacific Railroad is completed to the Rio Grande, considerable population will be brought in. With all the resources of mining, agriculture by irrigation, and grazing possessed by this immense region, its population will, however, always be inconsiderable.

As a whole the State is regarded as unlikely ever to have a population greater than Ohio. A moderately dense farming population in the center, flanked by a sparse population in the east and a still sparser one in the west, grading off to a region with no inhabitants worth mentioning, is all Texas can look forward to.

Bank of England Notes.

The financial editor of the Philadelphia *Ledger* states, on the authority of official report, that the notes of the Bank of England are made from pure white linen cuttings, never from rags that have been worn. They have been manufactured for nearly two hundred years by the same family, the Portals, Protestant refugees. So carefully is the paper prepared that even the number of dips into the pulp made by each workman is registered on a dial by machinery, and the sheets are carefully counted and booked to each person through whose hands they pass. The printing is done by a most curious process in Mr. Coe's department within the bank building. There is an elaborate arrangement for securing that no note shall be exactly like any other in existence. Consequently there never was a duplicate of a Bank of England note except by forgery. According to the *City Press* the stock of paid notes of seven years is about 94,000,000 in number and they fill 18,000 boxes, which, if placed side by side, would reach three miles. The notes placed in a pile would be eight miles high; or if joined end to end would form a ribbon 15,000 miles long; their superficial extent is more than that of Hyde Park; their original value was over $15,000,000,000, and their weight over one hundred and twelve tons.

A NEW OPTICAL DELUSION.

Mr. Sylvanus P. Thompson, Professor of Physics at University College, Bristol, England, presented a very peculiar optical delusion at the last meeting of the Société Française. Upon examining the discovery of Mr. Thompson it will be seen that it consists of two distinct phenomena, verified by the annexed engravings.

The first stroboscopic circle consists of a series of concentric rings about one twentieth of an inch in width and about the same distance apart (Fig. 1). It is not positively necessary to adhere to these dimensions, for the same can be varied in size in proportion to the audience that is to view the experiments. If the illustration is moved by the hand in a small circle without rotating it, or if it is given the

FIG. 1.

same motion that is required to rinse out a pail, the circle will revolve around its center in the same direction that the drawing moves, and will complete a revolution as the drawing completes its circular motion.

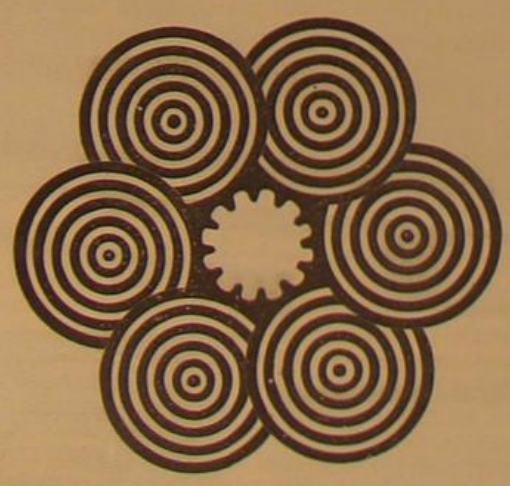
For the second experiment a black circle is drawn, the interior of which is provided with a certain number of equidistant teeth (Fig. 2). The drawing being moved in the same manner as above described, the toothed circle will also revolve, but in the contrary direction.

FIG. 2.

The movements are especially interesting and entertaining when the figures are combined as shown in Fig. 3.

The same result is obtained with other concentric curves as well as with circles. By means of a photographic transparency Mr. Thompson was enabled to throw the figure on a screen on a very large scale. The glass plate being moved as before described, caused the figures on the screen to rotate. In this case, also, each circle appeared to rotate around its own center.

FIG. 3.



No explanation can as yet be given for these curious and interesting facts. Mr. Thompson does not believe the property of the retina to retain images for a certain time can account for this, and we are of the same opinion. Without intending to produce a new theory, Mr. Thompson thinks it best to compare this with some other well known phenomena, from which a new property may be attributed to the eye.

Brewster and Adams have described phenomena which are equally curious and are analogous to those of Mr. Thompson. They say the eye has the property of "compensation;" that is, if an object or a movement acts upon the eye for a certain time, a sensation complementary to the real action is produced. For instance, if we gaze at the rocks in a cascade and then at the cascade alternately, for a short time, the rocks will appear to move upward; or if we examine a stream below a cascade or waterfall, we will notice that the water flows much faster in the middle than at the sides of the stream. If we look at the middle and sides alternately the water will seem to flow backward.

These are a few of the phenomena that might be compared with those of Mr. Thompson, and which may arise from a common cause.

New Curiosities at the Smithsonian Institution.

A number of interesting specimens have, according to the Washington *Republican*, been recently added to the ethnological division of the Smithsonian Institution, among the most important of which are the following: A carved figure of a man's head, made from iron pyrites. It was found in Southwestern Mexico, and is supposed to have been an amulet, belonging to a great cazique, during the reign of the Aztecs. The work is highly polished, and presents a beautiful green and gold appearance. The eyes, nose, and teeth are brought out in bold relief, the former being composed of opals, which gleam like sparks of fire. The features are of the most pronounced Aztec type. In a large cave, about two miles from Silver City, Col., there were found some specimens of ancient remains, which are supposed to have been made by the Pueblo people. They consist of arrows, which still have remnants of their sinew shaftings, rain gods, and fetiches in carved and painted wood, tribal totems, and bundles of straw bows and arrows. All these articles are in a remarkable state of preservation, and it is thought that the cave in which they were found was formerly used as a burial place. The entire collection was presented to the Smithsonian, and will be placed on exhibition in a few days. Probably the most important relic that has been added to the museum in a long time is an obsidian vase, made from itztle, or volcanic glass. The workmanship on this vase is perfect, not a flaw having been discovered in the work. It represents a monkey in a sitting posture, with his head bent slightly forward. In the back and shoulders are apertures in which articles for ornament were placed. The carving is exquisite, and shows what perfect lapidaries the semi-civilized people who made it were, as the material of which it is composed is considered the hardest to work in, owing to its brittleness. This relic was also found in the Aztec country of Southwestern Mexico.

On the first floor, in the main hall, stands another curiosity which deserves particular attention. It is a large case, 9 feet by 4½ wide, containing numerous species of snakes, all of which are alive. Through the top, which is covered with glass, the movements of the reptiles can be plainly seen. The cage is filled with stumps of trees, grasses, ferns, and sand, and an artificial lake keeps the ground continually moist. There the reptiles have full sway, and, although somewhat repulsive, their cage is always surrounded with curiosity lovers. Some of the varieties are: coachwhips, indigo or gophers, chicken, black and garter snakes. A king snake is also among the collection, and has to be carefully watched, as he is fond of hugging his companions, and very frequently kills them, after which they make a meal for his highness. This snake is the mortal foe of the rattlesnake, who always comes out second best in their fights.

The work on the annex to the Smithsonian, in which are to be stored the Centennial exhibits and contributions from foreign governments to the United States, progresses rapidly, a large force of workmen being employed. The brick work on the lower story is nearly completed, and the beams for the floors will be placed in position during this week. Nearly two and a quarter acres will be covered by the new building, and when completed it will be a great ornament. A visit to the Smithsonian will well repay all lovers of interesting and curious relics.

Hygienic Effects of Sea and Mountain Air.

This is the time of year when many families leave their homes in the city, for the more invigorating mountain or seashore air, anxious to go where they may derive the most health giving benefit, and still are undecided which way they will go, to the mountains or seaside. To such persons the following extract from a recent work by Dr. C. Alberto, a celebrated Italian physician, may be an aid in helping them to decide:

"The marine air," says the learned doctor, "produces the same benefit as that of the mountain, but each has a different *modus efficiendi;* the former acts more forcibly and energetically on the constitution which retains some robustness and internal resources to profit by it, while the second acts more gently, with slower efficacy, being thereby more suitable to the weaker and less excitable organizations. From this important distinction, the conscientious physician, who takes the safety of his patient much to heart, ought to be able to discriminate whether the alpine or the marine atmosphere is the better suited to the case he has before him."

MM. BANCEL and Husson have communicated to the Academy of Sciences observations on the phosphorescence of the flesh of the lobster. They consider it due to a fermentation in which carbo- and phospho-hydrogens are liberated, and which is destroyed by putrefaction, just as the bacteria of carbuncle are destroyed by the vibriones of putrefaction

NOVEL USE OF ETHER.—A prisoner, named Uhlmann, recently barricaded himself in his cell at Vevey, Switzerland, and defied the gendarmes to take him before the judges. It was not thought advisable to shoot him, and the court would not wait till he was starved into surrender, so ether was thrown into the cell until he became sufficiently stupefied to be harmless.

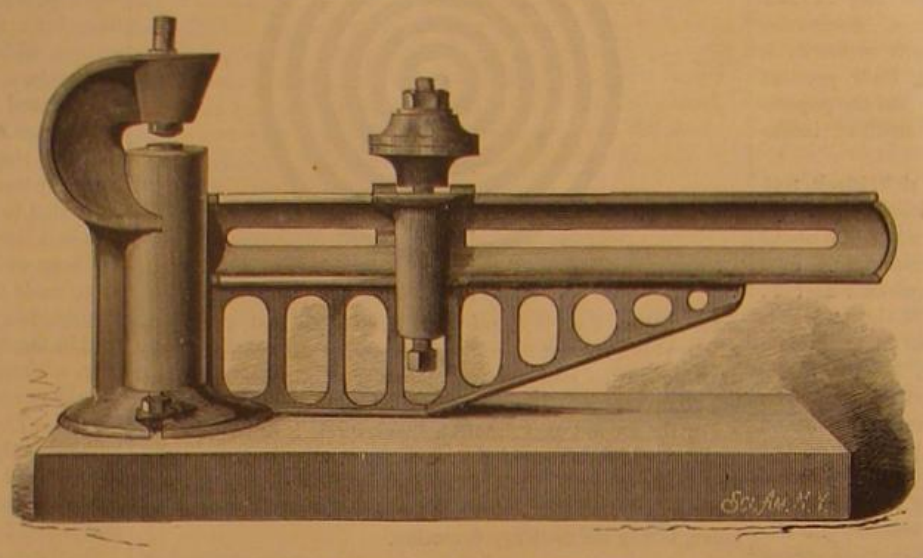
IMPROVEMENT IN SAW GUMMING.

The work of gumming a saw properly and quickly without injury to the saw plate requires the use of appliances perfectly adapted to the purpose. Improvements in this class of mechanism, which facilitate the process and give more satisfactory results, will be examined with interest by those engaged in this branch of industry.

The leading peculiarity of the saw gummer, represented in the accompanying engraving, is an arrangement by which the punch, when struck by the hammer, is driven entirely through the perforation in the saw plate and out of the machine This is effected by means of a flaring hole in the die and also in the die support In this way the liability of springing the plate, by backing out the tightly fitting punch from the perforation, is avoided.

In connection with the punch, there is a tubular guide, with a vertical bore corresponding to it so that the punch is accurately guided, and supported at all points against lateral deflection The different punches are accompanied by sleeves of uniform external diameter, but accurately fitted internally to its punch. The saw is held firmly on the arm by suitable devices which slide on the horizontal arm, and are easily adjusted to different diameters.

The gummer is the invention of Mr. Wm. Tucker, East Brookfield, Mass. Mr. C. A. Sibley, of same place, is general agent, to whom all communications should be addressed.



TUCKER'S SAW GUMMER.

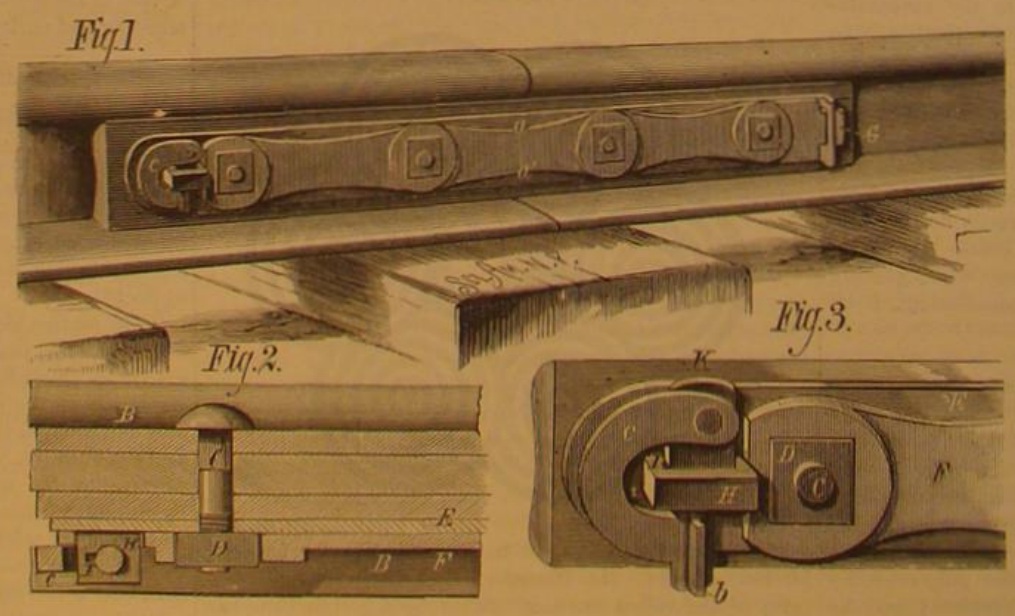
A New Great Gun.

Trial was lately made at Woolwich, England, of the new 100 ton gun. The shot with which it was loaded weighed 2,010 lb. The gun was fitted with a gas check. Its diameter was very little less than that of the bore, which has a caliber of 17¾ inches, increasing to 19¾ inches in the powder chamber. The thickness of the metal at the muzzle is about 5 inches only, but at the breech end the chamber is surrounded with a wall of iron 2 feet 5 inches through, making the maximum diameter 6 feet 6 inches. The gun is 36 feet in length, of which the bore occupies 33 feet, and the total length of gun and carriage when run out for firing is 44 feet. The cartridge, consisting of 440 lb. of cube powder, strongly bound in canvas and stiffened by wooden bands, was rammed home, occupying 5 feet of the bore, and then followed the projectile, the length of which was 2 feet 8 inches. The gun was fired by electricity from the instrument room, and recoiled a considerable way up the platform, but suffered no damage either to itself or the carriage. The screens registered a velocity of 1,590 feet per second, but the projectile was found to have broken up, which may have affected the result.

IMPROVED NUT LOCK.

The annexed engraving represents an improved nut lock recently patented by Mr. Moses H. Grubb, of Vincent, Pa. It is designed especially for connecting the rails of railroads, but it may be used for other purposes. The engraving represents a rail joint formed by the meeting of two rails. The usual fishplates, B, are placed upon opposite sides of the rails and fastened by the bolts, C. The lock is formed of two plates of metal, E and F, which are hinged together at G. Before the nuts are placed on the bolts the part E of the lock is put in place, the nuts are then turned on. The part F is then made to engage the opposite part of the hinge at G, and is placed parallel with the plate, E, so that the holes formed in it receive the nuts on the bolts. At one end of the plate, E, there is a staple which projects through a slot in the plate, F, and receives the key, K, which holds the plate, F, securely in place. The key, K, has a feather which passes through a slot in the staple and is turned to prevent it from jarring loose; it is looped and swiveled handle is then turned down against its lower end, preventing it from turning or being accidentally thrown out of place.

In some cases the inventor employs a ring like that shown in Fig. 4, instead of the key. The advantage of locking or unlocking all of the nuts at once will be apparent, and it will also be admitted that this form of nut lock has the advantages of simplicity and security.



GRUBB'S NUT LOCK.

A Meteorite in Iowa.

Professor S. F. Peckham says, in a letter to the *American Journal of Science*, dated Minneapolis, May 29, 1879: I have the pleasure of informing you that, on the 10th of May, a meteor exploded and fell in full daylight at 5 P.M., at Esterville, Emmet County, Iowa. One of the fragments, weighing about 500 lb., fell on railroad land and was dug up from a depth of fourteen feet in a stiff clay soil. Another smaller portion, weighing about 170 lb., fell on the farm of A. A. Pingrey at a distance of two miles from the first. Many smaller pieces of a few ounces or pounds weight, were scattered in the vicinity. The smaller mass fell upon a dry knoll and penetrated the earth vertically to a depth of 4½ feet. The fall was accompanied by a noise described as a continuous roll of thunder accompanied by a crackling sound

Through the efforts of Professor E. J. Thompson of our Faculty the smaller mass has been obtained for the university cabinet. It is irregularly square in form, about 15x18 inches and of an average thickness of 6 inches.

A preliminary chemical examination shows the metallic portion to consist of an alloy of iron, nickel, and tin. Full half the mass consists of stony matter, which appears in dark green crystalline masses embedded in a light gray matrix. When the whole is powdered, a violent reaction ensues on the addition of hydrochloric acid, which is increased on boiling. The boiling acid appeared to dissolve all but the gray matrix, abundance of iron passing into solution. Some of the crystalline masses are two inches in thickness, and exhibit distinct monocliuic cleavage. Under the microscope in thin sections, olivine, and a triclinic feldspar appear to be embedded in a matrix of pyroxene. This work is in the hands of Professor C. W. Hall of the University, who intends to make a very thorough investigation of the optical properties of the minerals and matrix. The chemical examination was first attempted upon a very small quantity of material, but, now that we have an ample quantity, a complete analysis of the several minerals and the alloy will be made. A small piece of the metal polished and etched exhibited the Widmanstättian figures very finely.

Fig. 4.—NUT LOCK.

The larger mass is still in the hands of those who dug it from the ground, although their ownership is contested by one who claims to have contracted for the land on which it fell. Their ideas regarding its value enlarge daily, the latest announcement being that they held it for $5,000.

It seems now fairly established, says the *Chemical Review*, (on insufficient evidence, we are inclined to think), that *Botrytis infestans*, the parasite which occasions the potato disease, is the same which gives rise to diphtheria.

A Chinese Tile Factory.

A correspondent of the *Builder*, in a recent account of his visit to one of the mining districts of China, thus describes the Imperial Tile Manufactory at Lien-li-ku, about fifteen miles west of Pekin: In this factory all the yellow tiles and bricks required for imperial buildings are made, as also large numbers of green, blue, and other colored tiles for various ornamental purposes. The material used is a hard blue shale, nearly as hard as slate, ground to powder by granite rollers, thirty or forty feet in diameter. The powder is then stored in heaps and taken to the works as required. For ordinary work the powder is mixed with a proper proportion of water and moulded into large bricks, which are laid out to dry for some hours, after which they are dealt with by the modelers. When bricks are to have a moulding on them, say for coping a wall, the plan of operation is as follows: Two pieces of wood, each cut to the shape of the moulding, are placed upright on a slab. The clay brick is placed between them, and two men run the mouldings roughly along with chisels. They then apply straight edges to test the accuracy of their work, and finally rub the edges with moulds somewhat in the same way as plasterers make mouldings at home. The brick is then passed to a third man, who cuts any necessary holes in it, and to the fourth, who trims it off and repairs any defect. The ornamental tiles and bricks, representing fabulous animals, etc., are first roughly moulded, and afterwards finished off with tools exactly similar to those used for modeling in clay in Europe. Some of this work has some pretensions to artistic merit. All the bricks and tiles are baked in ovens, and then, after having the glaze put on, are baked a second time. All the work done at this manufactory appears to be first rate, and the number of people employed when they are busy is about 500.

Breadth of the United States.

Few people are aware that the proud boast of Englishmen that the sun never sets on the British Empire is equally applicable to the United States. Instead of being the western limit of the Union, San Francisco is only about midway between the furthest Aleutian Isle, acquired by our purchase of Alaska, and Eastport, Me. Our territory extends through 197° of longitude, or 17° more than half way round the globe. The *Rocky Mountain Presbyterian*, in commenting on this fact, says: "When the sun is giving its good-night kiss to our westernmost isle, on the confines of Behring's Sea, it is already flooding the fields and forests of Maine with its morning light, and in the eastern part of that State is more than an hour high. At the very moment when the Aleutian fisherman, warned by the approaching shades of night, is pulling his canoe toward the shore, the wood-chopper of Maine is beginning to make the forest echo with the stirring music of his ax."

The Brooklyn Navy Yard.

The chief naval depot of the United States is widely known as the Brooklyn Navy Yard; but few have any adequate idea of its importance or the many objects of interest to be seen there. It is one of the most delightful as well as instructive spots in the vicinity of New York. Its huge workshops, its great dry dock, built at a cost of over $2,000,000, and the enormous amount of machinery and material attract attention; while the ships lying at the wharves repairing, or anchored off the yard in commission, and the enormous guns on the ordnance wharf, give one an idea of the means by which Fort Fisher, New Orleans, and Mobile were taken. The museum in the building in which the commandant's office is situated contains curiosities from every part of the world where our vessels have cruised and our flag has floated, with historical relics of the Navy, and of itself is well worth a visit.

A Deaf-Mute Cow.

A Russian veterinary surgeon reports that a cow, twelve years old, of Algava breed, belonging to a Russian nobleman, never showed signs of hearing, nor bellowed. Seeing the other cattle bellow, she tried to imitate them by stretching her neck and head, and opening her mouth, but she could not produce any sound. The sense of vision of this cow was found to be unusually well developed.

FIREPROOF paper may be made, according to the *Pharmaceutische Zeitung*, from a pulp consisting one part of vegetable fiber, two parts of asbestos, 1-10 part of borax, 1-5 part of alum. The ink is made from 85 parts of graphite, 0·8 part of copal varnish, 7·5 parts of copperas, 30 parts of tincture of nutgalls, and a sufficient quantity of indigo carmine.

THE NARICA.

The narica, or quasje, sometimes called the brown coaiti, found in Southern America, is represented in the accompanying engraving. It is a very lively and amusing animal, and possessed of singular powers of nose and limb. Distrustful by nature it will very seldom venture to approach a strange object until it has endeavored to ascertain the nature of the unknown by means of its sense of smell, which is marvelously acute. It seems to be as inquisitive as it is distrustful, and will not be satisfied until it has, by gradual degrees, approached and examined anything which it does not quite understand.

One of these animals, which was kept in confinement for some time, was extremely tame to those who understood the peculiarity of its temper, but was irresistibly morose and sulky with those who would not respect its customs. Any stranger who ventured to approach the animal was repelled with open mouth and threatening cries, unless he propitiated the creature by offering it some delicacy of which it was fond. It would then lay aside its suspicious demeanor and become suddenly confidential, returning the caresses of its newly found friend, and searching eagerly for a further supply of food. It proved to be quite a useful inhabitant of the house when it was domesticated, for it was accustomed to roam over the premises in chase of mice and rats, which it pursued unrelentingly through house, hay loft, and stables. It was also accustomed to pay visits into the garden, where it spent much of its time in catching snails and slugs, and in digging after worms—a task for which its powerful claws are eminently calculated to adapt it. When it was supplied with meat, it was accustomed to tear its food to pieces with its claws before carrying it to the mouth; and in the act of feeding, it always supplied itself by hitching one of its claws in the morsel which it was about to carry to its mouth. It struck up a friendship with a little dog, and would permit its four-footed friend to occupy the same bed, but would never endure the society of any other animal.

The color of this creature is extremely variable, as it seldom or never happens that two specimens are marked in precisely the same manner. In some individuals the dark portion of the fur is brown, mottled with black; but the general hue of the fur is a brown, tinted more or less with chestnut, and occasionally being so pale as to be of a warm fawn color. The under surface of the body and the internal face of the limbs are of a gray hue, tinged with yellow or orange, according to the individual, and extending, in some cases, to the sides of the neck and the lower jaw. The coat of the narica is rather thick, and the texture of the fur is harsh; it does not lie closely to the body, but presents a rather shaggy and rough aspect.

NARICA, OR QUASJE.—*Nasua Narica.*

Uses of the Hop-Plant.

In the *Wiener Landwirthschaftliche Zeitung*, Dr. Emil Pott calls attention to the many useful purposes for which various parts of the hop plant may be applied, over and above the mere production of the umbels employed in brewing, to which alone the growers' care appears to be given at the present time. To begin with, the tendrils furnish a good vegetable wax, and a juice from which a reddish-brown coloring matter can be extracted; further, their ashes are greatly valued in the manufacture of certain Bohemian glass wares. Of still greater importance is the fact that a pulp for paper-making can be prepared from them, and though the goods thus manufactured cannot be satisfactorily bleached, very serviceable unbleached papers and cardboards are got from this raw material. The fibers can also be used in the manufacture of textile fabrics. Experiments in this direction extend to a far-back date, and in Sweden yarn and linen making from hop fibers has long been an established branch of industry, which is constantly increasing in importance and extent. The separation of the fibers has hitherto presented considerable difficulties, but these appear to be effectually overcome by the process recently devised by Dr. Weiss of Neutomischel, of steeping them for 24 hours in cold water containing 5 per cent of sulphuric acid, or for 20 minutes in boiling water to which 3 per cent of the acid has been added. Other mineral acids, such, for instance, as muriatic, may be similarly employed. Nordlinger, of Stuttgart, also has patented a plan of rendering the fibers very flexible and tractable. This he effects by boiling them in closed vessels with soap and soda, and after thorough washing, treating them with diluted acetic acid, and then again washing in cold water. Another use to which hop twigs may be put is that of basket and wicker work. Lastly, it must not be forgotten that the young shoots form a very palatable vegetable, not inferior to asparagus in delicacy of flavor, while the leaves, and the spent hops themselves, supply an excellent food for live stock generally, and especially for sheep. Dr. Pott contends that by due recognition of some or all of these numerous virtues of the plant, growers can always repay the cost of cultivation without reference to the hop itself, which of course will remain the chief object in view, and can render themselves more independent of the great fluctuations in the price of the latter to which they are at present subjected.

Fossil Footprints in Anthracite.

At the last meeting of the Academy of Natural Sciences, Dr. Joseph Leidy read a letter from Mr. W. Lorenz, Chief Engineer of the Philadelphia and Reading Railroad Company, referring to a fossil specimen presented to the Academy by Mr. William D. H. Mason, of Williamstown, Pa. The specimen is a mass of coal shale with footprints, and was discovered by the donor at the Ellangowan colliery, in the Mahanoy coal field. Mr. Lorenz remarks that it is of special interest as having been the first specimen of the kind found in the anthracite coal field. The specimen is an irregular slab, upwards of a foot long, and less than half the breadth. The upper surface is obscurely ripple marked longitudinally, and is crossed in a slant by seven tracks, which are in pairs, except one, in advance on the right. The four tracks on the right occupy a line of six inches, and are about an inch and a half apart from those on the left. The more perfect impressions exhibit four widely-divergent toes, successively increasing in length from within outwardly, excepting that the fourth toe is slightly shorter than the third. The expanse on the tracks is about one inch. The impressions probably pertain to some salamandroid animal; and as it had been found useful to refer to fossil foot tracks as the representatives of the animal by which they were made under distinct names, he would, in accordance with a suggestion from Mr. Lorenz, name the form represented the Ellangowan anthracis.

Parrot Speech.

The interesting sketch of the "History of My Parrot," which Dr. Wilks contributes to the current number of the *Journal of Mental Science*, deserves a passing notice. The comparative study of the facts of intercommunication among men and among animals necessitates the admission that animals possess language; and the mechanism and apparatus for articulate speech, in those animals which possess it, do not differ from those of man. A bird learns to speak by imitation, through the organs of hearing, and in a manner very similar to that in which children learn words and sentences, and the bird speaks on special occasions in consequence of some association or suggestion, "the usual provocative for set speeches at all periods of human life." A new expression, after having been repeatedly uttered before the parrot, is practiced by it spontaneously, indefatigably working at the sentence by itself. At first it is only able to get out the first word or two, then more and more, until it has the power of uttering the whole. In just the same way a child will learn a French sentence. A sentence is soon lost by the parrot if not frequently uttered, and the last words are lost first; the first words—those most readily acquired—are lost last. Speech of the bird, on any given occasion, is due to suggestion—the presence of the person or object with which the words were first associated. Of this Dr. Wilks gives several striking instances; as, "half-past two" whenever the coachman comes for orders, "go to sleep" when approached after dark, "give me a bit" when dinner appears, and "cheese" when the cheese is put upon the table, a sound like water being poured out whenever a jug of water is brought in. Thus the bird associates words or sounds with objects, and, where the right names have been taught it, may be said to know their names; more, the bird invents names, making a particular sound, which had never been taught, whenever nuts were brought upon the table. The sight of a cat makes the parrot say "mew," as the sight of a train makes a child say "puff, puff."

Dr. Wilks concludes by remarking that the differences between animals and children are much slighter than are the explanations, which, on the assumption of instinct in the one case and reason in the other, we put upon them, and suggests that the chief difference between man and animals is to be found in smallness of knowledge of the fine arts possessed by the latter.—*Lancet.*

A Baby Sea Lion.

A sea lion, sent by rail from San Francisco to Central Park, New York city, in the latter part of June, gave birth to a cub on the way. By the 4th of July the little fellow had attained a length of about two feet, and weighed fifteen pounds. The mother did not seem very affectionate, and was rather disinclined to suckle her offspring, at least in the day time. The superintendent said, however, that the nursing probably took place during the night. As the swimming powers of the little fellow were not fully developed, it was proposed to draw the water out of the tank, so that the baby could suck his rather unnatural mother. When the latter is approached she shows anger and makes for the intruder, barking and showing her ugly fangs. Last year, in the Brighton (England) aquarium a sea lion was born, and one also in the Cincinnati Zoological Garden. In the latter case the mother died soon after the birth of her cub, and the little sea lion died also.

THE height of impudence, the *Chemical Review* thinks, is the man who seeks to abrogate patents calling himself a patent law reformer!

Intellect in Brutes.

During my residence in Cornwall, says a correspondent of *Nature*, I had a most intelligent and faithful dog for fifteen years. I had him when a month old. His mother was a beautiful liver-colored spaniel, rather large; his father a black Newfoundland; my dog took after him in color and shape.

In 1843 a young and self-taught artist asked me to allow him to paint my likeness in oil colors, and I consented. His studio was in the next town, three miles distant, and as often as required I went over; I, however, did not take my dog with me. It was done in Kit-Cat size; and he succeeded so well in the likeness and artistic work, that when exhibited at the annual meeting of the Polytechnic Society at Falmouth, a medal was awarded to it, and, as well, it was "highly commended." Not only this, it brought him into notice and gained him lots of employment. The artist was so grateful for my attention that he presented me with the painting, and I still have it. When it was brought to my house, my old dog was present with the family at the "unveiling;" nothing was said to him nor invitation given him to notice it. We saw that his gaze was steadily fixed on it, and he soon became excited, and whined, and tried to lick and scratch it, and was so much taken up with it that we—although so well knowing his intelligence—were all quite surprised; in fact, could scarcely believe that he should know it was my likeness. We, however, had sufficient proof after it was hung up in our parlor; the room was rather low, and under the picture stood a chair; the door was left open without any thought about the dog; he, however, soon found it out, when a low whining and scratching was heard by the family, and on search being made, he was in the chair trying to get at the picture. After this I put it up higher, so as to prevent it being injured by him. This did not prevent him from paying attention to it, for whenever I was away from home, whether for a short or long time—sometimes for several days—he spent most of his time gazing on it, and as it appeared to give him comfort the door was always left open for him. When I was long away he made a low whining, as if to draw attention to it. This lasted for years, in fact as long as he lived, and was able to see it. I have never kept a dog since he died, I dare not—his loss so much affected me. I might tell of many of his wonderful actions; he could do most of such things as are related of other dogs. I am now only anxious to notice this recognition of my likeness, from never having heard of another such fact being recorded of any other dog.

Another correspondent says: During the recent severe winter a friend was in the habit of throwing crumbs for birds outside his bedroom window. The family have a fine black cat, which, seeing that the crumbs brought birds, would occasionally hide herself behind some shrubs, and when the birds came for their breakfast, would pounce out upon them with varying success. The crumbs had been laid out as usual, one afternoon, but left untouched, and during the night a slight fall of snow occurred. On looking out next morning my friend observed puss busily engaged scratching away the snow. Curious to learn what she sought, he waited, and saw her take the crumbs up from the cleared space and lay them one after another on the snow. After doing this she retired behind the shrubs to wait further developments. This was repeated on two other occasions, until finally they were obliged to give up putting out crumbs, as Puss showed herself such a fatal enemy to the birds.

Immunity of Rodents to Solanaceous Poisons.

According to the *Lancet*, Prof. Haeckel, of Marseilles, has investigated the action of the alkaloids of solanaceous plants upon the rodents, with a view of ascertaining the conditions which determine the remarkable immunity to the poisonous effects of such alkaloids presented by these animals. The fact of the immunity has long been known in the case of the rabbit and guinea-pig, especially with regard to belladonna, and Prof. Haeckel has shown that it is also possessed by several species of rats, and exists not only for belladonna, but also for the alkaloids of black and white hellebore, and of stramonium. The results which he has obtained show that the rabbit and guinea-pig may be fed for a long time with the leaves, and even with the roots, of the poisonous solanaceæ without detriment, and that the rat bears very well the addition of these plants to its ordinary food. The immunity of the rabbit and guinea-pig is so great that Prof. Haeckel was able to bring up several generations on this food, giving them, during the summer, the leaves exclusively, and during the winter mixing dried powdered leaves and roots with equal parts of other food. He adopts the views of Bouchardat, enunciated long ago by Chatin with respect to arsenic, that the effect of the poisons lessens in proportion as animals recede in organization from man. He believes, from further experiments, that the alkaloids of these poisons are destroyed as fast as they enter the blood. M. Colin, in the discussion on the report, was inclined to attribute the immunity of the rodents rather to the small solubility of the vegetable alkaloids, which need, for absorption, transformation into a soluble compound by the action of the gastric juice. In these animals the food rests a very short time in the stomach, and passes with great rapidity into the intestine, and the alkaloids pass away by the bowel almost unchanged. M. Chatin, however, doubted this explanation, on the ground that the alkaloids of the vegetables, although in themselves insoluble, are commonly so combined in the plant that they will dissolve readily. He believed that the immunity of the rodents to these poisons depends on their peculiar organization, and suggested, as an important subject for investigation, the precise point in the animal series at which the immunity exists.

Traveling Rocks.

Lord Dunraven, in an interesting article in the *Nineteenth Century* about Canada, and his experiences in moose hunting, relates the following:

A strange scene, which came within my observation last year, says his Lordship, completely puzzled me at the time, and has done so ever since. I was in Nova Scotia in the fall, when one day my Indian told me that in a lake close by all the rocks were moving out of the water—a circumstance which I thought not a little strange. However, I went to look at the unheard-of spectacle, and, sure enough, there were the rocks apparently all moving out of the water on to dry land. The lake is of considerable extent, but shallow and full of great masses of rock. Many of these masses appear to have traveled right out of the lake, and are now high and dry some fifteen yards above the margin of the water. They have plowed deep and regularly defined channels for themselves. You may see them of all sizes, from blocks of, say, roughly speaking, six or eight feet in diameter, down to stones which a man could lift. Moreover, you find them in various stages of progress, some a hundred yards or more from shore and apparently just beginning to move; others, half-way to their destination, and others again, as I have said, high and dry above the water. In all cases there is a distinct groove or furrow, which the rock has clearly plowed for itself. I noticed one particularly good specimen, an enormous block which lay some yards above high-water mark. The earth and stones were heaped up in front of it to a height of three or four feet. There was a deep furrow, the exact breadth of the block, leading down directly from it into the lake, and extending till it was hidden from my sight by the depth of the water. Loose stones and pebbles were piled up on each side of this groove in a regular, clearly defined line. I thought at first that from some cause or other the smaller stones, pebbles, and sand had been dragged down from above, and consequently had piled themselves up in front of all the large rocks too heavy to be removed, and had left a vacant space or furrow behind the rocks. But if that had been the case the drift of moving material would of course have joined together again in the space of a few yards behind the fixed rocks. On the contrary, these grooves or furrows remained the same width throughout their entire length, and, have, I think, undoubtedly been caused by the rock forcing its way up through the loose shingle and stones which compose the bed of the lake. What power has set these rocks in motion it is difficult to decide. The action of ice is the only thing that might explain it; but how ice could exert itself in that special manner, and why, if ice is the cause of it, it does not manifest that tendency in every portion of the world, I do not pretend to comprehend.

My attention having been once directed to this, I noticed it in various other lakes. Unfortunately my Indian only mentioned it to me a day or two before I left the woods. I had not time, therefore, to make any investigation into the subject. Possibly some of my readers may be able to account for this, to me, extraordinary phenomenon.

[Any one familiar with ice action in our northern lakes and rivers, will have no great difficulty in accounting for the rock movement described. It takes place in various ways, depending on the depth of water, the breadth of the pond or river, the force of the wind and waves, variations in water level, and other conditions. Just which of these causes, alone or combined, operated in Lord Dunraven's Nova Scotia lake it is impossible to say from the description he gives. Probably the last named, and the wedging of the ice-masses against the larger rocks, when rising and falling with the water, had most to do in moving the bowlders on shore. —ED.]

Machine-made Hammered Horsenails.

According to the *Ironmonger*, another of our labor-saving machines is about to be adopted in England. The Stirchley Company will now, the writer says, become the sole manufacturers in England of the Sheridan horsenails. These are the product of a recent American device of indubitable merit. They are hammered hot from head to point by a succession of blows similar to those made by hand. To manufacture the nail in America a joint-stock company was recently started at Cleveland, Ohio, with a capital of $50,000, and having Mr. Henry B. Sheridan, C. E., the inventor of the machine, for its managing director, or president. The machines are capable of turning out an average of 500 lb. a day, and any pattern which may be required can be shaped. Two forging machines have been brought over from Cleveland, and under Mr. Sheridan's personal supervision they have been erected at the Stirchley Works, where I have just seen one of them in operation. It was served by an American nailer, who, taking his Swedish iron rods hot from a small portable furnace and thrusting them two at a time into the machine, which weighs about 1½ tons, and runs at 1,000 revolutions a minute, quickly shows them dropping out in the blank, properly bent, and shaped in a style surpassing any hand-made horsenail I ever saw. From the forging machine the blanks are taken, when cold, to the finishing machine, which draws the blank out, compresses it, and points the nail ready to drive. This machine weighs about 18 cwt., and finishes, with two boys to feed it, 500 lb. a day.

MISCELLANEOUS INVENTIONS.

Messrs. Charles Holzner and John Winstandley, of Louisville, Ky., have patented an improvement in coal-hods, which consists in forming the lower edge of the body portion of the hod with an outwardly-flared flange, and fastening the hoop, foot, or base-ring thereto by contracting it upon said flange and riveting the ends of the hoop together in such contracted position upon the flange. It also consists in combining with the flanged body portion and base-ring a wooden bottom having a metal *lining* and a tapering or beveled edge, which bottom is forced inside the base-ring up into the lower edge of the hod, and clamps the flange at the bottom of the body portion between its beveled edge and the base-ring to make a compact and secure connection. We call attention to an advertisement in another column relating to the invention.

An adjustable "scoop-board," adapted for attachment to the tail of the wagon, for use in husking or hauling corn, and for other purposes, has been patented by Messrs. Thos. F. McGuire and John Ditto, of Oxford, Ia. It consists in the combination, with the hinged scoop-board, of a semi-circle-brace, having apertures for a clamping pin or screw, that passes through a keeper.

Mr. Samuel T. Harrison, of San José, Cal., has patented an improvement in magazine fire-arms, which consists of a carrier having an intermittent vertical movement controlled by a lever connected with a finger on the guard, which receives the cartridge from the magazine, carries it to the breech of the piece, and when it is ejected into the breech, returns and locks the breech-block in place behind it. Also, a breech-block, in which is sheathed the needle, connected by a link with the finger of the guard, from which it receives an intermittent reciprocatory movement, serving to drive the cartridge from the carrier into the breech.

A paper bag, provided with a tie-cord secured within a fold on that edge of the blank which forms one of the seam-laps, has been patented by Mr. Charles Newman, of Alton, Ill.

Mr. Edwin D. Finch, of Stanton, Mich., has devised an improved mechanical telephone, in which the vibrations of a diaphragm are transmitted by a cord or wire to a receiving-diaphragm at a distance; and the invention consists in novel features, whereby the vibrations are concentrated upon the line, and false vibrations prevented; also, in means for adjusting the tension of the line and diaphragms, and relieving the diaphragms of tension when not in use.

Mr. Robert MacKellar, of Peekskill, N. Y., has invented an improvement in fire-grates for burning soft and hard coal. It is so constructed that the coal can be easily stirred and kept loose and free from ashes, so as to burn freely. It consists in the combination of the screw with a grate having a slot formed through its center, the screw forming the middle portion of the grate.

A hanger, having arms or yokes formed of spiral springs, united by a central piece of wire formed into a loop, by which it is hung from a hook, has been patented by Mr. Frederick H. Zahn, of Springfield, Ill.

An improvement in apparatus for disintegrating grain and distilling spirits, patented by Mr. Edward Fox, of Brooklyn, N. Y., consists in combining, with the mash-tub and still, a steam-pipe, injector, mash-pipe, and pan, and in combining with the still a dome having a pipe leading to condenser, perforated trays, and gutters.

A lock adapted for securing both the upper and lower sash of the same window has been patented by Mr. George F. Knight, of Carroll, O. It consists in the combination of a detachable key having a nib, and a pivoted spring-actuated angular lever, having a lug to engage with a window-sash, and the apertured case inclosing the lever, so that when the key is turned in a certain position its nib will catch over the edge of the free end of the lever, and traction on the key will then tilt the lever, but when turned into another position will release the lever.

An improvement in that class of coffee-pots which are provided with an inner receptacle or strainer, has been patented by Mr. Thomas Keys, of Jacksonville, Ill. It consists in providing the inner receptacle or strainer of a coffee-pot with an inwardly-projecting flange or lip near its top.

Mr. David Smith, of Boston, Mass., has patented an improvement in urine-guards for water-closet seats. The guard is preferably made of glass or glazed earthenware, or other material which will not absorb moisture.

The Manufacture of Damascus Steel.

In a series of articles on mining and metallurgy at the Paris Exhibition is promulgated the following interesting data on the method of making Damascus steel sword blades at Zlatoust, in the Ural: The pig iron used in making the latter is a spiegel, with 8 per cent of manganese, which is partly converted into puddled steel and partly refined. The cast-steel ingots of about five pounds weight are made from selected qualities of puddled steel, 61 per cent of the crucible charge being hard, 23 per cent medium steel, 10·37 per cent refined pig iron, and 3·71 pure magnetic ore. The tilted bars are twice piled for shear steel, a layer of sulphide of antimony being placed between the different bars. The final pile is made of four square bars, about one-eighth of an inch in the side.

THE way to convert modern pottery into the antique is to boil the former in oil and bury it in wood ashes. One will be astonished to find how quickly the new article will become in appearance a veritable antique.

After Graduating—What?

The season of college commencements has just closed, and hundreds of young graduates, with their sheepskins in hand, are pondering, undecided, what profession to pursue.

Whither are all these talented and accomplished young gentlemen going? inquires the *Christian at Work*. What will they do? Where and how strike for success?

Although the professions of law, medicine, civil engineering—and, some may cynically add, the ministry also—are overcrowded already, and are driving multitudes at the point of starvation out of their ranks, yet the vast majority of these inexperienced and ambitious sheepskin carriers are persuaded that "there is always room at the top," and that each for himself is exactly the individual fitted by his Maker—and his Alma Mater, of course—to climb there, and with immense applause. Now it is well for society and mankind that there are so many ardent natures who thus challenge a trial in coveting the best gifts and highest places. Their aim is not to be ridiculed or despised. It is in the main noble and generous. Very rarely does the deliberate acquisition of mere "filthy lucre," or of the means of low and selfish gratification, consciously and avowedly enter into it. One says: "As a physician my object shall be unequaled skill in baffling disease and saving life;" another: "As a lawyer, I will work for the largest knowledge of legal principles and the attainment of commanding ability in settling differences between contentious dispositions;" and so each in turn is largely influenced, let it be granted, by the purest motives which can be marshaled at the threshold of his future calling, and which beckon him with winning voices to enter therein.

Against such allurements it may seem as ungracious as it will possibly prove vain to put two stern and needful inquiries.

First, admitting that the hero of commencement honors is not expected to be an angel acting with absolute unselfishness and unworldliness in the choice of his life-sphere, and admitting, therefore, that he has a certain right to calculate the chances of the success and the advancement of which, veil it as we will, *self* is the center and mainspring; it is nevertheless proper that he be required to make his calculation of chances with a cool head, with a rigid and unflinching investigation of his defective traits. The trick of translating a Latin ode, or of demonstrating that the three angles of a triangle are equal to two right angles, or of showing that Leibnitz is the author of the theory of unconscious mental activities in metaphysics—all this is not an immaculate sign of fitness to argue a case before the Supreme Court, or to diagnose the ills to which humanity is heir. Let the young graduate be cautious, be wise, be deliberate in his decision, remembering that it carries with it the gravest issues of time, and that it binds him to hardest toil and manifold self-denials.

Secondly, we must not fail to remind the new-born graduate that conscience should be appealed to as the highest arbiter in this sovereign self-election to a life-work. As a rational and accountable being every man is under obligation to his moral powers and to his God to ask: Where can I be the most useful? How can I accomplish the most good? Possibly he may conclude—and we suspect that just here lies room for the exercise of good sense and wisdom—that to be useful and happy it is not necessary to be a professional man at all. The farm makes its cry—and it is a loud and emphatic cry, too—for educated and noble-minded occupants. The bane of American society to-day is the silly, nay, the wicked idea that whoever has been through the schools must sport a title to his name, or descend to the disgraceful position of a nobody. This idea is heresy against manhood, and will prove the utter curse of its proud victim.

What Ismail Pasha did for Egypt.

In a long and intelligent letter suggested by the downfall of the late Khedive of Egypt, Charles Dudley Warner pointedly sums up the great works of improvement begun and largely carried out by the bankrupt monarch. After trying to show that the unfortunate Khedive only paid the penalty of all men who get ahead of their time and have not power enough to quite break with it or to compel circumstances to their will, Mr. Warner says:

Ismail Pasha has done more or attempted more for the good of Egypt than any ruler since the great Pharaohs. He has done more to put it in the line of modern progress than any ruler since the Conquest. The achievements of the man are something amazing, as all readers on Egyptian affairs know. The Suez Canal is his work in a very large sense. The modernization of parts of Cairo and Alexandria is due to him. The building of railways, telegraph lines, and numerous canals is his work. The creation of a trained army, and of schools and bureaus of technical education in connection with it, is his work, aided by foreign military talent (much of it American) which he has called in—an army the common soldiers of which were taught to read and write, and the brightest minds of which had an opportunity for superior education. He has put steamers on the river, on the Mediterranean, and on the Red Sea. He has developed a large trade with Central Africa. He has been not only friendly but zealous in the support of schools, of science, of investigations and explorations for the benefit of Egypt. His organized expeditions into the south have been more for exploration and for scientific purposes than for conquest; and he has loyally co-operated with England in the suppression of the slave trade. He has made expensive and almost desperate attempts to interest the Egyptians in improved agriculture and in manufactures. It is in these great public attempts that he has become bankrupt—his private extravagances (not to be apologized for) never would have reduced him to this condition.

The Action of Sewer Gas on Lead and Zinc.

We take the following, says our excellent contemporary, the *Plumber and Sanitary Engineer*, from the report by Mr. T. Kinnear, sanitary inspector of Dundee, Scotland, for 1878:

It is impossible to determine otherwise than by experience and observation how long an ordinary lead soil pipe or trap will resist the action of sewer gas before perforation takes place, but it is certain that a thick one will do so much longer than a thin one, and it is equally true that one efficiently ventilated will serve nearly double the time of one continuously air-bound. I have paid particular attention to the action of sewer gas on zinc rhones on eaves of buildings where it was striking on the under part, and found in the course of a couple of years or so pretty large holes eaten completely through, showing that that material could not long withstand the effect of the gas. Lead is, of course, more durable than zinc, but the difference is only a question of degree, as shown by the fact that, in not a few of the water closets repaired by the officers of the department during the year, small apertures were found in the main vertical lead pipe, and in the cross or horizontal one leading from it to the trap of the closet various perforations were found on the top, indicating clearly the operation of foul air from the drain. Lead traps and soil pipes from water closets, baths, and fixed basins, are all subject to tear and wear, but the traps, being burdened with the additional strain of barring the passage of sewer gas, do their work less efficiently and for a much shorter period than they are generally credited with, hence the necessity for proper ventilation and occasional inspection. There is often considerable indifference shown by many plumbers when sent by their masters to examine into complaints of smell supposed to be coming from lavatory appliances. They usually look for a fluid leakage; and when that is not perceptible they leave, declaring to the complainer that the pipes are all right, when probably a little longer time spent in making a more complete examination would have revealed that such was not the case. They seem to imagine that it is the liquid only which wears holes, and do not even dream that the gas from the drain is the most powerful agent of the two as an element of mischief. This is another fruitful means by which sorrow is brought to many a home. It is indisputable that drain air accelerates decay in lead fittings, and these and their drain connections ought to be periodically examined. To facilitate this they should be placed in a position of easy access, with their covering left to open freely, and not hidden in an out-of-the-way corner as they usually are.

A Story of Pluck and Industry.

We have heard a good deal about hard times of late years, and more, perhaps, about the "insurmountable difficulties" attending the career of a young man, particularly a working man, who has neither influence nor capital to back him. A very pretty commentary on that sort of cant is furnished by the experience of two German boys who landed at Castle Garden, strangers and without money, about a dozen years ago. The story—more or less closely paralleled in the experience of thousands—is worth telling, both as an encouragement to the young and as an index of the chances which American life offers to the plucky and persevering. It comes out in connection with a recent festival celebrating the tenth anniversary of the founding of a novel industry, and the completion of some extensive factory buildings in the little village of Brockett's Bridge, N. Y. The story, as told by a *World* correspondent, runs in this wise:

Thirteen years ago—or, to be precise, on the 11th day of July, 1866—Alfred and Bruno Dolge, boys of seventeen and nineteen, landed at Castle Garden as emigrants from the city of Leipsic. Their worldly means were less than one dollar. But they immediately sought and found work, one at his trade as piano maker at $4 a week, the other as an engraver. For three years Alfred Dolge, the younger of the two, worked steadily with Messrs. Steinway as a journeyman, and then he determined to go into business on his own account as a dealer in piano materials. He had little capital and was not twenty-one years old. But he had pluck and industry. Understanding the business, he concluded to manufacture piano feltings instead of importing, and he opened a small workshop in Brooklyn, associating his elder brother with him. Success followed, and he has seen his feltings take the first prize at the World's Fairs in Vienna, Paris, and Philadelphia. The feltings are made chiefly from Silesian wool, though certain brands of Australian and Cape Town are used, and such is the demand for them that the agents in New York have ceased to solicit orders. Of course this has not been easy of accomplishment, for, even in this country, there was a feeling that nothing but European goods were fit for use; but now the best pianomakers of London, Paris, and Leipsic (in which the three other felt manufactories are located) send to Brockett's Bridge for their supplies.

When the Exposition was held at Vienna Mr. Dolge arrived there in July only to find that, through the incapacity of the United States officials, his boxes were still unpacked. The jury in piano materials had already made their award, but Mr. Dolge, undaunted, challenged their attention, brought his goods before them, and by practical experiments demonstrated their superiority. Finally the gold medal was unanimously awarded him, though there was not an American on the jury. Triumphs at Paris and Philadelphia followed as a matter of course.

Up to 1875 piano-makers manufactured their own sounding boards. But at that time Mr. Dolge began their construction, and now supplies all the leading piano-makers of the United States, and exports these sounding boards to England, Germany, Italy, Norway, etc. A thousand were shipped to London, July 5, and the foreign agents have received directions to take no more orders until March, 1880. A large portion of the new building will be devoted to this branch, the spruce logs being sawed into planks in the basement and thence carried through every process until ready for shipment. In conjunction with this the manufacture of piano mouldings will be carried on, the facilities for carving being greater than in any other factory in the United States.

Perhaps the thought which most often occurred to the visitors recently was that all this had been accomplished during the four years of severest depression that the country has ever known. It was in 1875 that Mr. Dolge made his purchase of the old tannery at Brockett's Bridge, with its immense water privilege (600 horse power), and determined to launch his little bark on larger waters. His best friends tried to persuade him from the venture, but as he expressed it, he "had faith in the country and its future." Now the buildings have a frontage of 440 feet, with a height of three and four stories. Mr. Dolge has $220,000 invested in the property and gives employment to 150 laborers, nearly all of whom are American, and all of whom are of the highest type of intelligent working people. The success of these new industries has transformed a once deserted village into a prosperous hamlet, and though the village is eight miles distant from the railway station at Little Falls, it is attracting many visitors. The Brockett's Bridge people point to their work with pride as a living proof that even in the hardest times pluck and brains can force their way to fortune.

Formerly the makers of English pianos shipped the spruce lumber from this country to make their own sounding boards, each dealer constructing his own. When it was first proposed to send them the completed sounding boards the Englishmen laughed at the idea, and when Mr. Bruno Dolge arrived in London, three years ago, he found his agents overwhelmed by this ridicule and so discouraged that they had not taken a single order. It looked dark, so bitter was the prejudice against this Yankee idea. "Why, it's all nonsense," said one leading London manufacturer; "you might as well send us our pianos from America all ready made, you know." But Mr. Dolge stuck to his man, got him to see the boards and test them, and finally took his order for 500 sounding boards, and then every prominent dealer in London followed suit. American ingenuity had saved them time, trouble, and expense, and the success that has crowned these industries will follow others if our capitalists will only make the venture. At least this was the moral of the celebration and speeches.

Lemon Verbena.

The well-known fragrant, sweet-scented, or lemon verbena (*Lippia citriodora*) is regarded among the Spanish people as a fine stomachic and cordial. It is either used in the form of a cold decoction, sweetened, or five or six leaves are put into a tea-cup, and hot tea poured upon them. The author of a recent work, "Among the Spanish People," says that the flavor of the tea thus prepared "is simply delicious, and no one who has drunk his Pekoe with it will ever again drink it without a sprig of lemon verbena." And he further makes a statement, more important than all the rest, if true, that is, that if this decoction be used one need "never suffer from flatulence, never be made nervous or old-maidish, never have cholera, diarrhea, or loss of appetite."

ONE MILLION BUSHELS OF WHEAT.—The transactions in wheat at Chicago, on Saturday, July 19th, the newspapers of that city state, exceeded one million bushels.

Rocky Mountain Railways.

In a letter from Colorado a correspondent of the New York *Tribune* says that there is no more striking evidence of the prosperity and enterprise of Colorado than the rapidity with which narrow gauge railroads are built into the Rocky Mountains. "The Denver, South Park and Pacific road zigzags up the South Platte cañon and over the pass into the South Park on grades that no engineer could have dared to suggest ten years ago. Scarcely less daring has been the engineering of the Denver and Rio Grande road over the La Veta Pass of the Sangre de Christo range into the valley of the Rio Grande River. More wonderful than either in its conception and execution has been the construction of the Arkansas Valley Railroad from this place through the Royal Gorge, a cañon almost as grand in its proportions and more inaccessible than that of the Colorado. I have not passed through the gorge, and shall not undertake the impossible task of describing it at second-hand, but I did observe with great interest the progress of the work above the gorge. The grading is nearly completed to Grainett, more than a hundred miles from Cañon City, and the bridging and track laying can be pushed forward with almost any desired rapidity, unless the quarrel between the Denver and Rio Grande and the Atchison, Topeka and Santa Fé companies causes delay. Much of the grading above the gorge has been difficult and expensive, and the grades are very heavy, but the work seems to have been well done.

"I met in this city, to-day, an engineer of the Santa Fé

road who told me that if his company retained control of the Arkansas Valley line, and the Gunnison country should develop into a rich mining region, a line across the great range would probably be built next season. I expressed surprise and doubt that it would be possible to cross that range with a railroad track. He assured me that it was not only possible, but very probable. It used to be supposed, he said, that the only way in which it was possible to build a railroad over a great elevation was to distribute the grade over as much space as possible. This made the road bed very expensive. Railroad engineers in Colorado, he said, now work on a different theory. They follow the natural contour of the ground as nearly as possible, and "bunch" the heavy grades together as much as possible. It is much cheaper, he continued, to use locomotives heavy enough to take the trains over the steep places than to spend so much money in bringing the road to an average grade over a considerable portion of its line. With the completion of the railroads now in progress of construction much of the wildest and grandest scenery in Colorado will be easily reached, and the Rocky Mountains will yearly become more popular as a summer resort."

Jelly and Jam.

Raspberry jam is an essential element in the construction of Washington pie, and as this pie is a Boston institution which is not frequently met with outside of a circle whose circumference is fifteen miles distant from the Massachusetts State House, it is not surprising that the greater portion of the raspberry jam consumed in the United States is made here.

The manufacture of the article has been increasing of late, and there are now some eight firms engaged to a greater or less extent in its production, and making an aggregate of nearly 500 tons per annum. As their product sells for 18 cents per pound, its total value is therefore $180,000. The dried raspberries of which the jam is made costs 85 cents a pound, and are bought by the jam manufacturers either of farmers and country storekeepers, or of Boston commission merchants.

The manufacture of jelly is a less prominent industry here, though several parties make more or less of that article for bakers' use. Few Boston concerns have had the temerity to attempt to compete with Baltimore manufacturers of cheap "jellies," such as are being wholesaled all over the country at the present time at 70 cents a dozen, or less than 6 cents each. As the glasses which contain those jellies can hardly cost less than 2 cents apiece, and as the labels, covers, etc., are not made for nothing, the price received for the "jelly" itself is evidently not much above 3 cents per glass. Although the demand for this "jelly" has become large, of late, it is pretty well understood that it is principally an animal instead of a vegetable product, being composed mostly of gelatine, variously colored and flavored.

A story was current once that the consumption of cattle hides in the manufacture of jelly in London was so great as to cause a sharp advance in the hide market. Such an effect could hardly be produced at the present time, however, since merchantable hides can be made to yield a good deal more money in the form of leather than in jelly.

The jelly that is manufactured in Boston is nearly all made of apples, and sells at about 14 cents per lb. Apple now forms the base of an endless number of jellies, such as currant, raspberry, peach, pineapple, etc., which are made by simply adding extracts to flavor the apple jelly; and so perfect is the imposition that the great majority of consumers are deceived by it, or, in other words, cannot tell it from the jelly made from the fruit with which this is only flavored. It comes much cheaper than the real article. Real current jelly, for instance, costs somewhere about 28 cents per lb. The latter is made to some extent, and is sold by grocers who cater to the highest class of family and hotel trade.—*New England Grocer.*

Activity not Energy.

The *Christian Union* thus defines the difference between activity and energy, and suggests wherein a large class of industrious people lack that element which produces success.

There are some men whose failure to succeed in life is a problem to others as well as to themselves. They are industrious, prudent, and economical; yet, after a long life of striving, old age finds them still poor. They complain of ill luck. They say that fate is always against them. But the fact is that they miscarry, because they have mistaken mere activity for energy. Confounding two things essentially different, they have supposed that if they were always busy they would be certain to be advancing their fortunes. They have forgotten that misdirected labor is but waste of activity. The person who would succeed is like a marksman firing at a target: if his shots miss the mark they are a waste of powder. So in the great game of life, what a man does must be made to count, or might almost as well have been left undone. Everybody knows some one in his circle of friends who, though always active, has this want of energy. The distemper, if we may call it such, exhibits itself in various ways. In some cases the man has merely an executive capacity when he should have a directive one—in other language, he makes a capital clerk of himself when he ought to do the thinking of the business. In other cases, what is done is not done either at the right time or in the right way. Energy, correctly understood, is activity proportioned to the end.

American Competition with Sheffield.

The Mayor of Sheffield, England, recently presided over a meeting of business men, held in that city, to discuss the situation of their manufactures, and hear a paper read on Free Trade, by a Mr. Fletcher. At the conclusion of the discussion, Mr. Ward, the Mayor, said that one gentleman had remarked that in his opinion the competition between America and England would cease as regarded manufactures, because American goods were not so good in quality as the English. He was in a position to contradict a statement like that, because, having a connection with Australia, he found that American goods were being preferred in that market to those manufactured in Sheffield. When he went up to London he found that merchants who had hitherto sold large quantities of Sheffield goods, had indents for American ones, which were cheaper and better in quality. He could not for a moment conceive how the American manufacturers were to suffer in the race of competition. It was of the utmost importance that those in this country should put aside that feeling of lethargy that had come like a cloud over it, and bestir themselves once more. He could remember that in his younger days it was nothing unusual for him to work 14 or 15 hours a day, but nowadays, if they went to a merchant's office at ten o'clock in the morning, they found often that he had not "come down" to it, and if they went at four o'clock in the afternoon, he had "gone to his country seat." They were luxurious now, but the Americans were painstaking and persevering. They worked from early morn to late at night. Some time ago, when he was in America, he found the working-classes laboring in the grinding-wheels and shops at seven o'clock in the morning, and there they would remain until seven o'clock in the evening. He believed the Americans were working 15 or 20 hours a week more than they were in Sheffield. Then they saw restrictions put on by the English Government. By the Factory Acts, the manufacturer now must not allow his factory hands to work more than 53 hours a week. If they went to the continent they would find them there working 72 hours a week—according to law. Seeing that the machinery on the continent was working equally as rapidly as in England, it followed that in the 72 hours they got through a far greater proportion of work than could be done in the 53 hours. He concluded that such restrictions tended to retard progress in England.

Utilization of Waste Lands.

The utilization of waste lands in Great Britain is one of the questions of the day, and an example of what can be done in this direction by spirited private enterprise, and which is being rewarded by capital results, is the reclaiming of some 750 acres of land which once was Pagham Harbor on the Sussex coast. The first step taken was to make an embankment or sea wall, to get the soil drains into an open bed in the center of the harbor, the outlet at which is controlled by a sluice which is automatically closed at high water. Next came the process of cultivation. This was first attempted with horses, but the soil of a great part of the reclaimed land is close and muddy, and one of the essentials of its successful culture is to loosen and lighten the top soil so as to admit the air and rays of the sun. Plowing with horses did not satisfactorily effect this, because after plowing and harrowing a shower of rain caused it to run together again. It was then decided to apply steam power to the work, and the result has been remarkably successful, lifting up and thoroughly loosening the soil to a depth of 10 inches. The land thus treated keeps light, and does not run together again, and the condition of the corn sown on lands thus treated by steam power is remarkably superior to that on the same class of land worked by horse power. Of course, from the soft, muddy character of the soil, it would be impossible to travel engines over it, and, benefiting by the experience of a somewhat similar operation carried out at Barth, on the Welsh coast, a few years ago, the proprietor resolved to adopt the same system as that adopted at Barth, namely, that of Howard. The engine is placed on a road which has been made alongside the reclaimed lands, the ropes being passed round the piece to be cultivated, two traveling anchors taking the place of two men. During the past season a large number of acres were plowed and cultivated in this way, and, at the present moment, the corn sown there is fast ripening for the sickle.

The Writing Telegraph.

Cowper's writing telegraph has been placed on the London and Southwestern Railway, and has been working most successfully, says the *Engineer*, from Woking to Waterloo, a distance of 26½ miles, writing off the messages in ink, one after the other, in a perfectly legible manner, whether regular line messages or messages made up in order to give the instrument more work to do. On some days more resistance coils of wire have been introduced into the two line wires, in order to represent greater distances, and thus 62½ miles and 99½ miles have been worked through in a most satisfactory manner, it only being necessary in such cases to add a few more cells of the battery, which in no case was as powerful as is very often used on the same line. The effect of the currents through the multitude of other line wires, in close proximity to the two in use for the writing telegraph, was closely observed, and the effect of induction was so exceedingly small as only to produce occasionally a slight roughness in a straight line, when the pencil of the operator was quite stationary, but such effect was hardly ever perceptible in the writing itself, and never to affect its legibility.

We understand improved instruments are now being constructed, and will shortly be at work. The fact of this instrument requiring no clerk to receive the message, translate, and write it down, seems to be much appreciated, as a half-dozen such instruments may be telegraphing their yards of messages into one office without the least assistance from the clerk, who may from time to time cut off and send out the ready written messages; so that not only is the time of "calling" (as with ordinary instruments) saved, but the time of waiting till the clerk can attend at the other end of the line to receive the signals, which very often amounts to a much longer interval than is required for the whole message to be transmitted, especially in offices fitted with many instruments.

There is also a great advantage in having an absolute record of what has been sent by the writing telegraph at the transmitting station. Another very important feature is the facility with which all that it is necessary to learn to use the instrument may be found out in five minutes. Every operation is exceedingly simple, and there are practically no fine adjustments anywhere. Variation in the power of the battery is of no importance, as its effect may be overcome by simply pushing the levers, carrying the springs against which the needles pull a little further in or out, as may be necessary. The pen, which is a very small glass capillary siphon tube, is, though of glass, very strong—it may fall several feet on to a bare floor without breaking—and is very easily adjusted.

The writing telegraph presents facilities and advantages which, we believe, will make its adoption rapid and extensive.

RECENT MECHANICAL INVENTIONS.

Mr. John F. Secord, of North Greenwich, Conn., has devised an improved chain pump bucket, consisting of a rubber knob moulded solid upon an iron link.

Messrs. James M. Johnson and Charles E. Burns, of Lancaster, N. H., have invented an improved machine for making spool blanks. In this machine the blocks are cut out and bored simultaneously.

Mr. Thomas J. Torrans, of Mobile, Ala., has patented an improved device for making bale band ties, formed of the lower or stationary part, an upper or movable, a nicking chisel, made with a rounded edge, and a cutting chisel, made with a rounded edge and concaved sides. These parts are combined with a shear plate, and the whole is arranged so that a complete tie is delivered at each operation.

An improved brake for wagons and carriages, which is so constructed that the brake will be applied by the action of the horses in holding back, and with a force exactly proportioned to the forward pressure of the load, which will allow the brake to be locked in position when off, so that the wagon can be backed without applying the brake, has been patented by Messrs. Lycourgus L. Johnson and William E. Johnson, of Alanthus Grove, Mo.

Mr. Lorenzo D. Hurd, of Wellsville, N. Y., has patented an improved running gear for wagons, in which each wheel may rise in passing over an obstruction independent of the others, and without changing the level of the wagon body, and in such a way as to bring the wagon more perfectly under the control of the team.

A device for clipping horses and shearing sheep, to be operated by steam or compressed air, has been patented by Mr. Ernest W. Noyes, of Bay City, Mich. The several parts are arranged so that the speed of the clipping knife will be fully under the control of the hand holding the implement, and the exhaust steam or air will be carried away from the animal.

An improved millstone driver has been patented by Mr. William J. Blackwell, of Waynesborough, Va. It consists in forming the inner ends of both sections of the driver with an eye that encircles the spindle, and in connecting the lapped ends of such sections by lugs and recesses which cause the two sections to act in unison.

An improved apparatus for separating coal from slate, and for separating other substances of different specific gravities, has been patented by Mr. David Clark, of Hazleton, Pa. It consists in the combination of the perforated inclined chutes and adjustable slides with the perforated stationary bottom and the tank, and other devices which cannot be clearly described without an engraving.

An improvement in the class of door latches known as "thumb" or "drop" latches, has been patented by Mr. Joseph R. Payson, of Chicago, Ill. It consists in extending the inner end of the lever through an orifice in the latch piece, the lever having a fulcrum in the rose, with a preponderance of its weight upon the inner or latch side.

A simple, cheap, and efficient fastener for plow colters has been patented by Mr. P. A. Bagwell, of Oakland, Ky. This arrangement of brace and fastener reduces the leverage or strain, when working, upon the colter and beam at their point of contact, and it holds the colter so that it cannot become loose, as it ordinarily does when used in plowing heavy sods or among roots.

An improvement in needle bars for sewing machines of that class in which two needles are attached to and operated by the needle bar, so as to sew two seams at once, has been patented by Mr. Nathan Hayden, of Chicago, Ill. The invention consists in the combination of a slitted needle bar, two needles, and a single clamp and screw adapted to compress and retain both needles with equal security.

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.

NEW BOOKS AND PUBLICATIONS.

LABORYTORY TEACHING. By Charles Loudon Bloxam. Fourth edition. Illustrated. Philadelphia: Lindsay & Blakiston. 12mo., pp. 261.

In the ten years since this useful manual was first published its fitness as a guide to the beginner in practical chemistry has been amply demonstrated. The present edition differs from the last chiefly in giving the formulæ for the compounds to be studied. The book is well printed and has a good index.

FOUNDATIONS AND FOUNDATION WALLS. By George T. Powell. New York: Bicknell & Comstock.

A work for the house builder rather than the engineer, strictly practical, and obviously of much value to all having to do with foundation work.

ZEITSCHRIFT DES ARCHITECTEN UND INGENIEUR VEREINS ZU HANNOVER. Edited by W. Keck. Band 25, No. 1 and 2. Hannover: Schmorl & von Seefeld. 1879.

A technical journal, edited under the auspices of the Architects and Engineers' Society at Hanover, and of a very high standing in Germany. The first two numbers of 1879 contain, among other scientific and technical information, a paper on driving spiles by means of a jet of water; a statistical table showing the different observations on this subject; plans and descriptions of the Point Bridge at Pittsburg and of the proposed East River Bridge at Blackwell's Island; a carefully prepared description of the great railroad repair shops at Hanover, and a new theory for the computation of the strains in joint arch bridges.

RESULTATE AUS DER THEORIE DES BRUCKENBAUS. Von R. Krohn. Aachen: J. A. Mayer. 1879. (Results in the Theory of Bridge Building.)

In this work the author, Mr. R. Krohn, Civil Engineer and Professor at the Royal Rhenish Polytechnic School at Aachen (Aix la Chapelle) Germany, has collected and arranged the latest developments in the "Theory of Bridge Building," and has explained their application by numerous examples in an excellent manner. The work will be complete in two parts, the first of which has appeared and is now before us. It treats of iron truss bridges, their construction and calculation, the formulas, the derivation of the same, and the advantages of the several variations in the arrangement of the elements. The author has adopted the analytical and graphical method of calculation, and has based the computations of the strains on the experiments of Wohler and on the Daunhardt Weyrauch formulas. The distribution of the load and the strains arising therefrom are admirably demonstrated. The second part will treat of iron arched bridges and combination arched and truss bridges. The work is carefully illustrated and handsomely printed.

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 not 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) Olivia writes: We have a 10"x30" improved Allis Corliss engine, 95 revolutions per minute, and makes indicated h. p. as follows:

Log. π (3·14159)	0·497150	Area of piston in inches.
Log. 25	1·397940	
Log. steam pressure (60lb.)	1·778157	
Log. piston dist. 475 ft.	2·676694	
	6·349935	
Log. 33,000	4·518514	
Log. indicated h. p.	1·831421	∴ 67·83 h. p.
Less friction, etc		17·83
Actual h. p.		50·

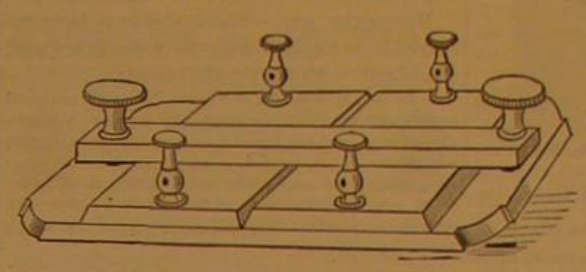
We are told that the engine will not develop over 30 h. p. by parties who claim to know. Have we figured correctly? If not, please correct us. A. Yes, if 60 lb. is the average pressure on the piston. But we suppose it is the pressure in the boiler. If so, there is your error.

(2) C. W. W. asks if there is any difference between a plumb and perpendicular line; if so, what. A. A plumb line is always a vertical line; a perpendicular line is one at right angles to some other line or surface, and may itself be vertical or horizontal, or at any angle with either.

(3) W D. M. asks: 1. How many square inches are there in a safety valve 2½ inches in diameter? A. 4·90 inches. 2. What pressure to the square inch would it require to raise a weight two feet from the center of valve and 2¾ inches from the center of the valve to the end attached to the outside of valve? A. See reply to F. J. R., p. 267, volume 40.

(4) J. L. C. asks: 1. Is it possible to become a good mechanical draughtsman without studying geometry? A. Possible, but a knowledge of geometry is very essential. 2. If so, what book or books would it be best to get on the subject, and where could I get them? A. "MacCord on Mechanical Drawing," for sale at this office. 3. Is it possible to get as good satisfaction in point of economy, out of a throttling slide valve engine, as you can from a cut off engine? A. No. 4. Which is best to do in cleaning out a boiler, to blow it out under pressure, or let the water run out after the pressure goes down? A. If there is time, let the boiler cool, the deposit will then be left comparatively soft.

(5) C A. P. asks (1) how to make an effectual lightning arrester to be used on a short line (400 feet) of telegraph. A. The engraving shows a common form of lightning arrester. It consists of two small brass plates mounted on a larger metallic plate and separated from it by a sheet of mica. The upper plates are put in the circuit, the lower plate is connected



with the ground wire. An overcharge of electricity passes through the mica and finds its way to the earth. 2. Do I infringe on any one's rights or break any law relating to patents when I make a pair of telephones like those (using horseshoe magnets) described in your SUPPLEMENT, No. 142—would I be doing so if I sold them? A. See Rights of Investigators, p. 128, volume 39, of SCIENTIFIC AMERICAN.

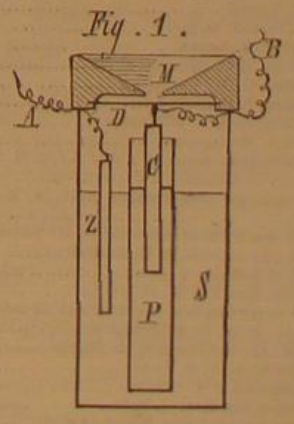
(6) C. E. B. says: I am using a small compressed air boiler, and I am troubled with a few leaks at the hub on the side; will two or three coatings of lead on the inside check it? If not, what will? A. Stop the leaks by calking if possible. If you do not succeed in this you may apply the white lead.

(7) W. H. R. writes: I have a cylinder, 6 inches diameter and 1 inch long, filled with water at 100 lb. pressure per square inch. 1. How many tons, acting on the 6 inch piston that works in the cylinder, would be required to compress the water 1-16 inch? A. That is equivalent to 1-96 its bulk; no liquid is susceptible of that amount of compression. 2. Is there any other liquid less compressible than water that will not affect either iron or brass? Is mercury less compressible? A. Mercury is less compressible than water, and does not affect iron. It will, however, affect brass.

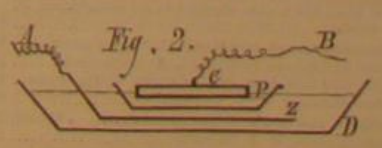
(8) A. B. J. asks how to use ultramarine blue for a wash blue, that will not spot in hard water. A. We know of no practical way of overcoming this, as the blue does not form a true solution. For this purpose Nicholson's blue (blue aniline) is preferable to ultramarine.

(9) W. J. asks: What is the horse power of an engine required to ascend a grade of 7 (seven) inches to the foot on a cogged rail for center of track, cog wheel to fit in same not to exceed 12 inches diameter, the weight to be taken up exclusive of the engines, and boiler's weight about 35 hundred weight? A. You do not give the speed at which you wish to run, but assuming 4 miles per hour, the power required would be, with engine, weight, say 20,000 lb. and other weight 3,800 lb., total 23,800 lb., 151 horse power, and to this add 25 per cent for friction and other losses. If weight or speed be increased, increase the power in proportion.

(10) H. W. F. writes: I have lately been making some interesting electrical experiments, and have arrived at very satisfactory results, some of which I would like to make known. Fig. 1 represents the



section of a telephone, which I think has one novel feature, the production of the electric waves at the source of the electricity. S is an ordinary battery jar, filled with salt and water, in which the zinc, Z, is suspended. P is a porous cup filled with ordinary battery solution of bichromate of potash. In this is suspended a piece of carbon, attached to a vibrating diaphragm, D. The wire, B, extends from the upper part of the carbon.



When a sound is made in the mouth piece, M, the diaphragm vibrates, the carbon is alternately immersed and drawn out of the fluid, the result is a series of electric impulses which act on an ordinary telephone receiver. In this way I have been able to transmit articulate speech with distinctness. Fig 2 shows a section of a very powerful and cheap battery. D is the containing vessel, either a pie or soup plate. Z is a piece of amalgamated sheet zinc, with the wire, A, attached. P is a flower pot saucer which takes the place of the porous cup. C is a flat piece of gas carbon with the wire, B, fastened on the upper side, so as not to be eaten off by the acid. The plate, D, is filled with salt and water; P, with battery fluid. This makes a very good battery for three reasons; first, it is powerful; second, it is easily made; third, it is cheap.

(11) J. C. K. writes: I beg to differ from your answer to L. C. R. (36), in issue of 12th July. I remember that 45 years ago nails were made by hand and sold by count, and not by the pound—fourpenny at 4 pence per 100, sixpenny at 6 pence per 100, and so on through the different numbers; the term penny or number of pence was the retail price for 100. I notice the penny is pretty generally dropped now, and the simple numbers substituted, as 6's, 8's, 10's, etc., instead.

(12) H. J. P. asks how strong a battery is necessary to show the repulsion of bismuth from the poles of a magnet. I intend to try it with three cells of Leclanche, but do not think that will be enough. A. Use a magnet about 4 inches long, and 4 cells of Bunsen battery.

(13) A. Y. asks: 1. Is charcoal hammered No. 1 boiler plate always marked C. H. No. 1? A. For steamboat boilers, yes. 2. May plate not so marked be C. H. No. 1 iron to fill specification? A. No.

(14) H. J. C. asks for a detailed description of an "induction coil," suitable to be used with "Lyons transmitting telephone" which you described in SUPPLEMENT, No. 163. Please give diameter of central core, diameter and length of coil. No. and length or weight of both primary and secondary wires. The whole to be used on a circuit, two miles long, with ground connections. A. The core consists of a bundle of No. 18 iron wire 4½ inches long, ⅝ inch diameter. The spool upon which the primary and secondary wires are wound is as thin as it is possible to make it. Two layers of No. 18 silk covered copper wire are wound on the spool for the primary, and about eight layers of No. 36 silk covered wire are wound upon the primary, the several layers being separated by pieces of thin writing paper.

(15) W. A. M. asks how to prepare the so-called fish food used in fresh water aquaria, and what amount to use in an aquarium of about six gallons capacity, with from eight to twelve small fishes. A. We do not know to which preparation you refer. Seth Green says in relation to gold fish: "Feed them all they will eat and anything they will eat, worms, meat, fish wafer, or fish spawn, but take great care that you take all that they do not eat out of the aquarium."

(16) G. B. F. asks for the simplest and best process for estimating the amount of potassic iodide in a known quantity of co. fluid extract sarsaparilla. A. If the solution contains no chlorides, evaporate to dryness in a porcelain capsule, and heat cautiously to redness to destroy the carbonaceous matters. Moisten the residue thoroughly with silver nitrate dissolved in water, warm, throw on a tared filter, wash with water, dry in the dark, and weigh. One part of this is equivalent to 0·706 KI, nearly.

(17) W. M. asks: 1. Will a ten horse power boiler run a ten horse power engine, or is the boiler of greater power then the engine? A. Usually the boiler is more than equal to the power at which the engine is rated. 2. What is the reason that a person weighs as much before as after eating? A. Try the experiment of weighing yourself before and after eating. If you find you do not weigh more after eating we would be pleased to know what kind of food you eat. 3. In speaking of perpetual motion, do you not mean a machine that will act the same as an engine, that is, to drive other machinery? A. Any machine or apparatus that would keep in motion without any external aid would be called a perpetual motion.

(18) W. W. asks (1) how to make a small still on a cheap scale. A. You may use an ordinary iron retort capable of holding say 3 pints, and a small glass or block tin worm; place the worm in a tub or bucket, the lower end passing through a cork fitting a hole bored for its reception near the bottom of the vessel. Adjust the beak of the retort to the upper end of the worm. During the distillation conduct a stream of cold water to the bottom of the tub or bucket, and draw off the heated water near the top. See No. 110 of SCIENTIFIC AMERICAN SUPPLEMENT. 2. Please give a receipt for making a first class vinegar for family use. A. See p. 267, (19), volume 39, SCIENTIFIC AMERICAN.

(19) J. F. B. writes: 1. I have a 4x4 engine, and will 129 feet of ½ inch pipe give heating surface sufficient to run it; if not, how much more do I want? A. No, if your engine works up to 200 revolutions per minute, ½ inch pipe will be very likely to stop up; use the same length of ¾ inch pipe. 2. Is there any patent on a simple coil boiler? A. No.

(20) W. E. P. asks for the dates on which Mars came to opposition in the years 1858, '60, '62, '64, and '67. A. About as follows: 1858, May 15; 1860, July 22; 1862, September 29; 1864, November 23; 1867, January 30.

(21) F. P. K. asks: 1. Where can the fine red clay used in the manufacture of imitation lava ware be procured? A. Consult the report on "Clay and Clay Deposits of New Jersey," Professor George H. Cook, New Brunswick, N. J. 2. Is there any chemical that, by mixing with white clay, will in the burning turn it to a red color? A. Moisten it with strong aqueous solution of sulphate of iron, common copperas. 3. What can I mix with clay, to strengthen and toughen it? A. Try one or two per cent of fluorspar. The clay should be properly washed.

(22) G. A. F. asks: 1 How are scorification assays of gold and silver ores made? A. The powdered ore is mixed and covered with about ten times its weight of pure granulated lead in a small dish of refractory clay (scorifier) and introduced into the muffle of a cupellation furnace. If the ore is at all basic a few

fragments of anhydrous borax (borax glass) are added to the contents of the scorifier. As soon as the lead has melted the door of the muffle is opened and the scorification proceeds until the ring of slag closes over the lead button. The scorifier is then removed and poured into a smoked iron mould. If, after breaking away the slag, the button is found to be small enough, it is immediately cupelled; if not it must be returned to the scorifier and reduced in size by scorification. The cupellation is the same as with the crucible beads. 2. I inclose clipping from an exchange which does not correspond with processes given in your paper from time to time for the manufacture of nitroglycerine: who is correct? A. The statement that nitroglycerine is a compound of glycerine and prussic acid, is incorrect.

(23) S. E. asks: For what is realgar used, and what is it worth? Is there a good market for it? A. It is used in the manufacture of certain pyrotechnic preparations, such as Bengal lights (niter 27, sulphur 7, realgar 2); also in the manufacture of orpiment and other arsenical compounds. It is quoted at 20 cents per lb.

(24) W. H. C. writes: 1. I have finished the two sections of the secondary coil of an induction coil, ¼ size of that given in SUPPLEMENT, No. 160. Connecting one Watson cell I find no result from the secondary wire, no spark or feeling when I touch the terminals with my tongue. The fine wire broke three times by accident; each time I soldered, using muriatic acid as a flux. I should think that, though I have no insulating medium between the two sections, I would have some results. A. Use battery enough to vibrate the interrupter strongly. Two cells of Grenet would answer. If you do not then get a spark you should examine the connections and test the insulation. Possibly your condenser may be at fault. 2. Ought not one Watson cell to be enough? A. One Watson cell is not enough. Use at least four.

(25) H. P. asks: What are the proportions given to the air chamber of a pump? A. From 4 to 8 times the capacity of the pump.

(26) A. D. writes: Referring to the phonograph described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 133, will you give more definite instructions regarding the construction of this little wooden spring, size, force, and kind of wood? A. The accompanying

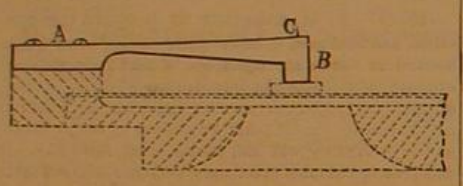


diagram gives the exact size and proportion, A being the portion attached to the mouth piece, B the portion that rests upon the diaphragm, and C the needle. The width should be about 3-16 inch and the end, B, should rest with some pressure on the small soft rubber block placed against the diaphragm. Any wood that springs well will answer. Holly is perhaps as good as anything.

(27) H. S. W. writes: 1. I contemplate building a small stern wheel steamer, dimensions: length, 50 feet, beam 9 feet, deck 12 feet, between decks 6 feet, height of cabin 7 feet, center 8 feet. She will be sharp forward instead of round, as our larger vessels are. Her boiler is 42 inches diameter, height 7 feet, engines 6 inches diameter, 24 inches in length. Are my proportions right? Is my boiler large enough for the boat? A. Your boiler is ample to drive the boat, and having about 180 feet surface should supply the engines. 2. Are my cylinders too large or small? A. Cylinders not too large; you might make them 6½ inches. 3. Would it be possible for such a boat to make the trip from New Orleans to the Suwanee River, in Florida? A. Yes with care and prudence.

(28) C. C. W. writes: I have a clinker built boat, 18 feet long, beam 4 feet 6 inches, draught at stern 18 inches; about 12 inches of this is extra keel. I have two high pressure engines, plain valves, set on the quarter; cylinders 2 inches by 4 inches working in ¾ expansion, carry 40 lb. steam, revolutions of engines 125. What would be the correct size of screw to run in shallow streams, and what would be a correct pitch of screw? A. 24 inches diameter and 2 feet 8 inches pitch. 2. I wish to know on what principle does the boiler injectors and inspirators work, or rather, how can an injector feed a boiler under 80 lb. steam, as they have to inject water into boiler against a pressure of 80 lb., and have only the same force to do the work? A. We cannot explain clearly the principle of the injector within the limits of "Notes and Queries." Consult some good book on engineering; that it does feed boilers with their own pressure there is no doubt.

(29) M. W. C. asks: 1. What knowledge of mechanics or machinery is requisite to the obtaining of an engineer's certificate to run a steam launch 20 or 25 feet long? A. Sufficient theoretical to understand the principle of operation of the steam engine and sufficient knowledge of the use of tools to be able properly to adjust the parts. 2. Is it necessary that a pilot license should be had to run such a launch? If so, what requisites are necessary to the obtaining of the same? Can one person take out both licenses? Are such licenses necessary for running a steam canoe such as was described in the AMERICAN a short time since? A. For reply to your other queries apply to the steam boat inspectors in your city.

(30) E. P. asks (1) for a cheap method of waterproofing cotton factory cloth suitable for a tent. A. See SCIENTIFIC AMERICAN, volume 39, p. 321 (9). 2. In the sentence "port the helm," does it mean to put the tiller to the port side? A. Tiller to port side.

(31) G. F. P. asks: 1. In the improved forms of dynamo-electric machines now made for producing the electric light, is the same current that supplies the carbons made use of to excite the fixed electro-magnets, or is it usual to have two series of armature coils? A. Usually, but not always. 2. Would a resistance of five ohms introduced in the working circuit of such a machine, by causing the current to traverse a considerable length of wire in the coils of the fixed electro-magnets before reaching the carbons, impair to any extent the brilliancy of the light with a machine capable of consuming rods ¾ inch square? A. Of course the introduction of resistance into the circuit will impair the light, and the greater the resistance the more will the light suffer.

(32) F. & Co. ask: Can you give us any information of a way of bleaching resin? A gentleman informs us that proto-chloride of tin will do so. Is there anything injurious in introducing it into soap, it being first dissolved in water? A. Brown resin may be converted into yellow resin by simply boiling it with water for about 10 minutes. Its appearance may be somewhat improved by adding to the water about one per cent of stannous chloride. The trace of the latter adhering to the resin, after washing, will not prove injurious in soap.

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

A. J.—Mr. M. von Lill, of Vienna, has lately analyzed some wolfram steel, generally known as Mushet's special steel, and has found it to contain: Iron, 87.120; manganese, 1·043; copper, a trace; wolfram or tungsten, 9·9888; carbon, 1·239; silica, 0·330; phosphorus, 0·039; sulphur, 0·008; total 99,767.—H. A. F.—The rock contains no precious metals, lead, or copper. It has no economic value.

COMMUNICATIONS RECEIVED.

On Small Propellers. By P. H. W.
On Alum Baking Powder. By E. B. F., Jr.
On the Microphone without a Battery. By A. C. R.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

July 1, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Agricultural implement, Woods & Whewell 217,086
Automatic gate, W. J. Hutchins 216,959
Axle, vehicle, Laskey & Arnold 217,012
Axle, vehicle, O. B. Thompson 217,027
Baby walker, J. L. Edel 217,078
Balances, platform, S. S. Hitchcock 216,957
Bale band bender, L. Miller 217,135
Bale tie, wire, A. Buckman 216,997
Baling press, W. A. Wright 217,037
Barrel swinger for store counters, L. Eckert 217,077
Battery carbons, connector for, W. H. Rodgers 217,023
Beehive attachment, J. C. Lyons 217,017
Bellows valve, Badger & Benjamin (r) 8,780
Binder, temporary book, H. W. Schweckendiek 217,162
Blasting powder, C. Felhoen 216,949
Boiler furnace, steam, H. M. Pierce 217,143
Boot and shoe heels, manufacture of, B. F. Locke 217,123
Boots, manufacture of rubber, F. Flynn 217,087
Bottle stopper, J. C. Schaffer 217,159
Bottles, corking, T. D. Stetson 216,981
Box, W. C. Turton 217,174
Box cover clasp, H. M. Quackenbush 217,146
Bracelet, R. T. Chapman 217,061
Bricks and the art of making the same, J. K. Caldwell 217,057
Buckle, W. J. Carnes, Jr 217,058
Buckle, G. M. Harnisch 217,097
Buckle, trace, G. M. Harnisch 217,098
Buckles, etc, to strap, device for securing, B. F. Barrow 217,044
Bung, vent, T. M. Armstrong 216,998
Button and stud, B. J. Angell 216,930
Button, metallic, C. Radcliffe 216,973
Button, separable, G. Pitts 216,971
Calendar, C. W. Bryan 216,937
Calendar, J. W. Robinson 216,975
Cam, J. H. Cranston 217,068
Can, W. H. King 216,963
Can, J. F. Tyrrell 216,985
Can, etc., case, J. M. Bean 216,932
Car coupling, M. Logan 217,124
Car coupling, B. C. Paine 216,968
Car coupling, G. W. Putnam 217,145
Car coupling, J. B. Safford 217,158
Car seat head rest, W. B. Taylor 217,169
Car wheel, J. Montgomery 217,136
Carding machines, trumpet guide for, E. B. Tibbetts 217,170
Carriage springs, manufacture of, H. M. Wentworth 216,989
Cartridge case forming machine, H. H. Barnard 217,045
Cartridge, pyrotechnic, E. D. Kendall 217,115
Caster, J. H. Schlott 217,160, 217,161
Casters, top plate for, W. H. Tucker 217,172
Celluloid or pyroxyline, manufacture of moulding, etc., from, R. A. Johnson 217,111
Chain and rope tightener, W. L. Gracey 217,091
Chandelier hook, A. D. Judd 217,009
Channeling tool, E. F. Stevens 216,980
Chisel rolling machine, G. Parr 216,969
Chuck attachment, lathe, Bielefeld *et al* 217,048
Chuck attachment, lathe, G. T. Chattaway 217,062
Churn, J. Cochran, Jr 217,065
Churn, J. E. Taylor 217,168
Clippers, hair, C. Carlton 216,998
Cloth shearing machine, D. C. Summer 216,984
Clothes drying machine, R. F. Hatfield 217,102
Clothes pounder, C. D. Roberts 217,153
Clutch and brake, reversing friction, T. A. Weston 217,032
Coal from slate, etc., apparatus for separating, D. Clark 217,064
Coat and blanket, combined, C. A. Hodgman 217,107
Collar and hames, combined, A. Rutherford 217,157
Collar and hames, combined horse, F. Hartman 217,099
Colter fastener, P. A. Bagwell 217,043
Compass, mariner's, S. Longfellow 217,014, 217,015
Copying press, H. J. Baldwin 216,995
Cork, machine for splitting for slicing, D. S. Yeoman 217,188
Crozing machine, O. J. Pennell 217,021
Crushing and pulverizing mill, J. T. Davis 217,075
Cuff holder, D. A. Johnson 217,008
Diamond cutting machine, A. Hessels 216,955
Ditching machine, J. L. Custer 217,073
Draught equalizer, W. A. Laird 217,119
Draught equalizer, wagon, B. C. Nelsen 217,138
Earring, W. E. Greene 217,092
Earring, L. Heckmann 216,954
Ejector, J. H. Irwin 217,109
Elevating or draining wheel, J. Jouet 216,961
Envelope and letter sheet, combined, L. H. Rogers 217,155
Fare box, V. Hall 216,952
Faucet, registering liquor, W. Williams 216,990
Feed water heater, J. Argall 217,041
Felted fabrics, manufacture of, E. Waite 216,986
Fermenting casks, apparatus for regulating pressure in, Ulscht *et al* 217,176
Fifth wheel vehicle, C. G. Wells 216,988
Firearm, N. R. Davis 217,001
Firearm, breech loading, L. A. Merriam 217,134
Fire escape, C. Pfefferle 217,142
Flour, manufacturing, J. W. Collins 217,066
Flower stand, Judson & Hancock 217,010
Folding chair, D. N. Selleg 217,025
Food, preparation of corn for, H. Tilden 217,171
Fuel, device for decomposing water for, M. W. Hazleton 217,104
Furnaces, supplying liquid fuel to, J. Rogers 216,154
Gas burner, G. Reznor 217,149
Gas meter, E. Haas 218,033
Gate, S. Hobbs 217,106
Glassware, manufacture of graduated, M. Block 217,050
Glazier's point setter, W. B. Fenton 216,950
Glove and other fastening, E. Atkins 216,931
Grain binder, J. Pagin 217,139
Grain binder, D. Williamson 217,185
Grain testing device, J. N. Stacy 217,165, 217,166
Guano distributer and seed planter, J. W. F. Gilreath 217,090
Gun for firing signal cartridges, E. D. Kendall 217,116
Gutter hinges, securing metallic, A. W. Decrow 217,002
Hammer for posting bills and cards, W. Hart 217,101
Harrow, M. S. Blair 216,933
Harrow, Falck & Neff 217,084
Harvester cutter, F. M. Conner 216,941
Harvesting machine, S. Johnston 216,960
Hat shaving machine, R. Eickemeyer 217,079
Hay loader, D. C. Jewett 217,110
Hinge, spiral spring, I. Buckman 217,054
Hinge, spring, L. Bommer 217,051
Hitching device for animals, C. E. Haynes 217,103
Hitching post, E. S. Elmer 217,094
Hog cholera compound, E. Twomley 217,029
Hogs, device for forming and inserting rings in the noses of, O. A. Essig 217,082
Hoisting drum and shaft for windlasses, etc., T. A. Weston 217,031
Horse detacher and brake, combined, Kaplan & Illowy 216,962
Horse power, A. P. Benjamin 217,047
Horseshoe, H. G. Yates 217,187
Hose, universal joint for fire engine, B. Holland, Jr 217,006
Hub attaching device, G. Finkbeiner 217,086
Hydrocarbon burning apparatus, S. C. Salisbury 216,977
Ice cream freezer, J. McAnespey 217,130
Incubator, Leonard & Maury 217,121
Incubator, E. S. Renwick 217,148
Insects, powder duster for destroying, W. B. Allen 217,040
Iodine and bromine, manufacture of, J. N. J. Dubreuil 217,076
Kitchen or bath boiler, R. Wells 217,181
Knitting machine, W. H. Abel (r) 8,779
Lacing hooks, Setting instrument for attaching, E. Maynz 217,018
Lamp collar, R. D. Haines 217,095
Lantern, magic, Rhind & Shirley 217,150
Latch, J. R. Payson 217,140
Leather skiving machine, Dancel & Smith 216,948
Loom shuttle motion, G. Cuthbert 216,947
Loom stop motion, F. O. Tucker 217,028
Loom temple bracket, J. B. Stamour 217,167
Lubricator, L. J. Crecelius 216,943
Manure distributer, J. M. Chastain 217,060
Marquetry, E. F. Masselin 217,129
Metal tubes, machinery for the manufacture of, Payton & Bourne 217,141
Milk jar cork, A. Cunningham 217,072
Milk, vessel for setting and cooling, D. Lockhart 217,122
Moulding machine, L. Wenchel 217,183
Oil tank, cabinet, F. C. Wilson 217,034
Organ bellows, J. J. McLaughlin 216,965
Organ, reed, S. J. Crockett 216,964
Packer for oil wells, O. B. Latham (r) 8,785
Packer, metallic, A. Cunningham 216,946
Packing for deep wells, Robinson & Strong (r) 8,786
Paneling machine, J. W. Groff 217,005
Paper box, Osborne & Heinig 217,190
Paper tubes, machine for making and cutting, M. F. Wilson 217,035
Peat machine, E. P. Hudson 216,958
Petroleum, centrifugal apparatus for treating, Christopher & Squire 217,063
Pile guide, M. Parks 216,970
Plane, bench, J. Siegley 216,979
Planter, corn, C. E. Beckwith 217,046
Planter, corn, A. C. Evans 217,083
Planter, potato, M. Bockman 216,934
Planter, seed, W. E. Kelley 217,113
Post office box, L. Yale, Jr. (r) 8,783
Post office box front, C. J. Clements 217,069
Printer's galley, T. T. McNish 217,132
Printer's roller, R. Lanham 216,964
Printing machine, sheet delivery apparatus, L. C. Crowell 217,071
Printing machines, bunter mechanism for, J. H. Cranston 217,069
Printing press paper plier, O. Wakefield 217,177
Projectile, I. L. G. Rice 216,974
Pulley, J. Mackie 217,128
Pulley covering, J. J. Adgate 217,038
Pump, Garlock & Cooke 217,089
Pump, W. Loudon 217,126
Pump, F. D. Tuttle 217,175
Punch, G. C. Ainsworth 216,992
Rag machine, T. W. Harding 217,100
Rail, cellular, G. B. Field 217,085
Railway brake automatic, T. Potter 217,144
Railway rails, track bar for raising, J. W. McClure 217,131
Railway switch, self-acting street, T. Sharts 216,978
Railways griping device for wire rope, J. Hansen 217,096
Refrigerator, J. Bostwick 216,935
Rods and tubes, machine for straightening and smoothing, J. Nuttall 216,967
Rotary cutters for mouldings, manufacture of, L. Wenchel 217,182
Sad iron heater, H. H. Brown 216,936
Saddle, harness, W. S. Webster 217,179
Sash cord, guide, F. S. Clarkson 216,940
Sash holder, E. Bernhardt 217,056
Sash holder, J. S. Blinn 217,049
Saw guide, sawmill, A. Zachmeier 217,189
Saws, metallic liner and slab guard for, Kendall & Hall 217,114
Sawing machine, drag, W. W. Giles (r) 8,782
Scoop, sifter, and strainer, combined, L. E. Brown 216,996
Scraper, farm and road, J. J. Lowe 217,016
Screw heads, etc., machine for burnishing, C. D. Rogers 217,024
Scrubber, floor, J. Epting 217,081
Seeder, J. Richey 217,151
Sewing machine, J. W. Corey 216,942
Sewing machine, C. Junker 217,112
Sewing machine, D. Whittemore 217,184
Sewing machine, quilting attachment, D. Riker 217,152
Sewing machine take-up device, G. W. Baker 216,994
Shelf stand, rope, F. W. Rottmann 217,156
Shoe patterns, adjustable model for, H. Nelson 217,137
Soldering device, A. Barker (r) 8,781
Speed regulating and braking, automatic friction brake and hand lever brake for, T. A. Weston 217,090
Spinning mechanism, ring frame, J. W. Wattles 216,987
Spool, Woodbury & Gray 217,186
Stamp, perforating canceling, J. L. Tucker 217,173
Stand pipe, Lewis *et al* 217,013
Steam engine, Garlock & Cooke 217,098
Steamer and drier, grain, S. Brooke 217,053
Stirrups, machine for bending wooden, J. Welch 217,180
Stool, camp, E. Waters 217,178
Stove pipe, adjustable, J. P. Abbott 216,991
Stove pipe, joint, E. L. Case 217,059
Stoves, back fire-wall for, H. H. Crull 216,945
Strainer, tea and coffee, O. H. Buckley 217,055
Table and safe, combined, D. J. Davis 217,074
Tanning deer skins, L. W. Avery 217,042
Telephone, C. T. Dickson 217,003
Thill coupling, C. E. Brainerd 217,052
Thrashing machine, J. Alionas 217,039
Ticket clasp, W. H. Poole 216,972
Torpedo boat valve, J. L. Lay 217,120
Torpedo, marine, H. F. Knapp 217,011
Toy hoop propeller, C. Koehl 217,118
Tube cleaner, J. S. Smith 217,164
Tubular boiler, upright, C. Hart 216,953
Tug link, H. J. Moreland 217,020
Umbrella, Hodges & Healey 217,108
Urn for hot water, tea, etc., revolving, J. Meinen 217,133
Valve, balance, Moore & Pertz 217,019
Valves, machine for trimming circular, G. L. Miller 216,966
Vapor burner, C. Wintergerst (r) 8,784
Vehicle perch end, Carlton & Baker 216,938
Vehicle spring, E. P. Carter 216,939
Vehicle spring, W. Henry 217,105
Vehicle spring, F. A. Hill 216,956
Vehicle spring, P. F. Sticker 216,982, 216,983
Vent spout for bottles, etc., J. Luckhardt 217,127
Ventilating ships, J. L. Foulis 216,951
Wagon box, J. L. Russell 216,976
Wagon platform gear, C. E Hagaman 217,094
Water closet seat, urine guard for, D. Smith 217,163
Water trough for hogs, J. F. Elliott 217,080
Weigher and register, automatic grain, W. H. Allen 216,929
Wheelbarrow, H. Clark 216,999
Wind wheel, J. A. Creasey 217,070
Wind wheel, C. Lohnes 217,125
Windmill, E. N. Cowdery 217,067
Windmill, J. J. Reed 217,147
Windmill, W. A. Wheeler 217,033
Windmill motor, A. A. Stuart 217,026
Wire cutting and bending die, F. Irwin 217,007
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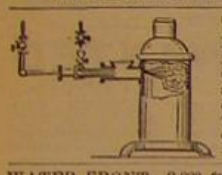

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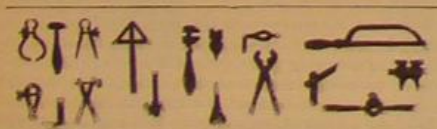

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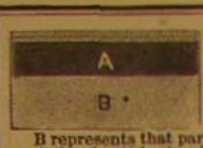

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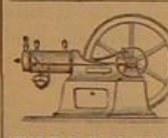

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Vol. XLI.—No. 7. [NEW SERIES.] NEW YORK, AUGUST 16, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

AMATEUR MECHANICS.

METAL SPINNING.

The operation of spinning metals, although exceedingly simple and capable of being practiced to advantage in almost every shop, and also by the amateur mechanic upon the foot lathe, is not generally understood. One reason for this is that the artisans who follow this branch of mechanics as a business usually conduct it under locked doors, and it is with considerable difficulty that the amateur in search of information on this and kindred subjects can obtain entrance to one of these establishments. The reason of this secrecy is plain enough, as the "kink" or "wrinkle," or, in plain English, the knowledge required to do the mechanical part of spinning, is so slight that secrecy is the only protection.

The tools required are few. They consist of a lathe; a form or mould on which to shape the article; a tool rest with a series of holes for receiving a pin to keep the tool from slipping, and a few spinning tools or burnishers of different sizes and shapes.

The lathe the amateur is supposed to possess; the tool rest he may easily make; and the only other addition to the lathe will be a back center of the form shown in Fig. 2. This form of center answers as a step to the work holder, and will bear considerable pressure without undue friction.

The tools required are shown in Figs. 3, 4, and 5. These are simply hard steel burnishers of the form shown, and varying in size, with the size and kind of work to be done. The size given in the engraving is about right for amateur work on the foot lathe. Fig. 3 shows in two views a ball tool. Fig. 4 shows both side and edge views of a curved

TOOLS FOR METAL SPINNING, AND EXAMPLES OF SPINNING.

tool. Fig 5 shows a plain round burnisher. In some instances it may be necessary to make tools of different forms. The operator will be guided in the selection of his tools by the particular work in hand, and practice will bring new suggestions as to tools and the manner of using them.

The materials generally used in spinning are brass, copper, zinc, britannia metal, and lead. All of these may be worked on the foot lathe, but perhaps the amateur will derive the most satisfaction at first by using britannia metal, as it works easily and does not require annealing. Articles in this metal also present a handsome appearance when done, whether simply polished or plated. Zinc must be spun quite hot. Articles of brass, if of considerable depth, must be annealed when partly done.

The form on which the metal is spun may be either hard or soft wood or metal. A good close-grained pine answers as well as anything for most purposes, and is very readily turned to the required form. It may be attached to the face plate, B, and the disk to be spun may be held against it at first by a hard wood or metal piece, C, as shown in Figs. 6 and 7, which is forced against the disk by the tail center. After the spinning is a little advanced, a cup-shaped holder is applied, as shown in dotted lines in Fig. 7. Sometimes the holder is secured by a bolt that runs through both it and the form or mould, as shown at D, Fig. 8. In some cases a little rosin is applied to the form to increase the friction, but this is rarely necessary. The motion of the lathe should be quite rapid, and the disk should receive a coating of grease (lard or heavy oil) before applying the burnisher. A very strong solution of soap may be used instead of oil. The position of the workman and the manner of holding the tool may be seen in Fig. 1. It will be noticed that the pin in the tool rest serves as a fulcrum for the tool, which must be brought with considerable pressure against the surface of the disk. This pin is moved forward from time to time as the work advances. The movement of the tool may be seen in Figs. 9 and 10, and the shape taken by the metal in front of the tool will also be seen. In swinging the tool toward the form it is moved in the direction of the arrow as shown in Fig. 9, and it is carried back as shown in Fig. 10. This last operation is very essential to the proper fitting of the mould, and it also thickens the metal. Too much should not be attempted at a time. A succession of quick movements, as indicated in Figs. 9 and 10, under a moderate pressure, is much better than to do a great deal of execution at a single stroke. Should the metal tend to vibrate or buckle, a piece of wood may be applied to the back with the left hand as shown in Fig. 8.

The method of spinning a cup or pot without a form is illustrated in Fig. 11. Here the metal is supported by a plain cylindrical mandrel, and is first spun into the form indicated by the dotted lines, and then bringing the burnisher on the return stroke only to the shoulder which forms the larger part of the vessel. For small work on the foot lathe the handles of the tools need not be as long as represented in Fig. 1. The length commonly employed for wood turning tools will answer.

To spin a ring a mandrel like that shown in Fig. 12 will be required. A plain flat ring placed between the shoulders of the mandrel is pressed upon by the roller seen above the mandrel until the ring assumes the desired form. Napkin rings are made in this way. Fig. 13 shows a concave reflector. Fig. 14 represents a simple cup formed of two pieces. Fig. 15 represents a small vase made of three pieces, the smaller end of the upper or conical part and the upper portion of the base piece being soldered in a spherical connecting piece. The two halves of the ball Fig. 16 are made upon the same form. The edges are beveled and soldered together. The pitcher, Fig. 17, is made of five spun pieces, a short cast and turned piece that unites it to its base, and a handle made of square wire. The card receiver, Fig. 18, has a spun top and base, and a cast standard. The vase, Fig. 19, consists of four spun pieces and three legs of square wire, uniting the body with the base. Fig. 20 shows a base for a magnetic needle or other small apparatus. Fig. 21 represents a vase composed of seven spun pieces and two handles of square wire. More complex examples of work done by the process of spinning might be furnished. The ones given are undoubtedly sufficient to enable the amateur to get an idea of the endless variety of articles that may be made by this simple and easily acquired art. M.

A Boy's Promptness and Courage.

Perhaps the most remarkable exhibition of pluck and promptness on record is that of a miner's son recently at Hollis, Ill. It is said that the father, Thomas Harland, lighted a slow match leading to a blast, and signaled to be drawn up the shaft. He struck a projection and was thrown back to the bottom of the shaft, where he lay with a rib broken. Realizing his father's peril, Harland's young son slid down the seventy feet of rope, lacerating his hands terribly, but reaching the bottom in time to tear the match from the fuse and prevent the explosion.

A GENUINE case of spontaneous combustion occurred on the 1st of July in a drug store on Biddle street, St. Louis. The proprietor, in anticipation of the "Glorious Fourth," had prepared four jars of "colored fire," and placed them on the shelves, not dreaming of any trouble from them, but in plain view of several persons present at the time, one jar exploded, shattering the other three, and quicker than can be described a lively conflagration was in progress.

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VOL. XLI., No. 7. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, AUGUST 16, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 189,
For the Week ending August 16, 1879.

Price 10 cents. For sale by all newsdealers.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The twenty-eighth meeting of the American Association for the Advancement of Science will be held at Saratoga, commencing on Wednesday, August 27. The headquarters of the association will be at the United States Hotel; the general sessions will all be held at the Town Hall. The meeting will occupy about a week, which will be devoted to the usual addresses of the president and the two vice-presidents and the reading of papers on different scientific subjects before the several sections of the meeting to which they are appropriate.

The meetings of the association are a matter of great interest each year to its large membership, and are perhaps entitled to more general public sympathy than they have yet received. In the several cities of the Union where the association has hitherto held its meetings it has been most hospitably entertained, and this was notably the case in Buffalo in 1876, where the presence of Prof. Huxley and a numerous body of eminent foreign men of science, who had come to the United States to attend the Philadelphia Centennial, stimulated the enthusiasm of the citizens. But the association is entitled to a serious hold upon the regard of the people generally, and it will be its own fault, perhaps, if it fails to make a strong impression upon the community at each annual session. It numbers among its members the most eminent men of science in America, a fair representation of the younger students, besides a number of persons from all professions, swelling its membership at the present time to nearly one thousand. In its organization and plan of meeting the American association resembles the British and French associations in spirit, if not always in detail. It is divided into two sections, A and B, the first devoted to mathematics, astronomy, physics, chemistry, and mineralogy, the second to geology, zoology, botany, and anthropology.

The meetings are, of course, devoted more or less to the reading of papers on special subjects, and to encourage all who take an interest in scientific studies the examining committees have always been generous in their judgment. As the result of each meeting a handsome volume is issued, which owes its excellent typographical appearance and arrangement of matter to the long continued labors of the permanent secretary, Professor F. W. Putnam, of Cambridge. The finances of the association are satisfactory, but have been crippled in the past by the attempt to publish too large an annual volume. The papers, which undergo a second sifting before printing, are all worthy of issue by the association, and among them, indeed, are some of the most noteworthy additions to our knowledge, both in physics and biology. But some papers printed by the association would have better found their medium of publication in the proceedings of local scientific bodies or in special serials devoted to their subjects. Of late, while the papers have been read before the association, they have more often been so disposed of, while some authors have still somewhat needlessly occupied space in the Proceedings.

The general aims of the association would be greatly furthered if a plan of evening lectures could be entered upon, at which the public could freely attend during each session. The popularization of knowledge would in this way be assisted and the association benefited, both in reputation and in membership, by identifying itself more boldly than it has yet done with the cause of popular instruction. Some attempts were made in this direction both at Nashville, in 1877, and at St. Louis, in 1878, but no definite action has resulted. We may hope that something may be effected in this direction at Saratoga.

Something of the general spirit of the association may be gathered from the subjects on which it has thought best to appoint special committees in order to further its views upon them in the community. Besides subjects of more local interest, such as a new survey of Niagara Falls, which might be left to Canada and the Legislature of our own State to arrange about, the association has a permanent committee upon weights, measures, and coinage, another to memorialize Congress in relation to meteorological researches, another on the relation of science to the industrial arts, and another on the introduction of science into the public schools. All these subjects are matters of national importance and public interest. That on the relation of science to the industrial arts, of which Prof. Thurston, of the Stevens Institute, is the accomplished chairman, has a most interesting matter to handle. Its purposes are set forth in a letter from Mr. O. Chanute, of New York, and which was read at the St. Louis meeting.

The committee proposes the issuance of a circular inviting communications from leading manufacturers, heads of public works, managers of mines, engineers, agriculturists, or business men, concerning the scientific problems or questions which may have arisen in the pursuit of their avocations and suggestions as to the subjects or points upon which they may think there exists a lack of scientific elucidation. Upon the results of this circular the committee propose to publish annually a list of such points and subjects, and invite papers upon them from members of the association. Further, the committee propose to induce subscriptions by which prizes may be offered for the best papers on the subjects so selected.

The committee on the introduction of science into the public schools certainly yields to none established by the association in interest at this time. Under our present system education is changing and becoming more practical in its effects with every day. The old idea of education seems to have

been that certain things ought to be learned, and we hear, accordingly, that everybody should know how to read, write, and cipher. The new idea seems rather to start with the pupil, and ask what a given brain and sensory power or capacity should be taught in order to develop to the best advantage, both to the individual and to the society to which it belongs. It is owing to this newer way of looking at the educational problem that we find exact knowledge or science coming to be preferred to ancient languages, for instance, or, generally, to metaphysics. At the present time it is needful to insist upon the value of science in general culture. Nothing else leads to firmer and yet less prejudiced thoughts, while the material and moral advancement of the nation must always ultimately depend upon the exactitude of its information. The committee of the association on the teaching of science has a work before it of which we trust it will not be neglectful. In his vice-presidential address at St. Louis, Professor Aug. R. Grote, who was chiefly instrumental in the formation of the committee, says: "The demand has come up from teachers throughout the country that they should be better informed as to the manner in which the sciences may be introduced into the schools and the matter to be taught. It is the duty of this association to furnish the information. If we have not sympathized with this inquiry in the past, let us assist it in the future. It is quite evident that the sooner this association commits itself as a matter of principle to the furtherance of science among the people the more following it will have and the greater influence. And if it does not it will fall behind its peculiar duty and out of the line of advance in human thought. This association must be prepared to demand more time for scientific studies from the public school authorities, and it must show to every one that education is a matter which not only falls properly under its cognizance, but which it is also prepared to take hold of. This association should no longer delay to bring all its forces to bear upon the question of science as applied to education. While it does not do so, it will always seem to shirk a duty and ignore one chief end of its existence."

We may informally point out at the present time some of the directions for improvement in our common school system:

First.—The establishment of primary schools for children between five and nine years of age, where no books are to be used, and object teaching is to be relied on for instruction in the several branches. The hours for tuition to be less than is now the practice in teaching children between these ages.

Second.—The introduction of physical, natural, and social science in the common schools, while the present teaching of grammar, geography, and declamation may be curtailed, and, in part, discontinued. The outlines of mechanics and industrial arts received in the public schools will assist the pupils in their after lives.

Third.—The establishment of a higher grade of schools in which an outline at least of the university course be pursued. The tuition to be by demonstrative lectures, and degrees to be conferred which will carry weight in professional and governmental examinations.

Fourth.—The entirely secular administration of the schools and the teaching of morality without being associated with any system of theology. This reform we seem to clearly owe to the spirit of our republican government and to a national sense of justice.

The time is at hand when our public school system must be extended in its practice, or fail of its legitimate results. The people not only demand better, fuller, and more practically useful tuition, but from an outside point of view it is evident that we need as a nation that liberal thought which only comes from a rounded knowledge. If the association can assist this development through its permanent committee on the introduction of science into the schools it will earn the gratitude of all thinking people in the community.

At its St. Louis meeting last year the American Association elected a limited number of fellows, choosing among its members Mr. Thomas A. Edison, of Menlo Park, N. J., and of world-wide fame as an inventor, for that honor. Its president for the Saratoga meeting is Prof. Geo. A. Barker, of Philadelphia, whose reputation as a physicist and chemist is already extended. The Saratoga meeting will listen to an address from its retiring president, Prof. O. C. Marsh, of Yale College, which will be heard with interest, in addition to addresses from the two vice-presidents of the meeting, Prof. Langley, of Alleghany, and Major J. W. Powell, of Washington. The papers to be presented bid fair to be of more than average interest in many departments, and the most noteworthy will be reported in the SCIENTIFIC AMERICAN.

SANDAL WOOD.

Dr. Berthold Seemann, the eminent botanist, in calling attention to the commercial importance of sandal wood, remarks that "the trade in this fragrant wood has been going on since the dawn of history, and will probably not cease until the connection between sandal trees and idolaters, existing from time immemorial, shall have been broken up by either the one or the other becoming as extinct a race as the Archyopteryx, the Moa, or the Dodo. The religious sentiment of millions of human beings is still intimately associated with this wood. When the Hindoo or Buddhist beholds its smoke curling heavenwards he feels that he has acted up to his religious duties, and that the perfume smelling sweetly in the nostrils of his deity will cover a multitude of sins."

Some of the most ancient records inform us of the prominent part played by the wood in India; and since the introduction of Buddhism into China that country, destitute of sandal trees, has become the principal market for this important production. A piece of wood of the diameter of four to six inches is considered as the most acceptable offering a person can make to the idols of the temples. Large pieces are presented by the rich on particular occasions. The perfume of the sandal wood, which has been held in high esteem throughout tropical Asia for ages, is due to an essential oil residing chiefly in the heart of the tree and near the root, the outer parts of old trunks and young trees being almost destitute of scent. Hence the sandal cutters carefully remove the outer and generally lighter portion of the wood, which they term "sap." The oil is made upon the spot where the trees grow. It is wonderfully strong and penetrating, and is easily extracted, a pound of wood yielding about two drachms. In 1872–73, 10,348 pounds, valued at about $42,000, were imported into Bombay, from whence most of it was exported to other countries. The oil dissolved in spirits and sweetened with a little oil of rose, forms the handkerchief perfume—"Extrait de bois de santal." From the fact that it mixes favorably with otto of rose it is often used for adulterating that article. Within a few years past the oil has been considerably used in medical practice in the treatment of gonorrhœa. It was once used, too, as a stimulant and sudorific, but is no longer employed for such purposes.

Santal wood is the product of several species of the genus *Santalum*, of the natural order *Santalaceæ*. The genus is composed of about twenty members, spread over Asia, Australia, and Polynesia, and in habit is best compared with the myrtles. The most easterly species of the genus is *Santalum insulare*, found in the Marquesas Islands and Tahiti, where it is known as "eai;" the southernmost, *S. cunninghamii*, is found in New Zealand, and is known there as "mairi;" the northernmost, *S. pyrularium* and *S. freycinetianum*, are natives of the Sandwich Islands, where they are called "lau ala;" and the most westerly, *S. album*, is indigenous to the Indian Peninsula. All the species prefer dry, rocky localities, and, commercially speaking, degenerate in quality when they grow in moist places.

Santalum album and a marked, though inferior, variety known as *Myrtifolium*, grow on the mountains of continental India and the Indian Archipelago; Mysore, Malabar, and Canara being the principal districts The tree usually attains a height of twenty-five feet, and when it is allowed to exceed these dimensions is generally found rotten at the core. After felling the trees the bark is removed at once, the trunks are cut into billets two feet in length, and these are buried in dry ground for about two months, during which time the white ants eat away all the outer wood without touching the heart. The latter constitutes the sandal wood of commerce. The billets are afterward smoothed and sorted. The deeper the color the stronger the odor, hence merchants often divide sandal into red, yellow, and white sorts. In general, also, the nearer the root the more powerful the perfume; care is therefore taken, by removing the soil, to cut as low down as possible.

The chips and fragments removed in the process of smoothing the billets and squaring their ends, and the smaller sized billets, suit the Arabian market best; and from these is distilled the essential oil, so much esteemed in Turkey. The larger billets are sent to China, which affords the best market for this wood. In 1866 there were received at the various ports of the latter country 5,197 tons. The smaller billets are used in India. The reputation of sandal wood in Europe rests chiefly on its excellence as a material for carving, and it is manufactured into a great variety of elaborately marked card cases, work boxes, card trays, fans, walking-sticks, etc. Dr. Hunter, some years ago, showed that it was admirably adapted for wood engravings. Some blocks yielded upward of 20,000 impressions without wearing out. The best wood for the engraver's purposes is the dark colored, five inches in diameter, grown on rocky soil.

In old English works sandal wood is sometimes called "Sanders wood," but our present form, "sandal" (which is the Arabic name for it), is more correct. The Chinese call the word "tan-heong" (scented tree); on the Malabar coast it is termed "chandana cotta," while the Polynesian species go by the generic name of "ahi," which in Fijian becomes "yasi;" in Eromangan, "nassau;" and in Tanna, "nebissi."

THE SYSTÈME SÉBILLOT.

A French engineer, M. Sébillot, has developed a plan for a ship railway across the Isthmus of Panama, with an alternative scheme involving a ship canal 30 kilometers long from Aspinwall to the mountains, a railway of 33 kilometers over the mountains, and another canal of 10 kilometers on the Panama side, or about 25 miles of canal and 20 of railway.

M. Francis A. Kieffer, of Paris, representing a syndicate of Parisian bankers and speculators interested in this system, arrived in New York July 23. M. Kieffer says that as long ago as 1873 the Colombian Government granted M. Sébillot permission to construct such a ship railway over the mountains of the isthmus.

The plan contemplates a railway with rails fifteen times as heavy as the ordinary T rail, to be laid twelve meters apart. Over this road vessels up to 7,000 tons burden will be transported in immense docks or cars, supported by wheels a foot thick. The driving power will be placed in the docks themselves under the bulge of the vessel, and will be applied directly to the wheels under the dock. M. Kieffer claims that these docks will be capable of a speed of fifteen to eighteen kilometers (nine to eleven miles) per hour, and that the whole distance from ocean to ocean can be traversed in five hours. The entire cost of construction he estimates at 250,000,000 francs ($50,000,000), while the ship canal favored by M. De Lesseps will demand a capital of 1,500,000,000 francs ($300,000,000). He also says that the tariff on vessels passing over this railway need not be higher than $1.50 per ton, against $3 per ton by canal, to yield a fair percentage on the capital, and that while seven years must elapse before the canal can be completed, the railway can be in operation at the end of three.

It is reported that M. Deitz Mounin, who was president of the French department in the Paris Exhibition of 1878, is at the head of the syndicate which M. Kieffer represents, and M. Emile Jupy, of the well known Parisian clock manufactory, is its secretary. M. Sébillot was the engineer-in-chief for the Martune Arsenal at Foo Choo, China.

A SANITARY CAPTAIN EADS WANTED.

The success of the jetty system at the mouth of the Mississippi makes that grand river a possible channel for a large part of the commerce of twenty States. What that commerce may amount to when the Mississippi valley harbors a hundred million people, as it is likely to in the near future, it is impossible to estimate. It is enough to foresee that it will surpass anything in the way of river traffic that the world has yet known, provided the sanitary condition of the Lower Mississippi is such as to allow commerce a safe and steady passage that way.

Captain Eads has shown how the Mississippi can be entirely freed from the physical barriers which have hitherto impeded the commercial development of that noble water-way. But, however perfect the channel, commerce will not adopt a route liable to annual interruption by pestilence. Trade cannot brook diversion or delay. No more will it subject itself to liability to interruption. Of greater importance even than thirty feet of water is freedom from sanitary risks. Sand bars are but negatively harmful; pestilence is positive. The Mississippi must be made as healthy as the Hudson before its commercial possibilities will begin to be developed. Sanitary science must complete the work which engineering has begun. The great need of the Mississippi valley, commercially as well as socially, is a sanitary Eads. May he come speedily.

The Scientific American in Italy.

One of our contemporaries says: The English Consul, Colnaghi, reporting from Florence, Italy, states that in steel rails and locomotives, and in Sheffield tools and in machinery (turning lathes, etc.), German enterprise is gradually pushing us out of the Italian market, and also endeavoring to push their goods in Italy, and to this end a newspaper called the SCIENTIFIC AMERICAN, chiefly devoted to the hardware interest, is widely distributed throughout the country.

The English Consul probably intended to say, instead of German, that American enterprise was gradually pushing goods into the foreign markets.

American Institute Exhibition.

Application for space should be forwarded at once to the General Superintendent, room 29, Cooper Union building, New York, and all details arranged through him with as little delay as possible. Persons familiar with the exhibitions annually given by this institute are aware that one of the great troubles with which the exhibitor has to contend is that of insufficient space. As all applications which comply with the rules are considered in the order of their coming, it is therefore evident that better location is secured by the early than by the late applicant. The Exhibition will open on the 17th day of September.

The Toronto Exhibition.

The Industrial Exhibition to be held at Toronto in September next, promises to surpass anything of the kind hitherto attempted in Canada. The Governor-General is patron of the association, and his Excellency, with H. R. H. the Princess Louise, have consented to open the Exhibition. Large additions are being made to the already commodious buildings on the Exhibition grounds. The Exhibition will be opened September 1, and will continue until September 20. The prizes offered aggregate $20,000.

American Cutlery in Sheffield.

A correspondent of the New York *Herald*, writing from Birmingham, England, says that recently a leading manufacturer in Sheffield showed his workmen an assortment of American made goods, and, taking up a pair of tailor's shears, offered to give the Union £50 if any one of his men, in a month, would produce one pair of shears as good as the American sample.

SUPERVISION has in it three elements—knowledge, counsel, and authority. A knowledge of each teacher's doings is the radical feature of the superintendent's office. Without that knowledge his office is practically vacated. What sort of superintendence is it, when the officer is in ignorance of the very thing he is appointed to superintend? This knowledge should be gained primarily by personal inspection, and secondly by correspondence, and thirdly by proxy.—*Superintendent Schools of Virginia.*

Another Juvenile Prodigy.

The latest addition to the long list of juvenile prodigies, in respect to memory and mathematical accuracy, is reported from Maine. He is, says the Bangor *Commercial*, the son of a former postmaster of that place, and is now ten years of age. He is untaught, save in the art of reading, to which he appears to give more attention than wiser parents would allow. His strong point is memory. He recollects not only everything that he reads, but everything that he does, remembers on what day he did it, where he was at the time, and what were the circumstances that led him to do it. For instance, he will tell where he was on any day within the past two years, and what he was doing. Further, he remembers and can tell everything that his friends have done, providing he has seen them do it, and can tell on what date and on what day of the week they did it.

The first that his friends noticed of his precocity was about a year ago, when they accidentally discovered that he was almost infallible on any date he had ever seen or heard. Walking in company with some relatives in a cemetery it was observed that he would look at a tombstone, read the date of the death recorded, and the exact age of the person buried there, then glance up and tell on what day of the week the dead person was born. This happened on several occasions, and but little attention was paid to it. Finally one of his relatives took pains to look into an old almanac covering some of the dates he had mentioned, and found that the day of the week had been given correctly in every instance. This caused them to ask him questions, when it was discovered that he could almost instantly tell the day of the week on which any date within the last 75 years fell.

In a series of tests made by the *Commercial* writer, the boy gave the day of the week corresponding to a large number of dates between 1812 and 1840, gave it correctly in every instance, and averaged five seconds for each test. The longest time required was eight seconds, the shortest three seconds. His habits are described as "peculiar."

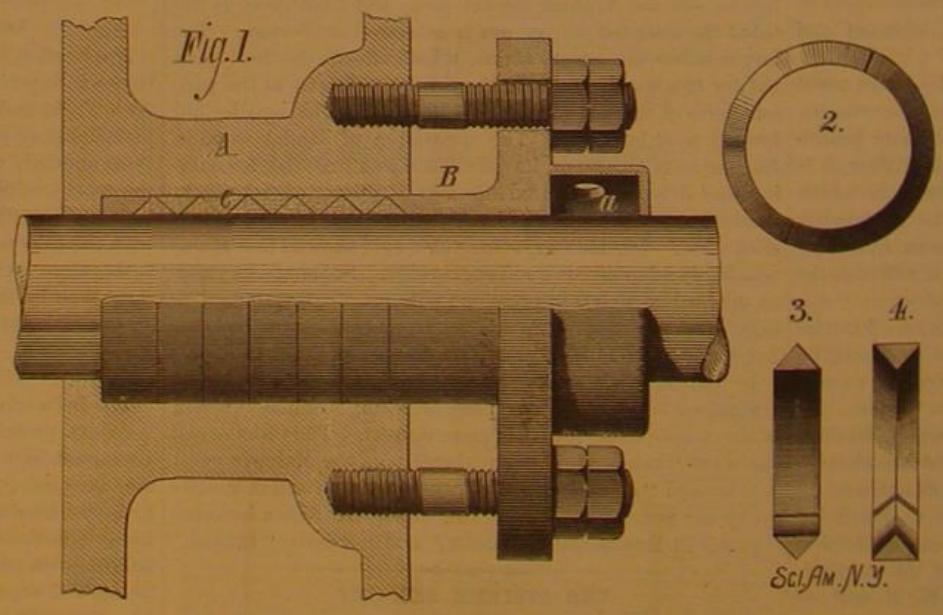
"He never plays with other boys, but is continually busy in reading. Oftentimes he takes an unabridged dictionary and studies it hour after hour, never seeming to consider it anything but a pleasure to do it. In fact he takes no comfort unless busying his brain about something. If there is anything he does not understand he keeps at it till he does understand it, and then it is next to impossible for him to forget it. One would naturally suppose that a child with such unusual powers would gradually fail and fade away, but, singularly enough, he is constantly growing stronger and more healthy."

It is to be hoped that the last assertion is strictly true, and that the precocious youngster will not exhaust his brain power in infancy. The chances, however, are heavily against him. His name is Charles Fuller.

A NEW PISTON ROD PACKING.

We illustrate herewith a novel piston rod packing recently patented by Mr. John Hewitt, of 1323 S. Jefferson avenue, St. Louis, Mo. The invention consists, essentially, of a series of beveled rings placed in the stuffing box and retained by the gland, the rings being beveled on opposite sides. In Fig. 1, in the engraving, the stuffing box is shown in section, and the gland and packing rings are broken away to show their form more clearly. Fig. 2 shows the face of one of the rings, and Figs. 3 and 4 are diametrical sections of internally and externally beveled rings.

The stuffing box, A, is of the usual form, and the gland, B, does not differ materially from those in common use. Its inner edge that comes against the packing is beveled, and it is provided with an oil chamber, *a*. The packing, C, consists of a series of soft metal rings which are triangular in cross section, as shown in Figs. 3 and 4. One half of the rings are beveled upon the inside, the other half upon the outside. These rings alternate in position, as shown in Fig. 1. When the gland is forced against the packing thus arranged, the rings that are beveled on the outside are forced against the piston rod, while the rings that are beveled on the inside are forced against the sides of the stuffing box. In this manner the joint between the rod and the packing and between the packing and stuffing box is made perfectly steam tight. We are informed that this packing will wear a long time without adjusting the gland, and that the wear of the piston rod is less than with other kinds of packing. The oil chamber, *a*, is filled with cotton waste for the purpose of feeding oil to the piston rod.



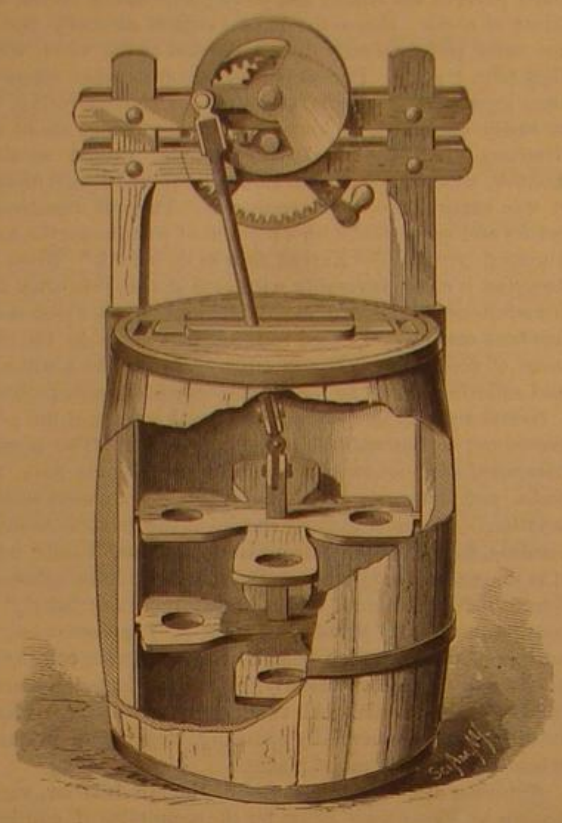
HEWITT'S PISTON ROD PACKING.

St. Petersburg as a Seaport.

The canal from Cronstadt to St. Petersburg is progressing so rapidly that Admiral Possiett, who directs the work, assures the Russian Government that in a year's time vessels of small size will be able to pass from the sea to the Neva, and that in the summer of 1881 the canal, the depth of which is fixed at 20 feet, will have been excavated to the extent of 16 feet, enabling a goodly sized craft to reach the capital.

AN IMPROVED CHURN.

We give herewith an engraving of an improved churn recently patented by Mr. Joseph N. Parker, of Titusville, N. J. The dasher consists of two pairs of cross arms fitted horizontally on a short dasher rod and arranged to slide in ways in the side of the churn. The dasher is reciprocated by gearing supported by a frame attached to the side of the churn. The rod that connects the dasher with the crank passes through a slide in the churn cover, and works through a slot in the cover, which is covered by the slide. The crank



PARKER'S CHURN.

is counterbalanced to insure a smooth action of the machinery. When the churn is driven by power a pulley may be placed on the crank shaft; when it is driven by hand a pinion is placed on the crank shaft, and driven by an internal gear wheel supported by the lower cross bar of the frame. The arrangement of the gearing is such that the churn cover may be readily removed without disturbing the frame that supports it. The mechanism is simple, and the inventor claims that it is very efficient.

Value of a Trade Mark.

The value of a trade mark met with a striking exemplification in Louisville, Ky., recently. Milton J. Harvey, of New York, member of the firm of P. Moorman & Co., brought suit in the United States Court to dissolve the firm. The firm have been large whisky operators, the J. H. Cutler brand being a specialty, and the New York, Boston and California markets being their principal centers for operations. This brand, or trade mark, was one of the valuable assets sold by the United States Commissioner. The first bid was for $5,000, and, after the auctioneer was three hours on the stand and nearly one thousand bids were made, Chas. P. Moorman became the purchaser for $51,050. This was probably one of the most remarkable trade-mark sales ever made in this country, and shows the value of a peculiar mark by which the manufacturer seeks to distinguish his own productions from those made by other persons. This sale further shows the importance of such a privilege, and also why laws of Great Britain and the United States have been especially framed to protect manufacturers in their rights in this respect, because no honest manufacturer will invent and apply a trade mark to his wares unless he is convinced that they possess some special excellence, which he wishes thus made known; and it is desirable the public should have the benefit of such direction in the choice of their purchases as is thereby afforded.—*Chicago Journal of Commerce.*

The Electrical Balance.

Mr. Chandler Roberts, at a recent meeting of the Physical Society, gave some results which he had obtained from an examination of certain alloys by means of the induction balance. He had been able to detect a difference of one part in 1,000 in the amount of silver in two shillings of equal weight. He also pointed out that Mathiessen divided alloys into three classes—(1) solidified solutions of one metal in another; (2) solidified solutions of one metal in an allotropic modification of another metal; (3) solidified solutions of allotropic modifications of both metals. For the first class the curve of electric conductivity is a straight line; for the second, a parabolic curve; for the third, a bent line. Mr. Roberts found that the balance gave the characteristic curve for the first class with an alloy of lead and tin, and for the second with an alloy of gold and silver. With a copper-tin alloy, which is a good example of the third class, he found the curve given by the balance to be intermediate between Alfred Risch's curve of density and Mathiessen's curve of conductivity, and considers that the balance is influenced by the density as well as the conductivity of the metal interposed.

ENGINEERING INVENTIONS.

Mr. Thomas L. Lee, of Paducah, Ky., has invented an improvement in chain propellers, which consists in the combination, with an endless chain, of the paddles, each of which is formed of two right-angular plates placed together and secured by bolts passing through their horizontal or base flanges.

Mr. Benjamin S. Benson, of Baltimore, Md., has patented a traction engine and steam plow combined. It is designed mainly to move backward and forward without turning around, but is also provided with means for turning when necessary. This invention cannot be properly described without an engraving.

Mr. James T. Bryant, of Richmond, Va., has invented an improved feed water cleaner, which consists in a strainer case having an inlet and outlet orifice, a vertical chamber containing a strainer of substantially the same diameter as said inlet and outlet orifices, and interposed between the same, in combination with a discharge valve, located below the strainer, and an independent pipe communicating with the space above the strainer.

An improved link motion for steam engines, so constructed that the motion may be readily reversed, and the throw of the valves may be easily regulated to cut off steam at any desired point of the stroke, has been patented by Mr. Daniel S. Stombs, of Stillwater, Minn.

Mr. William P. Lewis, of Oroville, Cal., has patented an improved pneumatic dredging apparatus for clearing out rivers and harbors, and for mining and other purposes. It consists in raising the solid matter by creating a vacuum in the tube, and expelling it from the vacuum chamber by the assistance of the direct action of steam.

An improvement in treenails for ships, etc., has been patented by Mr. Thomas W. Kirby, of Grand Haven, Mich. This invention relates to an improvement in fastening together the strakes of the ship's ceiling, and the fastening of the ceiling to the ship's timbers; the object is to bind the strakes together in a solid ceiling, and thus strengthen the sides of the vessel.

Mr. Henry A. Norton, of Ward City, Nev., has patented an improvement in that class of railroad switches in which the switch rails are actuated by a moving train or devices carried by the locomotive; and it consists in the construction and combination of parts, which cannot be fully described without an engraving.

Messrs. Emory D. Toops and Joseph Braddock, of Waverly, Ohio, have patented an improved ditching machine, by which the soil slice is divided into two equal parts by the central cutter of the ditching wheel, and carried up and removed from the channels of the latter by the spirally curved wing or clearer, and by it delivered upon a traveling carrier, which consists of an endless belt passing around pulleys or drums, forming the bottom of a trough which projects laterally from the machine.

An improvement in steam engines has been patented by Mr. Henry A. Walker, of Charlotte, N. C. The object of this invention is to provide an improved piston connection with the driving wheel shaft of an engine and cylinders open at the ends, through which the piston rod passes, so that no stuffing boxes will be required, and the loss of power by friction be consequently reduced.

Mr. Oliver W. Barnes, of Fishkill, N. Y., has devised an improvement in elevated railways. The invention consists of a compound girder that is made of different superposed sections of wood, with intermediate layers of elastic material, the sections being firmly bolted together.

RECENT AGRICULTURAL INVENTIONS.

A reversible plow, arranged to swivel upon a vertical axis, and having a right and left mould board, made continuous by a connecting wall arranged in a plane parallel with the line of draught, has been patented by Mr. Lucius S. Edleblute, of Cincinnati, Ohio.

An improvement in horse hay rakes of that form in which the rake teeth project from both sides of an intermittingly rotating shaft, has been patented by Mr. Lucius S. Edleblute, of Cincinnati, Ohio. It consists in peculiar means for controlling the revolution.

An improved hay gatherer has been patented by Mr. Henry Grebe, of Omaha, Neb. It consists in the arrangement of a rake of proper size, provided at each end with a gate, that is pivoted on a post and connected by means of iron bands, ropes, leather belts, or some suitable means, so that when the sweep has arrived at its destination the gates can be swung around on their pivots and the hay or straw pushed off.

An improved sweep for cultivating cotton, which shall be so constructed that the parts subject to wear may be readily ground to keep them sharp, may be readily reversed and exchanged when one edge becomes worn or notched, has been patented by Mr. Charles E. Estes, of Columbus, Ga. It may be moved down to take up the wear, and may be replaced with new ones when worn out at small expense.

An improvement in vertical reciprocating churns has been patented by Mr. Joseph E. Taylor, of Frankfort, Ind. It consists in the construction and attachment to the churn body of the bearing for the crank shaft and the guide for the pitman or rod which connects the dasher staff and crank shaft.

A machine for distributing manure in rows at proper distances apart and in variable quantities, has been patented by Mr. Jeptha M. Chastain, of Gaylesville, Ala. It consists in an ingenious valve motion, which insures the proper discharge of the manure at suitable intervals.

An improved device for attachment to reapers for binding the cut grain into bundles as the gavels are raked from the reaper platform, is the invention of Mr. Daniel Williamson, of Sunbury, Pa. It is so constructed as to receive the gavels, bind them with their own straw, and drop them from the machine. It consists in a series of mechanical devices that cannot be readily described without an engraving.

An improved plow, which is so constructed that it may be readily adjusted to cut a deeper, a shallower, a wider, or a narrower furrow, as may be desired, has been patented by Mr. Amandes Hackman, of Blakesburg, Iowa.

Rotten Wood as a Pest Breeder.

Commenting on the filthy condition of the rotten wood pavements of Memphis, and their alleged influence in causing the outbreak of yellow fever there, the Baltimore *Sun* says that they have been continually denounced as foci of pestilence ever since 1873. The joints between the blocks and the ruts are so deep and so enlarged that they are soon filled in with filth, which in warm, damp weather offers a wide surface for putrefactive action and for the generation of noxious effluvia. The blocks themselves become water-soaked and rotten below the surface, so that when any one is taken out it is found to be no more than a black, pulpy mass of decay, upon which the sun is acting all the time, eliminating malarious gases from it.

The cause of the yellow fever which devastated Norfolk in 1856 was very largely attributed to the decay of wood shavings, which had been used to fill in a wharf. The Memphis pavements must supply a much larger proportion of poisonous malaria to the air than was given out by these decaying shavings at Norfolk. It is a peculiar property of half decayed wood in masses to retain moisture, to continue long in a state of slow fermentation, and to give off malarious effluvia. In country neighborhoods many a case of typhoid fever has been caused by a neglected wood pile near the house, where, upon a gradually accumulated mass of chips and sawdust that is fair enough on the outside, but rotted down to mould at the bottom, all the kitchen slops have been poured. It is a well known fact in sanitary works that hospital gangrene often results from washing the wood in floors of wards with water, and on shipboard new or moist timber is injurious to the health of the sailors. The damp timbers of the United States steamer Plymouth retained and were able to revive and propagate the yellow fever germs recently, in spite of the most careful fumigation, disinfection, and refrigeration during a whole winter. The decayed wood of the berth deck of this steamer could not be disinfected, so resolutely did it retain within itself the fever germs.

Memphis is paved with mile after mile of this sort of decayed wood, and every block, exposed to a sweltering sun, may nurse a fatal fever germ. These pavements were laid down from ten to twelve years ago, and are reported by Mr. Niles Meriwether, a civil engineer, as being "almost entirely gone from decay and hard usage, so that their rotten and honeycombed condition makes them so many cesspools and receptacles for the retention of all manner of street filth and noxious gases, and they should therefore be removed as rapidly as possible."

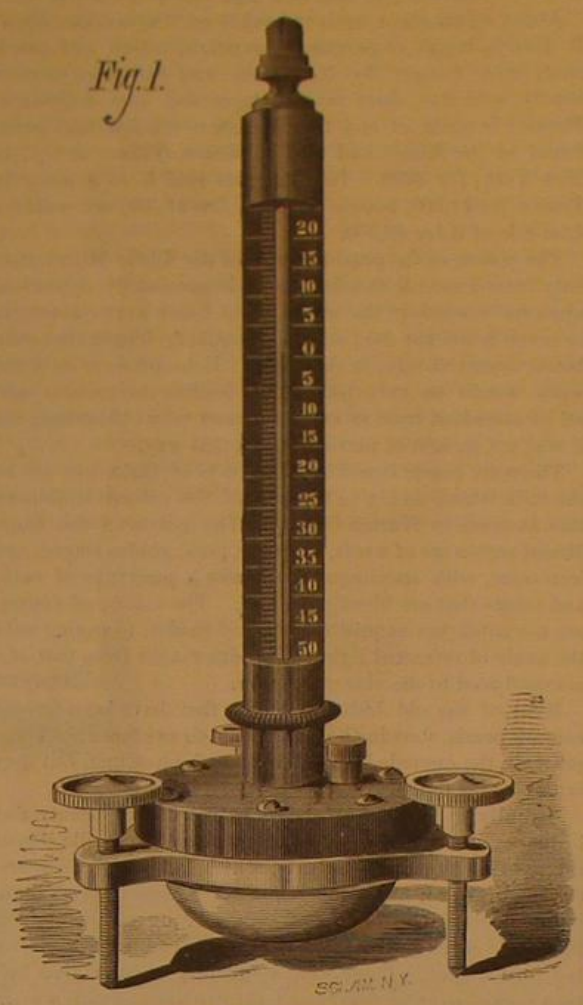
A FEW rubbing posts set up in pastures will save injury to the fences. Cattle will use these conveniences very often, and it is worth all the trouble, says an agricultural writer, to witness the enjoyment of the animals in the use of them.

NEW MAGNETOMETER.

BY GEO. M. HOPKINS.

The instrument represented in Fig. 1 is designed for the measurement of the attractive or repulsive force of magnets; it is more especially designed to measure and indicate the variations in magnetization of the field magnet of a dynamo-electric machine.

Fig. 1.

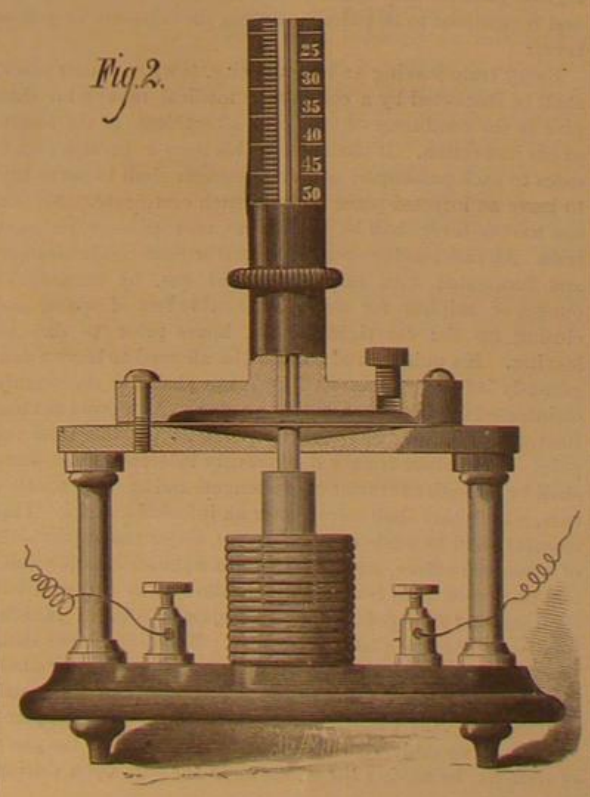


NEW MAGNETOMETER.

The changes in the resistances of the current from the modern dynamo-electric machines effect a corresponding change in the magnetism of the field magnets. An indicator that faithfully shows these fluctuations will give a correct idea of the strength of the current. The instrument illustrated does this, and it may also be used in detecting the location of the greatest magnetic force in an electro or other magnet.

The instrument shown in Fig. 2 is virtually an electrometer, as it indicates the electro-motive force of the dynamo or magneto machine when its helix is included in the electrical circuit. These instruments are quite simple, and are exactly alike so far as the upper portion is concerned.

Fig. 2.



ELECTROMETER.

The horizontal metallic plate, which in one case is supported by the columns and in the other by three milled screws, is concaved in the middle and supports a steel diaphragm that is held in place by the vulcanite cap secured to the plate by several screws, so as to clamp the diaphragm tightly.

The vulcanite cap is chambered out to receive mercury, and it has a stuffing box for holding a glass tube of small caliber. A vulcanite screw at the side of the stuffing box serves to adjust the height of the mercury in the tube. The graduations on the scale at the side of the tube represent the number of pounds of attractive force exerted on the instrument. The graduations from 0 upward indicate the degree of upward pressure when the force of repulsion is measured.

A short rod is attached to the middle of the diaphragm, and projects downward through a hole in the base plate to receive in one case (as shown in Fig. 1) a convex soft iron armature, and in the other case (as shown in Fig. 2) a cylindrical armature or core which extends into the helix.

The instrument shown in Fig. 1 may be placed upon any part of the field magnet. The rise and fall of the mercury in the tube, resulting from a deflection of the diaphragm by the action of the magnet, constantly indicates the internal condition of things in the dynamo-machine. By bending the glass tube at right angles near the vulcanite cap the instrument may be applied to the side of the magnet. It may seem that the approach of the armature toward the magnet—thereby diminishing the distance between armature and magnet—would involve an error; but the motion of the diaphragm is very slight, and in a large magnet the variation of ·02 of an inch in the distance between the armature and magnet is of no account.

The diameter of the diaphragm is 2 inches; the caliber of the glass tube, ·02 inch; therefore a very slight motion of the diaphragm is indicated by a considerable movement of the mercury in the tube.

When the repelling force of a magnet is to be exhibited the soft iron armature is replaced by a permanent magnet.

The instrument shown in Fig. 2 may be placed anywhere in the circuit, and will indicate the strength of the current. An increase in electro-motive force results in the drawing in of the iron core and a consequent deflection of the diaphragm and movement of the mercury column.

Improved Stables for Horse Railways.

The recently completed stables of the Washington and Georgetown Passenger Railroad Company, at Georgetown, D. C., are pronounced unique and perfect by a correspondent of the Philadelphia *Ledger:*

The company employ about 600 horses. Of this number about 330 are stabled at the central stables at Georgetown; the others are domiciled at other smaller stables on the car routes in Washington. At these central stables are the offices of the company, the machinery necessary to build and repair cars, elevate, store, and grind corn, cut hay, bale and press it for the supplementary stables, mix and elevate the feed, etc. Every conceivable operation is effected with ease, speed, and great economy by the ingenious application of steam power.

The offices of the company are on Bridge street, with a frontage of 90 feet. In the rear of these the commodious car house reaches 250 feet to the canal, on a level 34 feet above it. To the left of the car house stands a hospital for horses, wholly complete in itself, and isolated from the smaller stable on the east, and separated from the splendid main stable on the west by the 90 feet width of the car house. These main stables will hold about 300 horses. They are admirably divided into stalls. The floors are laid upon a solid surface, composed of a mixture of cement, gravel, and gas tar, which renders it wholly rat-proof. The story is 23 feet high, and windows everywhere admit abundant air and light. Great open ventilators run through the upper floor to the roof. A graceful and very useful balcony runs the entire length (347 feet) of the property on the canal side, whereon the bedding is sunned and aired. Across a short and wide alley at the southwest corner of the property stands the shoeing shop on the edge of the canal.

From this point an iron bridge spans the canal and enters the third story of the great building constructed on the south side of the canal for the machinery and hay department. The ground level of this building is 34 feet below that of the stables, being also on a level with the canal. The building is 302 feet long by 63 feet wide, and fronts on the canal and Grace street, from both of which stores and supplies are received.

The engine room is located at the northwest angle of this building, and is spacious and convenient. A 35-horse power engine and 40-horse power boiler supply power through long lines of shafting for the various machines employed.

Adjoining is the coal room, with its peculiar method of unloading coal from boats. On the other side is the smith shop.

The whole width of this building, 63 feet by 40 feet, is taken up by the heavy piers upon which the three grain storage bins are erected Forty-two brick piers, 27 inches square, go down to the bed-rock and reach five feet above ground. Upon these piers are placed immense yellow pine sills, 16 by 12 inches, cross timbered above as base for these storage bins, which rise to the third floor. They contain 15,000 bushels of corn. An immense swinging elevator occupies the canal side of these bins. A single man can project this elevator through the thirty foot high doorway down into a canal boat, and discharge 4,000 bushels of corn in ten hours. From the receiving hopper, after being weighed, the corn is taken by another set of elevators and distributed in the proper bins.

Two hundred feet of this entire building at the east end is for hay storage. It is a room 200 by 63 feet by 45 feet to the eaves, and will contain 1,000 tons. Four hoisting drums

with a spider web of guys and hoist ropes, unload baled or loose hay with magical speed, either from street or boat. The operation is quick and noiseless. A platform twenty feet wide projects from the third floor into the hay room Here are located the hay cutter, and elevators to carry cut hay into the bin constructed for it on this floor. The second floor of the machinery department contains the latest improved machinery for car construction. Above it on the third floor the cars are painted and prepared for use. The cars come on tracks from the car house over the bridge, and are hoisted and lowered from story to story by means of an immense elevator in the southwest corner of the machinery building

The milling department, with its paraphernalia of mill bins, scales, shafting, etc., stands on a floor over the storage bins, and is a model. Through the wall of this room a door opens into the cut hay bin; near this, in the floor, a trap door, being raised, discovers a cavernous space, with glimpses of shafts and arms. Into this the cut hay, meal, and bran, are drawn in proportions, motion is given, and, in a few minutes, the bottom falls, the mass is taken by an elevator and thrown into a car on the milling floor, thoroughly prepared for the horses. The whole operation is so simple, so easy, and out of sight, and the feed is mixed so thoroughly, that it is most interesting to witness. The whole of this work has been done under the supervision and direction of the president of the company, Mr. Henry Hurt. How well it has been done a visit will show.

The mechanical portion of the work was designed and constructed by Messrs. Ferrell & Mucklé, of the Enterprise Hydraulic Works, Philadelphia.

Correspondence.

The Devil's Darning Needle.

To the Editor of the Scientific American:

The *Diapheromera femorata* described in a recent number of the SCIENTIFIC AMERICAN, by our distinguished entomologist, Professor Riley, is found in Iowa, but never, so far as known, so abundantly as to materially damage trees or shrubs. It is locally known as the "devil's darning needle." The time of its first appearance in the spring seems to be variable. Evidently quite young individuals, light green in color, and from three eighths to one half inch in length, have been first seen by the writer on July 3 in one case, on June 22 in another, and on May 25 in a third.

A single observation would indicate that the adult individuals may sometimes survive the winter, and may be partially aquatic in habit. About the first week in April, 1878 (the exact date not being recorded), the writer saw an adult male of the species swimming freely in a pool of water situated in a meadow, fully a quarter of a mile from the nearest grove. It swam almost wholly submerged, seeming perfectly at home in the water, and in no way disposed to leave it. The preceding winter was unusually mild.

A precisely similar case in every particular was reported to the writer about five years previously; but he was strongly inclined to doubt the statement until confirmed by his own observation. Yours truly,

W. J. McGEE.

Farley, Iowa, July 21, 1879.

Effect of Exposure on Anthracite Coal.

To the Editor of the Scientific American:

"F. G." asks, "Is there any truth in the assertion that anthracite coal loses its heating qualities after being exposed to the air for any length of time?" to which you give a dogmatic No." I have handled, in all capacities, except as a hand laborer underground, for over 41 years, anthracite coal. With this experience, I can assure you that your answer needs modification. Anthracite coal, kept in a reasonably dry atmosphere in the dark, and not subject to violent changes in the temperature, your "No" is correct, as the deterioration would be imperceptible. But change the status. Place anthracite coal in the weather, exposed to storms of rain and snow, and to sunshine, water, heat, and cold, the deterioration is great, not less than ten per cent per annum for the first five years. WM. LILLY.

Mauch Chunk, Pa.

The Pearl Fisheries of Ohio.

About twenty years ago pearls were discovered in the Little Miami River, Warren County, Ohio, and since then the search for them has been one of the recognized industries of the region. The Cincinnati *Commercial* says that the mussels which furnish the pearls are found in beds anywhere from the banks to the middle of the river, and are generally discovered by the feet of the pearl fisher. About fifty men and boys are engaged in this work. They wade into the river from depths reaching from the knees to the neck.

With their feet they feel the shells, and raise them by their toes to a height where the hands can reach them without stooping so as to bring the head under water. Miniature canoes, tied to the shore and floating out, are used to deposit the shells. When a bushel or more have been collected the fisher goes to the shore, and sitting down on the grass, in some cool shade, he opens the shells with a large knife.

The pearls are found between a slight membrane that lines the shell and the shell itself—a translucent web of texture between a cobweb and a film of mica. Occasionally the pearl is embedded in the shell so firmly that only an expert lapidary could safely detach it. This is rare. The number of pearls found in a single shell at the Miami fisheries rarely exceeds three, and on an average only one shell out of one hundred and fifty has any pearls at all. It is a common experience to bring to shore bushels of shells with never a pearl. One may work for days with no reward; again, he may make from five to one hundred dollars in a single day. The uncertainty is probably half the fascination of the work to the peculiar class of men and boys who prosecute it.

About a year ago a wealthy banker of Waynesville, Mr. J. H. Harris, began to purchase the pearls, which had previously been bought by New York and European dealers chiefly, and has since made a large and fine collection. Mention is made of one fine specimen, the Everhart pearl, found in the Miami and sold to Messrs. Tiffany & Co., in New York, for $900. The Tiffanies sold it to a party in France for $1,000, bought it back for $1,500, and made a final sale of it for $2,800.

The season of the pearl fisheries of the Little Miami lasts only from June till October, as it is necessarily dependent upon the warmth of the water. The fisher works about six or seven hours per day, seldom remaining longer than two hours, consecutively, in the water. It would seem as if the work would be very unhealthy, leading to malaria and all its attendant train of low fevers and vital exhaustion, but it was not spoken of particularly in that way.

There are pearls found in other parts of Ohio, but are of the milk-white, owing to the lack of the calcareous deposit that abounds in Warren County. The pearls of the Little Miami region are of a soft, sky-blue, pink, golden tinged, and iron color, with specimens that show a pure type of each, and others that are blendings of all. The colors, of course, are not solid, but exquisite tints and shades, changing with the angle of refracted light. The size ranges from that of a mustard seed to the size of a bullet.

Many of the old Indian mounds that have been opened contain pearls, showing how ancient their existence is. These pearls in the mounds lie as if they had been strung, but they crumble at a touch.

Recently a pearl of the most extraordinary beauty and brilliancy was accidentally found on the Waynesville side of the river by Morton L. Roberts, a little lad of eleven years, the son of Mr. J. A. G. Roberts, of the Adams Express Company, of Cincinnati. Morton was visiting some relatives there, and went down to get mussel shells to border a flower bed for his aunt. There were a quantity of these that had been looked over by fishers and thrown aside, and it was in one of these that the observing eye of the little boy detected the gem that promises to be a very valuable one. It is said to be the largest pearl ever taken from this region, and perfect in its symmetry. It has the brilliancy of the purest and most intense tints of the opal. It seems to rest in an aureole of colors, so delicate, yet so glowing, as to suggest to one a dream of color. The pearl will undoubtedly prove one of very rare value. Its weight is six carats.

Rules of the National Board of Health.

The National Board of Health, which was created by a recent act of Congress, with full authority to take charge of all places in the United States in which infectious and contagious diseases may appear, have issued the following rules and regulations to be enforced during the existence of yellow fever:

Every train leaving an infected city, town, or other place, shall be inspected by a competent medical man, who shall give to the conductor of said train a certificate of the results of his inspection. It shall also be his duty to furnish certificates to each passenger, and no passenger shall be permitted to leave an infected place without such certificate. No person having fever shall be allowed to take passage on such train. All cars leaving such place shall be thoroughly cleansed and fumigated with sulphurous acid gas, by burning 18 ounces of sulphur for every 1,000 cubic feet of space, and closing up the car tight for six hours prior to date of leaving. No upholstered car shall be allowed to leave a dangerously infected place. All baggage shall be thoroughly disinfected at the station before leaving. At a point not less than five miles, and as near this point as possible from the point of departure from a dangerously infected place, there shall be an entire transfer of passengers and baggage to other cars, which cars shall never enter an infected district. This transfer shall be made in the open air, under the supervision of a medical officer, and as far from a habitation as possible, and no person with fever shall be allowed to proceed, but shall return to the point of departure, or be treated in hospital at or near the place of transfer. No sleeping car shall be allowed to leave a dangerously infected place, nor shall any sleeping car approach nearer such place than the point of transfer. Any passenger car leaving such infected place shall be thoroughly ventilated during its passage to the place of transfer, by having the windows of the cars open during such passage.

In cases of suspected infection of a passenger in a sleeping car, such car, including all the upholstery, cushions, curtains, mattresses, etc., shall be thoroughly disinfected, under the supervision of a medical officer, and shall be exposed to the open air for at least 20 days, before being again used.

All freight shall be transferred at a point not exceeding 50 miles from the point of departure, and the cars from which such freight has been transferred shall not proceed further on the road, but shall be returned to the point of departure. The freight cars, after unloading, shall be thoroughly cleansed by scrubbing, fumigation, disinfection, and ventilation.

Mail matter and mail bags should be heated to a temperature of 250° Fah., or should be otherwise disinfected before they are sent from infected places.

At some point, not less than 50 miles from the first transfer station, a second complete transfer of passengers and baggage is desirable, and should be provided for by the authorities of the States through which the lines run. If yellow fever infect a place situated upon a line of railroad, trains of all kinds may be permitted to pass through without stopping, at a speed of not less that 10 miles an hour, provided the National Board of Health has not declared it dangerous to do so, and published, through the local health authorities, a special rule forbidding it; but they shall not take on passengers within one mile of such infected place, and all persons taken on shall first obtain the certificate from the local officers set forth herein. No train having a certificate of such inspection, and no passenger having a proper certificate that he was free from disease and that his baggage was properly disinfected, shall be interfered with by any municipal or other local systems of quarantine.

Fortifying the Treasury.

The work of fortifying the Sub-Treasury Buildings, on Wall, Nassau, and Pine streets, New York city, goes on rapidly. The windows of the basement and first floor are being protected by steel bar gratings one and a half inches in diameter, nine feet long at the lower and eleven feet long at the first floor windows, completely covering the same from casing to casing. Each upright bar is pointed at the top; seventeen uprights are fastened to each of the basement windows and held in place by four cross bars. Five cross bars hold in position twenty-one uprights on each first floor window. The cross bars measure three inches, and are one inch thick. Fifty-two windows in the building are thus protected. Each of the cross bars weighs 100 lb., aggregating 25,000 lb., and the uprights average 15 lb. to the foot, making a total weight of over 100,000 lb. of highly tempered steel, strong enough to resist any attempt at removal. This grating, when complete, will not only give protection from without, but allow the windows to remain open for ventilation. An additional quarter inch steel plate is to be affixed to the present iron shutters, which are to be pierced for rifles. The loopholes are to be protected by coverings of steel. The riflemen, thus protected by the shutters, can sweep the streets from the north, west, and south sides of the edifice, they being concealed in a bullet proof fortification. Besides the loopholes for rifles, arrangements have been perfected for throwing hand grenades at a mob from the windows under the eaves of the roof, without exposing the throwers to any danger from the house tops opposite.

The architect of the Treasury Department has added another novel feature of defense. To repel an attack which might be made on the Treasury Building from the roofs of the Assay Office or the adjoining buildings owned by the government on Pine street, there will be three steel turrets built on the roof of the Treasury, in which will be mounted Gatling guns, which will have a clear sweep of every house top within range. It is expected to have the new fortification finished by the 15th of September. It must be remembered that from $150,000,000 to $200,000,000 are constantly in the vaults of the Sub-Treasury; hence the precautions taken by the authorities for the utmost safety of this vast treasure.

The Australian Exhibition.

Mr. O. M. Spencer, United States Consul General at Melbourne, Australia, reports that the relation which exists between the Sydney and Melbourne exhibitors is one of generous rivalry and cordial co-operation. The two cities will soon be connected by railway. There are several lines of steamships now plying regularly between the two places, with low rates for freight. The expense of transferring goods from Sydney to Melbourne will be moderate, including storage. Goods will be received at the latter Exhibition building on the first of June, 1880.

All the usual facilities accorded at previous international fairs in other countries will be liberally afforded at Melbourne. The protection of inventions capable of being patented is fully secured. Should the United States decide not to send out a man-of-war, it is advisable to ship all heavy goods in sailing vessels, via the Cape, not later than February, 1880. Goods from the Pacific slope and parcels of great value and small bulk may be shipped via San Francisco by the Pacific Mail Steamship Company, which runs a monthly line of steamers from San Francisco to Sydney. Show cases, shelving, belting, etc., may be procured in Melbourne at low rates, at the cost of the exhibitors.

A Berlin International Fishery Exhibition.

An international fishery exhibition, to be held in Berlin in April, 1880, promises to bring together displays from all nations. Although the exhibition is limited to a single industry and class of products, considerable variety is given to it by including—besides aquatic animals and fishing gear and craft and machinery used in the manufacture of fishing tackle and nets—models of fishermen's dwellings and costumes, objects and works referring to the history of fisheries, and maps showing the geographical distribution of fish. Exhibitors are to be under no expense except for transportation of exhibits to the Berlin termini and return, and the committee is not indisposed to bear this expense in the case of specially interesting and important objects.

NEW ELECTRIC CURRENT REGULATOR.

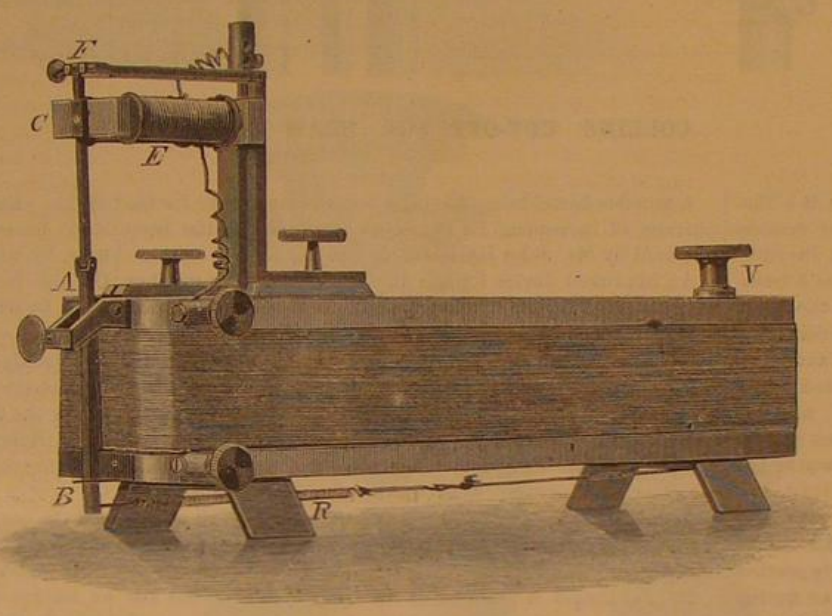
In a certain number of applications of electricity, such as the incandescence of platinum wires by the electric current, it is a very important point to maintain the current flowing at a certain strength, above or below which it must not vary appreciably. One of the most effectual means of doing this is to have a resistance in the circuit which can be varied according to the fluctuations in the current strength. M. Hospitalier, a young French engineer, has devised a very simple regulator on this principle.

The apparatus is composed of a resistance bobbin formed of insulated wire wound on in a single layer, and having each turn stripped of its insulating covering for about a centimeter of distance at the same spot. A lever, A B, slightly convex, can be made to touch at any particular part of its length the bared portion of the turn of wire immediately beneath that part. This lever, or "divider," has a joint at A, to which is connected a second lever having an armature, C, fixed near its outer extremity, which armature is placed in front of the electro-magnet, E. One end of the wire of the electro-magnet is connected to one end of the wire on the bobbin, the other end is connected to the metal piece on which the end, F, of the upper lever is swung. The other end of the wire of the bobbin is attached to a terminal on the lever part of the bobbin.

A spring, R, attached to the end, B, of the lever is adjustable by means of the thumbscrew, V, and by its tension draws the end of the lever to which it is attached forward; and the lever, by rocking or rolling on its curved surface, has its upper portion drawn in the reverse direction, that is, it pulls away the armature, C, from the electro-magnet. Under these conditions the lower part of the rocking lever will be in contact with the bare place on the lowest turn of wire on the bobbin, consequently the major portion of the current conveyed by the wires connected to the two terminals on the bobbin flows from the bare spot on the wire, up the lever, and thence through the electro-magnet back to the second terminal. The armature being consequently attracted, the curved lever is made to rock or roll on the bared surfaces of the wires, thus making contact with turns of the wire higher up the bobbin; but when this is so, the current entering the lower terminal has to traverse all the turns up to the turn with which the lever may be in contact, and the current is thus weakened. Hence it is easy to see that when the spring, R, is adjusted to a certain tension, the current flowing will, by pulling the armature, C, pull the lower lever on to such a turn of the wire on the bobbin as will introduce an amount of resistance sufficient to produce equilibrium, and if the current weakens or strengthens the lever will move backward or forward until the resistance adjusted by the decreased or increased number of turns in the circuit again produces equilibrium. To adapt the apparatus for alternating currents the electro-magnet is replaced by a bar of wire, which expands by the heating effect of the currents.

For dynamo-machines the apparatus is arranged to be worked by the machine itself. This is done by connecting the rocking lever to a Watt's governor. Under these conditions the apparatus regulates the velocity of the machine, and not the strength of the current.

It is hardly necessary to call attention to the utility of the invention, but the importance may be well understood when we consider that the apparatus bears the same relation to the regulation of the electric currents as the Watt's and other governors, or to the regulation of the flow of steam in steam engines.—*Telegraph Journal.*



HOSPITALIER'S ELECTRIC CURRENT REGULATOR.

The Fire Department of Topeka, Kansas.

Topeka is a city of about 12,000 inhabitants, situated in a region so new that the first white child born in the county is scarcely more than twenty-five years old; but it now supports three good daily newspapers and at least ten weekly and monthly ones. This is a good showing, but it will surprise no one who knows the character and habits of Kansas people. So says a correspondent of the *Fireman's Journal*, who gives the following interesting particulars:

There are two fire engine houses in the city, one in the main part of the town, and the other in North Topeka, 1½ miles away. They are substantially alike, but I shall speak only of the main one, designated as the "headquarters."

Mr. Wilmarth, the Chief of the Department, has occupied his present position for about eight years, and is a gentleman of intelligence. The present "headquarters" were built under his supervision. The first floor of this building is arranged with places for a steam engine, a Babcock engine, hose-cart, hook and ladder carriage, etc., and stables for the horses, six in number. The second floor contains a place for feed for the horses, a bath and wash room for the "boys," a reading room well supplied with books and newspapers, and sleeping rooms for eight men. Both the first and second floors are kept as clean as a building can well be kept.

This part of the building is surmounted by a tower some 60 feet in height, with machinery for drawing up the hose to be drained and dried. On its top is a station for a watchman, where he is constantly on duty at night, looking out for the first indications of fires.

The fire engines, hose carts, etc., stand facing the double doors opposite each machine, and the horses stand in the rear, also facing the front of the building, with feed boxes on the sides of their respective stalls. They are kept in their places by short chains, covered with gutta percha, stretched in front of them, and fastened by iron pins, which also secure the horses' halters.

In the front part of the building is an opening through the second floor, some 3 feet square. A pole as smooth as glass is erected on the first floor, and passes up through this aperture into the sleeping room of the firemen. There is also on one side of the building a wooden tube or slide, perfectly smooth on the inside, leading into a room where four other men sleep. At an alarm of fire the boys drop through these places almost instantaneously. The floor at the foot of each of these places is well cushioned to prevent injury to the men as they strike it.

As soon as the watchman on the tower discovers a fire he sounds a shrill whistle located in the end of a tube in the engine room, directly over a bunk where a man sleeps. This man immediately jumps and touches an electric key at the head of his bunk. This sounds a gong, drops the chains in front of the horses—which are always harnessed and bitted—releases the halter straps, and the horses are so trained that each one springs to the place where he belongs at the tongue of the engine or hose-cart. The same touch of the electric key lights the fire in the steam engine; sounds a gong at the head of the bed of the chief at his residence, which is near by; and also releases the horses, sounds the gong, and lights the fire in the other engine at its house, 1½ miles away. It will be seen that these arrangements are very complete.

Under rules which are strictly enforced no intoxicating liquors are permitted to be brought or used in or about the engine houses; gambling of all kinds is prohibited; loafers and idlers are excluded; no person of questionable character is permitted to be placed on the rolls of the department; and any man "who refuses to pay any just and honorable debt of his own contracting will be liable to discharge." "No person not a member of the department is allowed to sleep at the engine houses, and all firemen who sleep at the engine houses are required to be in bed at 11 P.M."

By enforcing such rules as these, and by strict discipline, this fire department has become an ornament to the city and the pride of her people. T. S. S.

American Manufactures in Cuba.

The British Consul-General at Havana, in a recent report to his government, says that the English are yearly becoming less and less in the commerce of Cuba, and the United States more and more.

"Machinery and hardware, in which we (the British) were once unapproachable, are falling into the hands of our rivals, the only remnant being a limited import of cutlery and large pieces of machinery, such as steam plows, sugar engines, etc.; but even these, from various causes, are now coming from other countries, notably the beautiful machinery from France, such as centrifugal machines, vacuum pans, and those connected with distilling. One of the largest imports from England was the large cane knife or machete; some of these are still imported from England, but the fact cannot be, and is not, disguised from the buyers, that these knives are inferior to those made in the United States and in Germany at equal prices; the only advantage possessed by the English article is superiority of polish, hence the increase of the import from England. Take the English plow; it has no chance against the American, for not only is the latter one third cheaper, but the American manufacturer makes a study of the island of Cuba, and his plow is consequently perfectly adapted to its requirements. So with heavy machinery on sugar estates; the planters find that, as a matter of course, an article whose prime cost is less, which has less freight to pay, and which is made expressly to suit the island, is preferable to the English one, which does not possess these advantages. In railway plant, also, the Americans are beating us, for the same objection is raised to the English manufacturers; rails, for instance, of the section required here, have to be rolled expressly in England, so that the purchaser has to give his orders four months in advance, whereas in the United States he finds his rails ready for immediate shipment, and cheaper into the bargain."

RECENT MECHANICAL INVENTIONS.

Messrs. A. O. Kaplan and A. Illowy, of Cincinnati, O., have patented an improved device for attachment to wagons, carriages, and other vehicles, which is so constructed that the horse may be instantly detached and the advance of the vehicle checked, preventing the passengers from being injured and the vehicle from being broken.

Mr. Andrew A. Armstrong, of Milford, Pa., has patented an improved sash lock for windows which is simple, convenient, and reliable, and is so constructed that it cannot be unfastened from outside the window, whether the sash be locked when closed or when partly raised.

A caster, in which the frame is made in two parts, the plane of division passing longitudinally through the pivot or stem and transversely across the middle part of the journal, has been patented by Mr. George L. Donovan, of West Meriden, Conn.

An improved machine for applying cane and other flexible seats to the seat frames of chairs, has been patented by Mr. Robert Fitts, of Lunenburg, Mass. It is so constructed that the seat will be drawn taut as it is being applied.

An improvement in wagon brakes has been patented by Mr. O. A. Kenyon, of McGregor, Iowa The brake is made easily adjustable at several points, and without trouble or expense can always be kept in an effective condition.

An improved wagon brake, which is so constructed that it will be applied by the forward pressure of the load in going down hill, and will be gradually taken off by the draught as the wagon comes to a level, has been patented by Mr. A. M. Van Ness, of Seymour, Ia.

Messrs. George W. Marsland and Arnold Hitchcock, of Pana, Ill., have patented an improved rack for wagons to adapt them for the transportation of hay, grain, fodder, and similar articles, as well as for transporting hogs, sheep, and products of various kinds.

An improved device for holding the brasses for car journal boxes, while being bored, has been patented by Messrs. Richard H. Briggs and James H. Dougherty, of Whistler, Ala. It is so constructed as to hold the brasses securely in place while being bored, and will insure the brasses being bored true, and it may be adjusted for boring brasses for journals of different diameters.

An improvement in that class of wheel hubs in which the spoke tenons are in lateral contact and form a continuous circumferential band, being supported by and clamped between metal flanges that encircle the wooden body of the hub, has been patented by Messrs. John D. Bultz and Joseph L. Baker, of Jacksonborough, Ohio.

An improved machine for plastering walls has been patented by Mr. Gustavus Stevens, of East Tawas, Mich. This invention consists in a receptacle for the mortar, which in shape is the longitudinal segment of a cylinder. It is provided with a hinged leaf or press-plate that moves radially against the mortar, and as the receptacle is moved upwardly against the wall presses the plaster out through a narrow-gauged opening at the bottom.

Mr. William B. Killough, of Larissa, Tex., has patented an improved wrench for holding and turning bolts, pipes, taps, etc. It consists of one fixed and one movable jaw, placed on a shank and pivoted to a sleeve controlled by a screw, and carrying a lever with a cam-face working under the pivoted jaw. The jaws have serrated V-shaped recesses to grasp the larger objects, while projecting from the front there are lips with serrated concave recesses for taking hold of the heads of bolts.

An improved trumpet-guide for carding-machines, patented by Mr. Edward B. Tibbetts, of Holyoke, Mass., consists of a pan provided with a shield and oval tubes or casings placed in front of and under the doffer, so that the shield partially covers the lower calender-roll, and the tubes or casings entirely cover the shaft, the pan catches the litter, and the incasing of the roll and shaft prevents the sliver, when broken, from catching and winding.

An improvement in crozing-machines, patented by Mr. Oscar J. Pennell, of Williamsport, Pa., consists in mounting the cutter-head in a swinging frame, which is vibrated, to cause the cutter-head to act on the staves, by means of a treadle-lever and friction-pulley; and in making the swinging frame adjustable in its bearings to change its radius, for the purpose of enabling the cutter-head to move through the arc of a greater or less circle, and thus adapt it to cut a deeper or shallower croze, as required for staves of larger or smaller barrels or other casks.

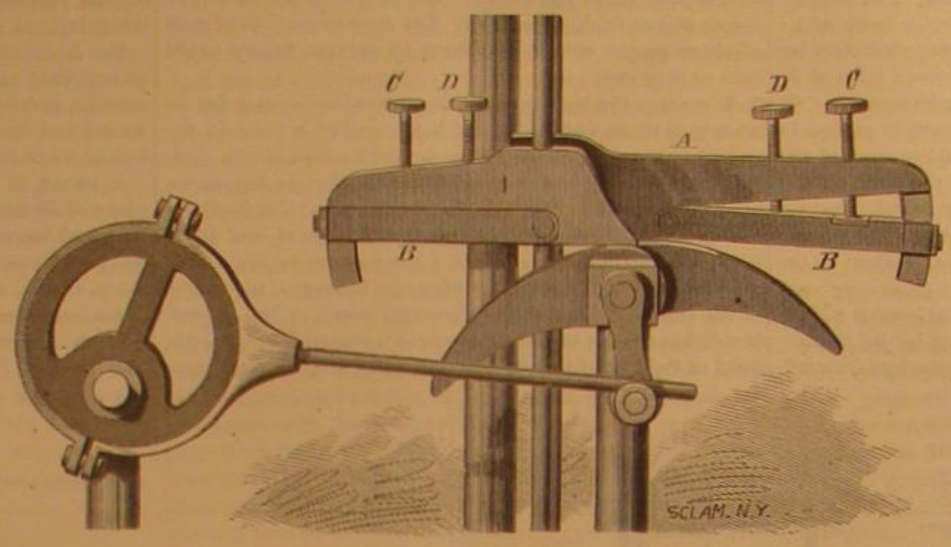
A CEMENT peculiarly adapted to stand petroleum or any of its distillates is made by boiling 3 parts of resin with 1 of caustic soda and 5 of water. This forms a resin soap, which is afterward mixed with half its weight of plaster of Paris, zinc white, white lead, or precipitated chalk.

NEW CUT-OFF.

The accompanying engraving represents an improved cut-off for steam engines recently patented by Mr. Thomas E. L. Collins, of Fall River, Mass. The improvement, although especially designed for beam engines, is not confined to this use. The lifters are made in two parts. The fixed portion, A, being attached to the valve rod in the usual way, the adjustable portion, B, is pivoted to the heel of the fixed portion, and is guided and supported by a curved arm that projects downward from the toe of the lifter. Two screws, C, D, pass through the lifter, the screw, C, being swiveled in the adjustable part of the lifter. The screw, D, merely presses against the back of the adjustable portion, giving an additional bearing.

The ordinary cut-off lifters of beam engines are secured to the valve rods by means of set screws and keys; and they can be adjusted only by loosening the set screws and keys and changing the position of the lifters. This operation involves a great deal of labor and requires considerable time, and the engine must be at rest.

The advantages of the improvement above described are apparent. The lifters can be adjusted with great accuracy even while the engine is in full operation, by simply turning the screws, C, D, and the application of the improvement to engines already in use involves no change except in the lifters.



COLLINS' CUT-OFF FOR BEAM ENGINES.

Browning's Stone Varnish.

Respecting the colorless preservative solution by which Cleopatra's Needle has been covered, a correspondent recently wrote to the *Times:* "In operating upon the granite, Mr. Browning first gave it a thorough cleansing, removing all the sooty and greasy matters from the surface, and then indurated it with his invisible preservative solution. The effect has been to give a freshness to the granite as if only just chiseled from the rock, retaining the original color, disclosing the several veins, the white spar shining in the sun's rays like crystals, and exhibiting the polished portions as they formerly existed. The solution soaks well into the pores of the granite, and the best authorities consider that it will have the effect of thoroughly preserving the monolith. Mr. Henry Browning has personally superintended the operations."

COMBINED SAD-IRON AND FLUTING ROLLER.

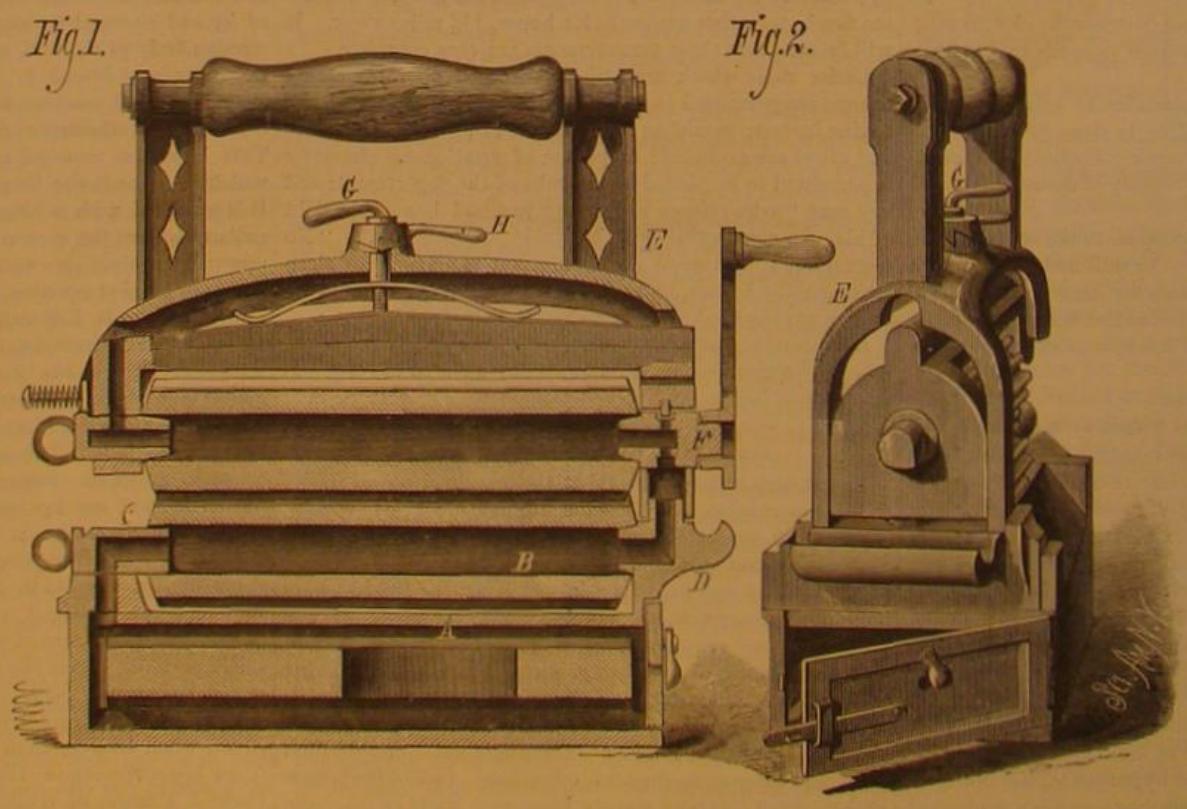
We give herewith an engraving representing in section and perspective an improved combined sad-iron and fluting roller recently patented by Mr. Carl J. Kramer, of Shreveport, La.

The sad-iron is made hollow, and is open at the top and rear end. It is provided with a door at the rear end, and the inner surface of the bottom is corrugated to facilitate the absorption of heat from the heated iron that is placed in the body of the sad-iron. A concave plate, A, is fitted to the top of the sad-iron to receive the lower fluting roller, B. The fluting roller is hollow, and it is fitted at one end to a hollow movable pivot, C, which conducts the heat from the sad-iron to the fluting roller. The opposite end of the roller, B, revolves on a hollow pivot, D, formed on the rear arm of the handle frame, E.

The upper roller is fitted to a hollow gudgeon, F, which is journaled in the handle frame, and is adapted to a crank by which the fluted rollers are turned. The gudgeon, F, communicates with the passage leading to the lower fluted roll. A movable hollow pivot supports the forward end of the upper roll and communicates with an upward flue, by which the heat escapes. It will be observed that by this arrangement a constant current of highly heated air is made to constantly pass through the rollers.

The part of the handle frame carrying the upper roller is movable, and pressure is applied to it through the spring at the top, the tension of the spring being regulated by the screw, G. This screw is provided with a cam, H, by which it may be raised whenever it becomes necessary to take the pressure from the upper roll.

In this sad-iron either a heated iron, coals, or gas may be used to heat the smoothing and fluting surfaces. Further information may be obtained by addressing Mr. Carl J Kramer, care of Mr. E D. McKellar, Shreveport, La.



KRAMER'S COMBINED SAD-IRON AND FLUTING ROLLER.

MISCELLANEOUS INVENTIONS.

An improvement in grain bag and fastening has been patented by Mr. A. B. Gardner, of East New York, N. Y. The invention consists in bags having inclined slits formed in their upper ends, forming ears and funnel-shaped mouths, and provided with two rows of eyelet holes to receive the fastening cords, and in a peculiar mode of applying a stiffener.

A wooden barrel hoop, having a lengthwise groove for the purpose of increasing its flexibility transversely, has been patented by Mr John Hartsook, of Sparta, Ill.

An improved device for use in setting dough to rise has been patented by Mr. James L. Campbell, of West Elizabeth, Pa. The improvement consists in a covered tray provided with a pan supporting perforated plate and an upwardly convex radiating plate, the latter placed over a bottom hole.

Mr. James L. Campbell, of West Elizabeth, Pa., has invented an improved device for hatching eggs artificially which is so constructed that the burning of the lamp may be regulated automatically, so as to keep the eggs at a uniform temperature. It is also provided with devices by which it is properly ventilated.

Mr. Ferdinand A. Reichardt, of New York city, has patented an improved device for the preservation and use of volatile substances. It is particularly intended for use in connection with nitrite of amyl, iodide of ethyl, and other volatile substances The invention consists in a combined casing and plug or piston of novel construction, adapted to the holding and carrying of a number of pearls or capsules containing volatile substances. When desired the pearls may be crushed and the contents liberated by moving the piston.

Mr. John Epting, of Stroudsburg, Pa., has invented an improved floor scrubber, having projecting elastic plates at each end of the metal frame, half inch wide, to protect the washboards of a room, when scrubbing, from being scratched by the frame, and to facilitate the cleaning of the corners.

A transposing key board for pianos and organs, whereby the music can or may all be written and played in the key of C natural, and yet will sound in any one of the twelve keys to which the finger board has been adjusted, has been patented by Mr. Asa J. Stafford, of Brushton, N. Y.

The combination of a table with a vertically adjustable top or cover that forms, when raised, a canopy and reflector, and when lowered a casing or safe for the table, has been patented by Mr. Daniel J. Davis, of Red Boiling Springs, Tenn.

Mr. Alexander Cunningham, of Augusta, Ohio, has patented an improved cork for milk jars, which consists of an elastic cork having a convex under surface, and provided with a rubber tube, fitted in an aperture in the cork, and with a bail.

Mr. H. W. Schweckendiek, of Baltimore, Md., has patented an improved temporary binder, consisting of hinged covers and a flexible back, and provided with sliding cords and loops for attachment of the sheets, papers, etc.

An improved device for decomposing water for fuel has been patented by Mr. Milton W. Hazelton, of Chicago, Ill. The object of the invention is to atomize water, and force it by and with a current of hot or cold air up through the incandescent coal lying upon the grate of a furnace or boiler, so that the water becomes decomposed and the oxygen combines with the carbon of the solid fuel, while the combustion of the hydrogen will increase the volume of heat and flame.

Mr. Hugh Nelson, of Philadelphia, Pa., has patented an improved adjustable model for shoe patterns, having sliding pieces with slots which receive the ends of screw studs passed up from a foundation plate, and provided with nuts, by which the slides are held in any desired position. On the foundation plate are graduated pieces under each slide, by which they are set to the different sized patterns.

An improved calendar, patented by Mr. Emanuel J. Trum, of Brooklyn, N. Y., displays two successive months and days of the week in the proper order opposite figures indicating the days of the month.

Mr. Robert F. Hatfield, of Brooklyn, N. Y., has devised an improved machine for drying clothes, so constructed that the clothes will pass through the machine in one direction and the hot air in the other. It will allow the clothes to be attached outside of the drying room.

Mr John McAnespey, of Philadelphia, Pa., has invented an improved ice cream freezer which is simple, convenient, and effective, freezing the cream quickly and evenly.

An improved blanket for army use, which shall also be adapted for use as an overcoat with a cape or hood, as may be desired, has been patented by Mr. Charles A. Hodgman, of Tuckahoe, N. Y. It consists in a blanket of woven material or rubber cloth of the required size, nearly square in shape, with a semicircular extension at one side, and fitted with sleeves. The blanket is provided with loops for gathering-strings, whereby, when it is used as a coat, it may be gathered around the neck, with the semicircular portion hanging as a cape, or turned and secured over the head as a hood.

An improved construction of abdominal corsets, by which the corset is made to fit comfortably to the body of the wearer without being liable to rise up in front, as is the case with the abdominal corsets in which the stays or bones run from the top down to the bottom of the corset, has been patented by Mary Ann Day, of Brooklyn, N. Y. The corset has a great degree of flexibility and sets easily on the body of the wearer, as well in a sitting as in a standing position.

HOLES IN HARD STEEL may be made with nitric acid. To apply it cover the steel plate, at the place where you wish the hole, with a thick layer of melted wax; when cold make a hole in the wax of the size you want the hole in the plate, then put on one or more drops of strong nitric acid, leave it on for some time, wash off with water, and if not eaten through, apply other drops of the same liquid, and continue this until the plate is perforated.—*Ironmonger.*

FAIENCE.

We present herewith an engraving of a group of faience jars and tazza in porcelain and enamel work, designed from Chinese and Japanese originals, by E. Collenot, of Paris.

China Ware in New Jersey.

Last year, at the suggestion of Governor McClellan, of New Jersey, a commissioner was sent to Paris to study the exhibition of ceramics there and purchase a library of works relating to that industry. Mr. W. C. Prime is reported as pronouncing the library thus selected the best of its kind in this country. A slight controversy, which has arisen among the Trenton potters, owing to a fear that the returning commissioner may bring to the company he is connected with more than their share of the knowledge gained by him abroad, has called out the following facts, which are printed in the *Sun*:

There are sixteen great pottery establishments in Trenton. In them are invested between a million and a half and two millions of dollars, and their annual sales amount to nearly the same figures. Their buildings cover large tracts of ground, and give employment to about 3,000 persons. Their grimy, stained buildings seem to be as old as Trenton, but the industry is, in reality, a new one. It is only about twenty-five years ago that the first pottery was established. It is there yet. It made only yellow or Rockingham ware. Other potteries started out to make only yellow ware, but the grades of goods made in Trenton improve every year, and there is now only one yellow ware pottery there. East Liverpool, Ohio, is the great center of yellow ware manufacture. It is nearly as great a pottery center as Trenton. Trenton owes its good fortune, in this respect, to its situation. It has no clay, except some black dirt that is used for the manufacture of the boxes that the crockery is laid in to be "fired." The clay used in Trenton comes from Pennsylvania, New Jersey, and Delaware. The clay near the Amboys, in New Jersey, is the best in the market. A poor man, in South Amboy, borrowed a little money, a few years ago, purchased a lot of ground, and began selling the clay that lies under its surface. He has dug great shafts and tunnels, and is said to have earned a fortune of $300,000. Trenton's handiness to New York and Philadelphia, and its railroads, canal, and river, are its attractions to the potters. Among the workmen in the potteries are many Englishmen and Irishmen, but Americans are learning to do good work. There are designers and decorators from Minton's great English tile works, and from Tiffany's in New York, employed to decorate the better grades of toilet and table ware.

A little while ago nothing better than cream-colored stone china, and blue stone, and stone porcelain ware was made in Trenton. Now there are establishments that make real china, and others that manufacture a grade of stone china that they claim looks as well and wears better than French china, and is the same in everything except that it is not translucent. This translucent quality is obtained by an intense "firing," and those who do not make "real" china say that this "firing" spoils a large proportion of the goods. Those who do deal in this fine work claim that by "firing" the china just as earthenware is fired—that is, by putting many pieces together where the French put only one piece—there is a tremendous profit at lower prices than the French obtain. The trouble is, however, that the French goods, in standing alone in the firing boxes, receive no blemish, while the American ware, which is stacked up on pegs, in the boxes, bears the marks of the pegs.

Mr. Fisk, of the American Crockery Company, estimates that the growth of the Trenton trade has reduced the importation of foreign ware from 35 to 40 per cent during the past three years. It is said that in one year a great stride has been taken. A market has grown up for fancy goods. People were educated a great deal by the Centennial Exhibition, and, more than all, Americans had ceased to copy from the English, and are relying upon their own originality. Other potters are less cheerful. One young man spent much time and money on a pair of plaques. The principal ornamentation was a wreath containing every garden flower of especial beauty. The copying from nature was almost mirror-like. The potter estimated the cost of the plaques at $125. He took them to Tiffany and to some one else in New York and asked what they were worth. At one place he was offered $50; at another $35. He says that if they had been imported he would have been offered at least $250 for them. He gave them to a bride, and found her a more appreciative connoisseur than the New Yorkers.

FAIENCE JARS AND TAZZA IN PORCELAIN AND ENAMEL.

White Africans.

Major Pinto, the Portuguese explorer, who has just crossed Africa, from Benguella southwestward to Natal, describes a race of white men found by him near the headquarters of the Zambezi. He says:

"I one day noticed that one of the carriers was a white man. He belonged to a race entirely unknown up to the present day. A great white people exist in South Africa. Their name is Cassequer; they are whiter than the Caucasians, and in place of hair have their heads covered with small tufts of very short wool. Their cheek bones are prominent, their eyes like those of the Chinese. The men are extremely robust. When they discharge an arrow at an elephant the shaft is completely buried in the animal's body. They live on roots and the chase, and it is only when these supplies fail them that they hold any relations with the neighboring race, the Ambuelas, from whom they obtain food in exchange for ivory. The Cassequeres are an entirely nomadic race, and never sleep two nights in the same encampment. They are the only people in Africa that do not cook their food in pots. They wander about, in groups of from four to six families, over all the territory lying between the Cuchi and the Cubango. It would seem that from a crossing of the Cassequeres with the negroes of other races sprang those mulattoes of the south, whom the English call Bushmen. The latter are, however, better off than the Cassequeres, and use pots in cooking their food, while their dispositions are good, though quite opposed to civilization."

Unfortunately Major Pinto does not say whether he saw more than one of the white Africans he describes, or whether the account he gives of them is based on observation or on hearsay. His promised book may clear up the matter.

Imitation Gold and Silver.

There have been a great number of alloys resembling gold and silver patented. The last which has come to our knowledge is a patent recently granted in England to one Thomas Meiffrer, of Marseilles, France, for the following ingredients:

Gold Alloy.—800 parts of copper, 28 of platinum, and 20 of tungstic acid are melted in a crucible under a flux, and the melted mass poured out into alkaline water, so as to granulate it. It is then melted together with 170 parts of gold.

Silver Alloy.—65 parts of iron and 4 parts of tungsten are melted together and granulated; also 23 parts nickel, 5 of aluminum, and 5 of copper, in a separate crucible, to which is added a piece of sodium, in order to prevent oxidation. The two granulated alloys are then melted together. Both alloys resist the action of sulphureted hydrogen.

EXPANSION OF WROUGHT IRON AND CAST STEEL.—It is important in workshop manipulation to remember that if a piece of cast steel be made red hot and quenched in cold water it will become longer, but if the same operation be performed upon a piece of wrought iron it will become shorter.

Cire Perdue—Bronze Casting in Wax.

The series of special loan exhibitions of fine art works, which have been held from time to time under the auspices of the Burlington Fine Arts Club, London, is this year enriched by one of considerable artistic interest—namely, an exhibition of bronze and ivory works of European origin. About 370 bronze works and 166 ivories have been brought together. Among the bronzes are some of the earliest specimens made by Greek, Etruscan, and Roman artists, lent by the Rev. Montagu Taylor. Among them is a mask of a marine deity with ruby eyes, and of a fine quality of finish. For excellence of pose as well as graceful modeling, a winged youth, holding a small dolphin in his left hand, is a striking Roman bronze.

The question of the *modus operandi* in producing these works seems to suggest itself. But on this point the catalogue yields us no information. From time to time the notes to the descriptive entries direct attention to the comparisons which it may be interesting to draw between various versions of similar subjects, as, for instance, between Nos. 180, 148, 138, 133, and 131, all of which are slightly varying editions of a Venus of John of Bologna. Again, No. 172, a fine saltcellar, composed of a kneeling nude male figure supporting a shell on his shoulder, is an artist's model from which others were cast; No. 182 is one of these casts. The difference in quality of texture between these two works should be noted. No. 172 is what would be termed a "*cire perdue*" model. Now, a little explanation of what "*cire perdue*" means would add much interest in the casual examination of the collection, and would help to clear up the difficulties which naturally crop up of understanding how it comes to pass that men chiefly known for their paintings or architectural designs appear in this exhibition as the makers of bronze medals, plaques, or statuettes. A short note placed as a label to one or two of the principal works, such, for instance, as the handsome candlestick designed by Pollajuolo, would help to clear away little misunderstandings on such points. This candlestick, No. 169, is ornamented with delicately worked garlands of flowers and leaves, sharply cut, and as crisp as though they had been produced yesterday. Much of this is due to good preservation. On the other hand, much more is due to the manner in which Pollajuolo's original models in wax were incased in plaster, so that the plaster faultlessly adhered to the wax. As soon as the plaster casing had set, the molten bronze was poured into it, and, melting out the wax model, filled up the impressions made in the plaster. Thus the wax or *cire* was *perdue*, and after the plaster had been broken away, the bronze alone remained as the tangible result of Pollajuolo's model in wax. From this reference to the process of producing certain bronzes it will be readily seen that a clever-fingered artist, without any extraordinary display of skill, might use wax as a vehicle for giving material shape to his designs, and, having made his model in wax, convert it into bronze by the process alluded to, and so appear on the scene as a bronze work. But the process *cire perdue* does not include all the methods of making a bronze object. Surface work has often to be resorted to, and handicraft other than that of modeling is thereby called into play.—*Iron*.

Incombustible Wood.

The following chemical compound is said to produce the result claimed by M. M. P. Folbarri for rendering wood incombustible, petrifying it, as it were, without producing any change in appearance. Intense heat chars the surface, slowly and without flame, but does not penetrate to any extent, and leaves the fiber intact:

Sulphate of zinc, 55 lb.; American potash, 22 lb.; American alum, 44 lb.; oxide of manganese, 22 lb.; sulphuric acid of 60°, 22 lb.; water, 55 lb.; all of the solids are to be poured into an iron boiler containing the water at a temperature of 45° C., or 113° Fah. As soon as the substances are dissolved the sulphuric acid to be poured in little by little, until all the substances are completely saturated. For the preparation of the wood it should be placed in a suitable apparatus, and arranged in various sizes (according to the purposes for which it is intended) on iron gratings, care being taken that there is a space of about half an inch between every two pieces of wood. The chemical compound is then pumped into the apparatus, and as soon as the vacant spaces are filled up it is boiled for three hours. The wood is then taken out and laid on a wooden grating in the open air, to be rendered solid, after which it is fit for uses of all kinds.

House Drainage.

On this subject Mr. George E. Waring, Jr., in a paper in the *Atlantic Monthly*, says:

Were I called upon to-day to specify the essential features of perfect house-drainage, I should include the following items:

The establishment of a complete circulation in the main line of the soil-pipe and drain, allowing a free movement of atmospheric air through the whole system from end to end, together with as complete a circulation through minor pipes as could conveniently be secured.

The complete separation of the over-flow of every tank or cistern delivering water for the general supply of the house from any soil-pipe or drain containing a foul atmosphere.

The supplementing of every water-trap with a suitable mechanical valve, to prevent the water of the trap from coming in contact with the air of the drain.

The reduction of the size of all waste-pipes, and especially of all traps, to the smallest diameter adequate to their work.

The abolition of all brick or earthen-ware drains within the walls of the house, using in their stead the best quality of iron pipe, with securely calked lead joints.

The substitution, so far as practicable, of wrought-iron pipes for lead pipes, in the case of all minor wastes.

The coating of all iron pipes, both cast and wrought, inside and out, with "American" enamel, a glossy black coating which withstands in the most complete manner the chemical action and changes of temperature to which it is subjected in such use.

The iron pipes should be extended so far beyond the foundation of the house as to obviate the opening of joints by settlement, so common where earthen-ware drains are subjected to a slight movement of the foundation, or of the new filling about it.

The object to be sought is the provision of a permanent drainage channel for the removal of all wastes, offering little asperity for the adhesion of foul matter, swept from end to end by fresh air, absolutely separated by mechanical obstructions from the interior atmosphere of the house, and literally a section of out-of-doors brought for convenience within the walls of the house, open to receive the contents of the various waste-pipes leading to it, but securely closed against the return of its air. I believe that the next step in advance will be the establishment of means by which the whole length of this drainage channel may be thoroughly flushed with clean water at least once in twenty-four hours.

As a prominent detail of house-drainage work, the long-accepted water-closet is being made the object of important modifications. The stereotyped article, the "pan" closet, has little to recommend it beyond the fact of its general adoption. It is faulty in principle, in arrangement, and in construction. While it is cleanly to look at, and lends itself readily to ornamental joinery, it has defects which should drive it out of existence. Deep down in its dark and hidden recesses, where only the ken of the plumber ever reaches, a large and sluggish trap—they call it a "cess-pool" in Scotland—is generally holding the filthiest filth in a state of offensive putrefaction. The iron chamber above this is lined with the foulest smear and slime, constantly producing fetid and dangerous gases. The earthen-ware bowl which surmounts this is set in putty, which yields to corrosion and to the jar of frequent use, until it leaks foul air, often in perceptible quantity. The panful of sealing water soon becomes saturated with foul gases, which exhale thence into the house. The whole apparatus is incofflned in tight-fitting carpentry, which shuts in the leakings and the spatterings and their vapors from the free access of air, boxing up in the interior of the house, and generally in free communication with the spaces between the walls and under the floors, an atmosphere heavy with the products of organic decomposition, and faintly suggestive to the unwonted nostril of the *mus decumanus defunctus*.

In the absence of anything better, I am disposed to go back to the simple "hopper" closet, such as is used in the cheapest work, and to depend on frequent and copious flushing to keep it clean. This closet has the great advantage that its only trap is in sight at the bottom of its pot. There is no inner "chamber of horrors" concealed by a cleanly exterior. I have recently used a number of these closets supplied with various sorts of apparatus for periodical flushing, and I find that wherever a half-gallon flush can be given every ten or fifteen minutes they are kept perfectly clean. I have no doubt that flushing every twenty minutes, or perhaps at longer intervals, would keep them free from all sanitary objection. This would require a supply of about fifty gallons *per diem*.

The Hopper Closet.

Recent invention has been turned in the direction of the provision of mechanical appliances for separating the trapping water from the air of the soil-pipe or drain. There are several devices which accomplish this purpose—one of them my own, and more than one of them constituting a very great improvement upon, and indeed an absolute step in advance of anything in use five years ago.

Another most important matter of recent development is the through-and-through ventilation of soil-pipes. Formerly the soil pipe invariably stopped at the highest closet of the house. When the danger of *pressure* came to be understood, it was considered imperative in all work of the best class to carry a vent-pipe out through the top of the house. As this pipe, from the smallness of its size and from the irregularities of its course, had but limited capacity of discharge, the necessity was quite generally recognized for carrying up the soil-pipe itself, full-bore, through and above the roof. This was the point reached at the time of my earlier writing. It soon became evident that even this large extension of the pipe afforded no real ventilation. A deep mine shaft cannot be ventilated by simply uncovering its top. No complete frequent change of air can be effected in a soil-pipe by merely opening its upper end. Air must be introduced at the bottom to take the place of that which is discharged at the top. It is now considered imperative in all good work to open the soil-pipe at both ends, or at least to furnish the lower part of the pipe with a sufficient fresh air inlet to effect a thorough ventilation of the whole channel.

American Cotton Thread.

Some time since, in a letter to the English trade journal, *Cotton*, Mr. B. F. Nourse, of Boston, Mass., said in reply to a question as to the fineness of American cotton cloths:

"American manufacturers do not produce the finest qualities of cotton cloths, such as muslins, fine cambrics, etc., not because they cannot (finer thread having been spun here than any ever produced by machinery in England), but because the available markets for such cloths would not sustain a manufacture of sufficient magnitude to be profitable."

To the words in parenthesis *Cotton* took exception and demanded proof. Mr. Nourse's authority for the statement was Mr. Edward Atkinson (an acknowledged authority in textile affairs), who has since written to Mr. Nourse as follows:

"The three-cord No. 550 thread produced by the Willimantic Company, suitable to be used on a sewing machine, was my warrant for this assertion. At the time I made it I also supposed that the same company, in spinning No. 1,100 single yarn on a mule in the open air of their factory, had accomplished finer yarn spinning than had been reached in Great Britain; but I have since learned that this was an error, a much finer number having been spun there. But it was made on a small mule, specially constructed and operated under a glass case. Such excessively fine numbers have, of course, no commercial value. More important is the success of the Willimantic Company in spinning No. 120 for regular commercial uses on a ring spinning frame. This success and our recent progress in fine work in several other mills promised good results, as the work done on the ring frame is cheaper and stronger than that of the mule."

Meantime Mr. Nourse had written for a statement of facts to Mr. William E. Barrows, the treasurer and examiner of the Willimantic Company. From that gentleman's letter of reply Mr. Nourse has condensed the following statement, which he embodies in a long letter to *Cotton*, dated June 6:

"1. Our fine numbers of thread are made for use on sewing machines. They are three and six ply, made from yarn Nos. 300, 400, 500, and 550. The finest numbers are used for pillow lace making, and, judging from the demand, give good satisfaction.

2. The finest number of thread regularly sent to foreign markets by this company is No. 100 six-cord, made from 200 yarn.

3. The finest yarn we have spun on the American ring spinning frame (built by the Lowell Machine Shop, Lowell, Mass.), with the Sawyer spindle, is No. 320. This was experimental, the yarn not used for regular thread. We regularly spin on ring frames No. 120 yarn for No. 60 six-cord sewing cotton.

4. We have no climatic or atmospheric difficulties.

5. We do prefer American machinery. The self-acting mules, built by the Lowell Machine Shop, give less trouble than foreign built mules in the same numbers, 100's to 140's.

6. All our overseers and more than one-third of our work people are Americans—a sufficient guarantee of their intelligence.

7. The most profitable numbers for us to spin are 120's to 140's.

8. See the accompanying certificates of the comparative merit of our sewing cottons from the Expositions at Paris and Philadelphia, and from American and Maryland institutes, and the reports (1876) of M. Louis Chatel.

9. We do not import any machinery for better work or cheaper production. Combers and hand mules are not yet made in this country, and we are obliged to import these machines.

10. I believe our extra fine numbers—400's, 500's and 550's—are finer threads than ever produced by machinery in England. All of these fine numbers have been tested on power-sewing machines at a speed of eleven hundred stitches per minute, giving satisfaction. Experimentally we have spun No. 1,100 on a handmule of 640 spindles, 60 "stretch, 1¼" gauge. Our usual fine work is 140's to 200's on mules, and 80's to 120's on ring frames."

American Tariffs.

It was not anticipated by the most ardent disciple of Cobden that the principles of free trade, which had proved so difficult of comprehension in the British Parliament, would be very quickly followed in other countries, though it was understood that its full benefit could only be realized by international acceptance. It was not, however, thought that in 1879 those principles would be so little understood that they would be rejected by our Transatlantic kinsmen at that then distant time. The belief that this could not have been the case would have been strengthened if they had had the evidence of the necessity for its adoption which Americans now have with respect to the iron and steel industries. All these years have, however, passed away, and American statesmen are still compelling their countrymen to pay very high bonuses to certain classes of manufacturers. That the high tariffs now imposed on iron manufacturers are simply bonuses to manufacturers will be seen from some of the following figures, and from the fact that the articles so highly taxed do not yield any revenue to the American Exchequer. It appears from the returns of foreign import duties, published by the British Government last month, that the percentage of tax paid by American consumers on the principal sorts of manufactured iron and steel is on an average no less than 71 per cent. On English and Scotch pig iron it is 70 and 60 per cent respectively, and on bar iron, plates, and rails, it ranges from 57½ to 85 per cent. On iron wire it is 85 per cent, on hoops upwards of 100 per cent; on tin and galvanized plates 42½ and 57½ per cent, and on steel and steel rails respectively 65 and 100 per cent. As these enormous taxes do not yet appear to have raised any very strong opposition on the part of the American people, we cannot but admit that there is some reason for the feeling now becoming somewhat prevalent in this country, that the better way to open the eyes of the American people to the necessity for either free trade or reciprocity will be to impose retaliatory duties upon certain American imports. Upon the cheapness of iron and steel many of the American manufactures mainly depend, and yet the Americans allow themselves to be handicapped to the enormous extent shown by the above figures. We cannot do better than conclude this short reference to an important question by quoting one instance as illustration of the tax paid by the American consumer in order to support by bonuses a set of manufacturers who are enabled to enforce the sale of their goods, at prices which have a most injurious effect on other industries. Wood screws, of which even larger quantities are used in America than in this country, are sold in the States at a trade discount of 60 per cent or 8s. in the pound net. The same screws are exported to this country at a discount in Liverpool of 75 per cent or 5s. in the pound net. A tax of 60 per cent on screws is thus paid by the American consumer above their market value. If a duty of upwards of 130 per cent did not prohibit it, our manufacturers would deliver superior screws into American ports at a discount of 75 per cent. Other instances might be cited in support of what has been said, and if a knowledge of these facts does not effect an alteration in American feeling on this subject they will certainly help to strengthen that which is growing in strength in this country.—*The Engineer*.

New Process of Phototypie.

Phototypie is a sort of lithography in which the stone is replaced by a hygroscopic layer of gelatine impressed with an image by the action of light passing through a photographic negative. Now, if we could cut down a lithographic stone, both in its surface dimensions and its height, to make it like a wood block, we should be able to insert it in the text, and take an impression from it simultaneously with that from the type. The difficulties in the way of doing this would be, first, the necessity of wetting the stone previous to each impression; and, secondly, the expense of cutting down lithographic stones, which would entirely lose their value in the process. But what we are on this account prevented from effecting with natural lithographic stones can be managed with an artificial one, provided that the latter possesses a hygroscopic surface from which, after being saturated with water, numerous impressions can be taken without its being necessary to wet it afresh. It became, therefore, necessary to make photo-printing blocks of the requisite size and height to be set up in the form with ordinary type, and possessing so great a hygroscopic quality that the moistening requisite to produce an impression should only be an accidental operation, and not one that is indispensable before each pull.

Now the ordinary process of phototypie was scarcely adapted for this purpose without modification. The plates in this process are made of metal or glass, or even lithographic stone, always larger than the image of which it is required to obtain an impression, and it would be impossible in every case to cut these plates to the size of the printing block. M. Vidal adopted another method for arriving at the same result as that produced by ordinary phototypie. He prepares the artificial lithographic stone and the hygroscopic support separately, and then attaches the one firmly to the other. The image is obtained as in the ordinary carbon process; an impression on carbon tissue is developed on a roughened glass plate coated with some fatty substance. When, by means of hot water, the picture is divested of all the gelatine not acted on by light, it ought to appear with all its half-tones like a good carbon print which is ready to be transferred to its definite support. This is then inclosed in a frame of thick cardboard, beveled outward on the inside, and coated entirely with paraffin or wax, the frame is then filled with the following composition, which is poured into it and over the picture:

Gelatine	20 grammes.
Gum-arabic	20 "
Glycerine	40 "
Water	100 cub. centim.
Ammonia	5 " "
Alum	0·5 gramme.
Salicylic acid	2 grammes.
Barium sulphate	10 "

The salicylic acid is added as an antiseptic, and the sulphate of barium gives to the layer of gelatine an opalescent appearance. The whole layer should be so deep as to have, after drying in the chloride of calcium box, a thickness of about five millimeters. When the desiccation is complete, the layer above the glass plate is turned out, and will be found to have the image transferred to it. We have now, therefore, a plate of gelatine bearing on it the picture of the exact dimensions required, and beveled downward from the edges, which latter will therefore not take any ink. This plate must then be mounted on a sheet of copper or zinc, which is raised on a wooden support until the height of the image is the same as that of the type with which it is to be printed. The gelatine plate is next saturated with moisture by immersion for a quarter of an hour in a bath composed of,

Glycerine	50 grammes.
Water	50 cub. centim.
Alum	2 grammes.

and the image will appear on its surface in considerable relief, so as to render it particularly well adapted for printing from. The separation of the black parts of the picture from the white parts of the hygroscopic gelatine is very perfect, so that no smudging, such as so often occurs with printing blocks on which the shadows are modeled by fine lines close together, need be feared. The mixture of which the formula is above given is of so hygroscopic a character that repeated wetting is rarely necessary. It must be effected with a sponge dipped in a mixture of half water and half glycerine, after having removed from the plate all trace of ink; but the latter should never be severely washed.

In this way, then, we obtain a carbon print, but with a light colored pigment, so that the degree of inking can be readily determined. Light colored earths in the form of impalpable powders, with a gelatine chosen for its resistant properties, make a very good tissue. The print should not be treated with alum before pouring on the layer of hygroscopic gelatine, otherwise it will not transfer easily. On the contrary, it is better to wash it with water containing a little ammonia, which will facilitate the penetration; the mixture already contains some ammonia, and the transfer of the image to the plate of glycerine and gelatine is thus rendered completely effectual. The alum contained in the first liquid used for moistening increases the hardness of the image, and prevents it from swelling too much.

It is easy to imagine what advantages can be derived from a process of this kind, which enables us to produce, at a moderate cost, plates capable of being inserted among type for the printing press. A number of different blocks obtained by this method can be mounted in the same form with the type of the text, and can be pulled all together in the press. They can be used in cylinder presses also, without any difficulty. Until the contrary is demonstrated, M. Vidal believes that this is the only process by which photographic printing blocks capable of being printed simultaneously with type can be produced.—*Photographic News.*

Freezing Fish for Winter Use.

To equalize the supply of fine fish, several varieties of which are apt to be overabundant in this market in summer and scarce in winter, the fish dealers of New York have erected three large refrigerating houses wherein many tons of frozen fish are stored. The largest of the freezing houses, is located on Front street, and belongs to the members of the Fish Market Association. When there is a greater supply of fish in the market than is likely to be sold during the day the wholesale fish dealers select the best and remove them before daylight from the vessels to the freezing houses, where each fish is cleaned and prepared for the refrigerator. The whole of the Front street house is devoted to the work; the first story from front to rear and the entire width of the building from floor to ceiling being one gigantic refrigerator divided into three sections, each capable of being subdivided into six apartments or boxes. The walls are coated with zinc, a second or inner wall of the same metal separating each apartment—a space of several inches being left between the wall of one subdivision and that of its neighbor, with oblong slits permitting the air from these spaces to pass into the apartments. These spaces are filled with ground ice and rock salt, a mill being used for grinding the mixture together, and at this season of the year it requires over 3,000 lb. of ice and about 14 bushels of salt daily to keep the freezing houses in proper order. The selected fish having been cleaned, are placed in freezing pans covered with ground ice and salt, thus excluding the air while the process of freezing is going on. This work is done on the upper floors of the same building. When frozen stiff the fish are taken to the apartment of the special owner and there laid away in the cold until wanted.

The season for freezing fish, says the reporter of the *Commercial Advertiser*, who furnishes this account, is not yet at its height, as the consumption now nearly equals the supply, and the bluefish have not been caught in such quantities as would pay for preserving. Before September, however, the work will be at its height, and according to the usual statistics of the probable catches, there will then be over 250,000 lb. of frozen fish in the storehouses in this city. The rarest fish will thus be obtainable for the rich man's table in the depth of winter, and sheepshead, salmon, bluefish, Spanish mackerel, and many other kinds, only known to ordinary consumers in the summer season, can then be supplied at rates which will be deemed cheap when the labor and expense of preserving the fish are taken into consideration.

A Congressman's Argument for Repealing the Patent Laws.

A member of Congress arguing in favor of the repeal of the patent laws, and complaining of the universality of inventions and patents, declared that the children of this country are swathed in patent baby clothes; rocked to sleep in patent cradles, danced in patent baby jumpers; take their airings in patent perambulators, amuse themselves with patent "playthings," wear patent bibs, spin patent tops; ride patent hobby horses, and, coming down to business, they prepare their land for crops with patent plows and harrows, sow their seed with patent grain drills, plant their corn with patent corn-planters, cultivate it with patent cultivators; cut their grain with patent harvesters, thrash it with patent separators, have it made into patent flour, by a patent middlings purifier, and finally baked in a patent oven. And thus they go through life, followed by patents, and at death are buried in patent burial-cases. Thus, literally from the cradle to the grave we are harassed and robbed by inventors and patentees. Now, he wanted the patent laws all repealed, that the people might be relieved of this intolerable oppression. That congressman ought at once to remove to China or some of the South Sea Islands not yet visited by the ubiquitous Yankee inventor, where he could live and die and be buried, as his great-grandfather did before him, unvexed by the thousand-and-one changes and improvements offered by the hand of restless invention. Seriously, adds the *Western Manufacturer*, he should remember that none of these patent improvements are ever forced upon him or anybody else. Those who choose may wrap their offspring in the traditional "rabbit-skin," and rock them in the half of a hollow log, and "jounce" them upon their knees. Patented improvements are only adopted because they are better, cheaper, and more convenient than the old styles, with which people are already familiar. The fact is, nobody complains of the inventor or his improvements until it is found that a patent stands in the way of their indiscriminate appropriation. Then it is that Congress is appealed to to repeal the patent laws—in other words, to "kill the goose that lays the golden egg." This is a terribly practical age, and the American people are the most practical portion of the human race. They pursue the business of invention as they do any other business, as a means of gaining a livelihood or making money. And that is the secret of the practical nature of their inventions. Take away the stimulus of protection in the property-right and ownership in their inventions, and all that kind of work would be laid aside at once. We would soon find as great a dearth of inventions and improvements as the most conservative could wish.

A Home Made Daniell.

The following method of constructing a voltaic couple, or a home made Daniell cell, may be of interest to the student: Select a small round earthenware jar, such as is used for keeping preserves, and having lined the bottom with gutta-percha, or some suitable cement, to the depth of ¼ inch, fix upright in this a rod of zinc, of equal height with the jar, to which a length of copper wire has been attached by passing it through a hole drilled in the upper part of the zinc rod, or by soldering. Make a cylinder of pipe clay, or other porous clay, larger than the zinc rod, and having dried it, make it hot in the fire by degrees, till it attains a red heat. Let this cylinder cool gently, and when cold place it in the jar round the center rod encircling it at a little distance. By moderately heating the end of the cylinder it will, when placed on the gutta percha, make a groove which will fix the tube, and prevent infiltration of the fluids. Line the inside of the jar with a plate of thin copper bent into cylindrical form and having a few holes punched in it, through which may be threaded the extremity of another length of copper wire. On the top of this cylinder place a flat ring of copper pierced with holes, and nearly, but not quite, touching the porous cylinder. This forms the battery. To charge it, the *Electrician* gives a saturated solution of sulphate of copper poured between the copper and the clay tube, and some crystals of the same salt are placed upon the perforated ring so as just to be in contact with the solution. The zinc compartment is then to be filled with a solution of sulphate of zinc, sal ammoniac, or common salt.

A Canal Mowing Machine Wanted.

Canal Superintendent Fish is accredited with the statement that within two weeks after its appearance in Erie Canal this summer eel grass grew eight feet in length, actual measurement. In July the canal was so full of grass in several localities that the flow of water was seriously impeded. The Rochester *Express* asserts that there seems to be at least half a dozen kinds of eel grass, several of which were entirely unknown to the superintendent, and much more harmful in impeding the progress of canal boats (as well as the flow of water) than the old variety. One new eel grass starts from very slender roots and grows to different lengths. At the end is a dense tuft, through which it is difficult for water to flow. By reason of the different lengths of the stems these tufts form a solid padding from the bottom to the surface of the water. Mr. Fish has had at work clearing out the beds an apparatus consisting of a couple of rudder like arrangements at the stern of a boat, with sharp sickle-like knives. These rudders are swung backward and forward by two men, and a passage is thus cut through the grass. Mr. Fish says this is the best device as yet found for removing the grass, but hopes that something better may be invented.

Study of Latin and Greek.

At the recent meeting of the American Institute of Instruction, at the White Mountains, Professor J. L. Lincoln read an able paper upon classical teaching and study. Greek and Latin, he said, as languages, must be taught by the tongue and the ear quite as much as by the eye; it must be voiced, and heard, and spoken, by all possible exercises of most practical kind, in union with the reading of the book. Such a method must be carried on from the beginning to the end of a course of instruction in school and college. Thus may our pupils come to master and appropriate the knowledge of these languages, so that the classic writers can be read with ease and satisfaction. The paper touched, also, upon the practice of reading at sight. This, however, can be used only after considerable progress has been made. It is not so much a means of learning, as a test of having learned or not, and also an incentive to further progress. The paper closed with illustrations of the crowning point of the theme—the literary knowledge and culture to be derived from a studious and generous reading of Greek and Latin writers.

In the discussion which followed, Professor Thatcher, of Yale College, thought that should no mental discipline be obtained, the knowledge secured was sufficient to pay for the trouble. If no knowledge is obtained the mental discipline would repay. The utility of studies is not in the knowledge obtained, but in the memorizing power developed.

Professor Louis Soldan, of St. Louis, said the moment Europe went back to the study of the classics a reformation commenced, and scholarship revived. The Scriptures were studied in the ancient tongues, and modern science owes its strength to the classics. The historic growth of our whole educational work is traceable to Latin and Greek. The classics are the basis of all progress in education. Language should be investigated, not only for itself, but for all other purposes.

The Consumption of Smoke.

As our manufacturing works are starting up afresh all over the country, a demand is renewed through the newspapers for some method to prevent the smoke nuisance in our manufacturing towns and cities.

It would seem not to be a difficult problem to solve, and *The Factory and Farm* pertinently inquires if some wise man will inform it why smoke may not be consumed if means are applied to that end. A smoke consumer that will burn the smoke before it leaves the fire bed or pot will reduce the consumption of fuel anywhere up to about one-half. Not alone because the combustion of smoke supplies fuel, but because the burning of the smoke prevents the lodgment of soot on the surfaces where heat is to strike; and less fire will produce greater results because a smoked or sooty surface is a non-conductor of heat, and it requires a fire at its greatest intensity to produce the required amount of heat.

Numerous devices have been studied up to fulfill the requirements, all perhaps with some merit, but none of them, as far as real tests have been made, being successful. So many have been tried and not proved of any real value, that manufacturers despair of being able to secure such a device, and are not in a mood to even try anything more, no matter how full of promise it may be; and yet actual experiment is the only thing that will demonstrate the success or failure of any plan proposed.

If the genius of this country cannot relieve the cities of the everlasting cloud of smoke and reduce the expense for fuel, it would seem there was degeneration and an early limit found to the ability of mechanical skill. The invention of a smoke consuming appliance would not only be a fortune to the inventor, but a blessing to those who dwell in large towns and cities.

A Large Smelting Contract.

The Leadville *Reveille* reports that J. B. Grant & Co., of Leadville, had contracted to smelt the entire product of the Little Pittsburg Consolidated Company, from the middle of July till the first of January next, and adds: "This is, without doubt, the largest transaction in the mineral line ever consummated in this country, and perhaps in the world, the anticipated amount of ore to be furnished being about 150 tons a day, or in the neighborhood of 25,000 tons for the period covered by the contract. In addition to this, Grant & Co. will buy ore of other grades to assist in smelting, so that the amount of ore handled daily will not be far from 200 tons a day." Large additions to the plant of Messrs. Grant & Co. will be required to do this work. The product of the works in June was $200,000; under the new arrangement it is estimated that the product will range between $300,000 and $400,000 a month.

The Children of Rum Drinkers.

Dr. Martin, of the *Salpetrière*, Paris, has made a series of interesting observations on nervous affections among the offspring of alcoholic parents. His results may be summed up as follows: In 83 families in which one or more members showed nervous excitability with a history of alcoholic origin, there were 410 children. Of these, 108—more than a quarter—had convulsions, and in the year 1874, 169 were dead; 241 were still alive, but 83, *i. e.*, more than one-third of the survivors, were epileptic.

Recent Decisions Relating to Patents, Trade Marks, Etc.

BY THE U. S. CIRCUIT COURT—SOUTHERN DISTRICT OF NEW YORK.

The Atlantic Giant Powder Company versus Jasper R. Rand et al.—1. The use of the explosive compound known as "rendrock powder," which contains in 100 parts, by weight, nitro-glycerine, 34·71; nitrate of potash, 52·68; sulphur, 5·84; and woody fiber, charcoal, and resin, in nearly equal proportions, 6 77 parts, is an infringement of reissue patent No. 5,799, granted to the Giant Powder Company, assignee, March 17, 1874, for the combination of nitro-glycerine with infusorial earth, or other equivalent absorbent substance, as a new explosive compound.

2. The owners of reissue No. 5,799 are not deprived of the right to ask for a preliminary injunction to restrain such infringement by the fact that they have prosecuted a suit in equity against the same defendants for an infringement of reissue No. 4,818, of which they were also owners, by the use of the "rendrock powder;" have taken testimony to show an infringement of No. 4,818, but not of No. 5,799; have notified the defendants that they need not, until further notice, make proof in the latter case, and subsequently, having successfully prosecuted suits on No. 5,799 in another court, have discontinued the suit on No. 4,818 and prosecuted this on No. 5,799 alone.

3. The reissue patent No. 5,799 does not cover an invention different from that embraced in the original patent No. 78,317, granted to Julius Bandmann, assignee of Alfred Nobel, May 26, 1868. The safety of the compound and its concentration were alike objects of the reissue and of the original patent.

4. The invention claimed in reissue patent No. 5,799 is not described in the French patent taken out by Alfred Nobel, September 18, 1863, nor by the certificate of addition thereto taken out January 19, 1864.

5. Nor is this invention shown in the English patent, dated September 24, 1863, and sealed March 1, 1864, granted to Alfred V. Newton for improvements in the manufacture of gunpowder and powder for blasting purposes upon a communication from abroad by Alfred Nobel.

6. The "rendrock powder" is not described in either of these foreign patents.

7. If Nobel's English patent No. 1,345 be regarded as a patent for the invention found in No. 78,317, and as having been granted more than six months before Nobel's application for No. 78,317, still No. 78,317 was not invalid because it does not appear that the invention covered by it was introduced into public and common use in the United States prior to the application for No. 78,317.

8. Neither the invention claimed in reissue No. 5,799 nor the "rendrock powder" is described in reissue No. 4,818 (division D) of Alfred Nobel's patent No. 50,617 for substitute for gunpowder.

Injunction granted.

BY THE COMMISSIONER OF PATENTS.

Ex parte Thaddeus Davids & Co.—1. The presence in a label of an element which is registrable as a trade mark excludes the whole from registration as a label.

2. A firm name printed in common type or in script type, not being an autograph signature nor the facsimile of an autograph signature, is not registrable as a trade mark.

3. But the name of a firm printed in script type in conjunction with a vignette of the coat of arms of a State is registrable as a trade mark, and the presence of such an element in a label excludes the whole from registration as a label.

Ex parte Wilson.—1. A generic claim may cover several processes as well as several machines; but the applicant must describe at least one of the processes embraced in the generic claim, just as he must describe one of the forms covered by a generic claim for a machine patent.

2. A process claim may be restricted to one of several stages of which a complete process consists. Each of these stages is itself a process, just as each of the elements of an aggregate fact is itself a fact. It is for the applicant to determine whether he will claim the entire process or only one of its subprocesses or several connected subprocesses.

3. The use of the term "shoulder" to designate the enlarged part of the base of the neck of a spinning ring is not unreasonable nor calculated to mislead where the specification and drawings show the part to which it is applied.

Young versus Van Dusen.—1. The construction and use in public of a working machine, whether the inventor has or has not abandoned it, excludes the grant of a patent to a subsequent inventor. An abandonment in such a case inures to the benefit of the public, and not of the subsequent inventor.

2. Abandonment will not be established by mere proof of the want of such a degree of diligence as is necessary to connect a prior conception of an invention with a reduction to practice.

Englemann versus Vester.—A ground for the dissolution of an interference not embraced in the motion before the Examiner of Interferences, but first suggested on the hearing of the application by the Commissioner, will not be considered.

Appleby versus Morgan.—The law aims to secure the grant of the patent to the original and first inventor, and not to him who, although conceded, or admitted, or upon default presumed, to be the original and first inventor, is not such in fact; and this purpose of the law ought not to be unnecessarily thwarted by such an exercise of the discretion vested in the Commissioner as to substitute presumptions for proofs through the enforcement of forfeitures which can only be reconciled with the law or with justice on grounds of necessity.

The Sun Dance of the Sioux.

A letter received at the Interior Department from Dr. T. Woodbridge, agency physician for the Fort Peck Agency, gives the following graphic description of the annual "sun dance" of the Sioux Nation, which took place near Poplar River, in Montana Territory, in the latter part of May:

I have just witnessed the great Indian festival of the "sun dance," or worship of the sun. Great preparations had been made for it, and everything was on the grandest scale. The city of lodges was moved, and the Indians encamped on a beautiful plain inclosing a hollow square, large enough for the movements of thousands of horsemen. In the center the great pavilion or medicine lodge was erected, 150 feet in diameter, the outside formed of small posts of green poplar and willow, thickly interwoven with green branches. Resting on this and on a rude frame-work within, all around for about twenty feet the space was covered with buffalo skins, forming the "dress circle," with places assigned to the musicians and actors or dancers. In the center was the great medicine-pole, fifty feet high. The diameter of the central space, about 100 feet, was open to the broad sunlight.

Only the men occupied the deep circle, where they were feasted during the performance of twenty-eight continuous hours, during which time about forty dogs were immolated and eaten, besides large quantities of buffalo meat, wild-turnip heads, and hot caldrons of other eatables that are nameless. The audience was composed of about 5,000 Indians, but as only the men occupied the circle within, the common people, women, and boys, had to be satisfied by viewing the performances through the wide entrance or through the interstices in the leafy barriers. All had on their holiday attire. The dresses of some of the chiefs, and those acting as directors or priests, were gorgeous.

When all was prepared, amid the waving of banners, music, and loud shouting of the assembled throng, over fifty braves entered—each an Apollo—painted and naked to the waist, except a profusion of ornaments, with headdresses of beautiful feathers, their black, glossy hair reaching down to their lower garments, which were most beautifully and artistically arranged. Each carried in his hand an ornamented whistle, made from the bone of an eagle's wing, which was blown shrilly during the dancing. Each also carried a bouquet composed mostly of the wild sage. Their appearance and reception were grand and imposing.

The first afternoon's performance would have been called wonderful for display of heroism and power to endure and suffer. Many had from fifty to two hundred pieces cut out of the living flesh from their arms and back. The dance was kept up all night with unabated fervor, every performance having something new and startling. But in the morning torture reigned supreme, men dancing with two, three, and four buffalo heads suspended from holes cut in their flesh. One Indian dragged on the ground eight buffalo heads fastened to the flesh of his back, and in the stooping posture he was forced to assume they had lacerated or torn the cuts in his back to the extent of three inches. Others were held by four different cords, two in the breast and two in the back—fastened to four stakes; and still others were fastened to the center pole with ropes which were fastened to the breast and back. Some, in addition to being fastened by the flesh of their breasts, had buffalo heads suspended from the back, and they would be seized by the hanging heads and jerked until one would think their life would be forfeited; others made frantic efforts to break loose, and I often noticed the integument to be stretched three or four inches from the body. Some fell faint and exhausted, and with wild shouts, the din of music, and weird songs, made of it a perfect pandemonium.

The dancers neither took food, sleep, nor water during the festival. Their dancing, their invocations, and their prayers were fervent. They laid their faces on the buffalo heads while praying for success in hunting, and the priest wept and asked the Great Spirit to give them success in the chase and let them have food for their wives and children; also, to give them plenty of horses, to prosper them, and help them to subdue their enemies. The sod was carefully removed in a spot four feet square, and within a white cross was made. This is all they knew, and with no teacher but nature, we must judge them charitably—"Count not impossible that which seems unlike." Their liberality was unbounded. Over 200 horses were given away, besides great quantities of other articles.

The Trade in Time-Pieces.

Galignani's Messenger furnishes the following statistics with regard to the manufacture of clocks and watches. Whether the figures are trustworthy or not, we are not prepared to say. France is placed at the head of the list, and is credited with the production of chronometers, watches, time-pieces, clocks, annually to the value of 65,000,000 francs; then comes Switzerland, with watches, 60,000,000 francs; America, in watches and Dutch clocks, 32,000,000 francs; England, chronometers and watches, 16,000,000 francs; Austria, time-pieces 10,000,000 francs; Germany, in time-pieces and a few thousands of watches, 25,000,000 francs. These figures give a total considerably over 200,000,000 francs for the whole watch and clock making trade of the world. The amount assumes the greater importance when the fact is remarked that, differing from nearly all other business, the raw material enters so slightly into the prime cost, the principal expenditure being almost exclusively in labor. The approximate number of articles produced is as follows: France, about 1,000,000 pieces annually; Germany turns out more, some 2,000,000, but they are of a much inferior average price. The same may be said of the American manufacture, which provides commerce every year with 700,000 or 800,000 objects. As far as watches are concerned, Switzerland heads the list with an annual production of 1,500,000. France follows with 500,000; the United States produces from 300,000 to 350,000, and England some 200,000, but these are of very superior quality. The enormous total is that 2,500,000 watches and 4,000,000 time-pieces are annually dispersed to the four quarters of the globe.

The Great Alpine Tunnel.

A Swiss journal has recently given some particulars of the present state of the St. Gothard tunnel works. The total length of the tunnel between the two ends at Airolo and at Goeschenen is 14,920 meters, including the approaches of 145 meters. There is, however, a separate curved part of the tunnel on the Airolo side which is 125 meters in length. At the end of May last 3,489 meters of the tunnel from the Goeschenen side had been completed, and 3,633 meters from the Airolo side. This gave a total of 7,122 meters completed from both ends, and this, compared with the length which it was estimated would be completed according to the programme arranged in September, 1875, shows a deficit of 3,389 meters. There is, however, no such great difference between the estimated and achieved lengths in the headings. At the end of May the advanced top headings had reached 6,940 meters from the Goeschenen or northern side, and 6,289 meters from the Airolo or southern side, showing a total length of advanced top heading of 13,229 meters, and only 214 meters less than anticipated in 1875, and leaving 1,548 meters of heading to be made. The meeting from the two ends will not be at the center of the length of the tunnel, but owing to the more rapid advancement from the northern side, it will take place somewhere about 300 meters nearer to the southern side. The present rate of advance of the heading is, on average of both sides, about 238 meters per month. At this rate the meeting of the miners from the two ends will take place soon after the end of January next. The completion work, however, proceeds at a more rapid rate, and it is expected in Switzerland, if the work continues at the present rate, it will be completed for opening in 1894.

Industrial Distress in England.

Press reports from London state that in the middle of July, there were in Burnley 5,795 looms idle out of 33,000, and 307,870 spindles out of 900,000. In the Blackburn district 11,300 looms were idle out of 52,000; 84,000 spindles were working on short time, and 48,000 had stopped altogether. In the Chorley district 1,600 looms, owned by two firms, were working on short time. Nearly twenty other firms were running part of their machinery on short time; several had stopped theirs entirely. In the Bury district both the woolen and cotton trades were very depressed. The average time of working in the woolen manufactories was only four days out of the week, and 406,000 spindles and 3,720 looms were working on short time. In Stockport the prospect, especially in the weaving department, was said to be almost hopeless. It was computed that only 500,000 spindles and 300 looms were working, against 1,195,000 spindles and 7,900 looms five years ago. In Rochdale, it was said, only five mills were working full time; 500 houses there were tenantless. The Manchester *Guardian* gave statistics to show that the condition of trade in the Rossendale district, where the machinery of the factories is adapted for Indian cotton, was even worse. Out of 100 mills only six—and these comparatively insignificant—were working full time; thirty-five were entirely stopped, and the remainder were only running on an average three and a quarter days a week.

American Philological Association.

The eleventh annual meeting of the American Philological Association began at Newport, R. I., July 16. There was a large attendance of college professors and other philologists from all parts of the country. Most of the papers read were as usual far above the level of popular interest. That of Prof. March, of Lafayette College, however, on the "English Dictionary of the Philological Association," should interest every American scholar.

The English Philological Society proposes to publish a great historical dictionary of the English language. For this purpose it has enlisted the services of many readers in England and a few in America. The plan is to make the dictionary cover the whole range of English literature. To Americans have been left the books of the eighteenth century of American literature, and this alone is as yet unread for a dictionary. Prof. March appealed to the members of the society not to allow the great thesaurus, which will be the standard English dictionary for a generation to come, to remain incomplete in the important department of American literature. Printed slips, he said, would be given to those who were willing to undertake the reading of American literary works, with a view to making excerpts and quotations for the dictionary. The society has already made a bargain with the managers of the Clarendon Press of Oxford, and hope to bring out the work in ten years from 1880. The materials already secured amount in weight to two or three tons.

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.

NEW BOOKS AND PUBLICATIONS.

PAINTER'S ALMANAC, 1879–1880. By Dr. Franklin. New York: Franklin B. Gardner.

Of special use to carriage painters, the author's aim being to furnish a handy manual of the American method of carriage painting. The instruction given is based on practical experience in the painting department of a prominent firm of carriage builders, and on information gained in the course of extended journeys among the carriage shops of the country.

THE HOTCHKISS REVOLVING CANNON. By Alfred Koerner. With 15 plates. Paris: Printed for private circulation.

The Hotchkiss revolving cannon was first brought out in 1871; since then it has been severely tested by several governments, and has been adopted for land and naval service by France, Turkey, Holland, and Greece. This handsome volume (which we owe to the courtesy of Messrs. Hotchkiss & Co., 21 rue Royale, Paris) describes the gun, its construction and operation, the methods of its employment in the several departments of military and naval service, and gives tabular statements of the results obtained in experiments made with it. The plates illustrate the gun and carriage, the ammunition used, and several targets made at Sandy Hook, at Helder, Holland, and elsewhere.

THE ART AMATEUR JOURNAL.

A new monthly illustrated journal bearing the above name, devoted to the cultivation of art in the household, as the title significantly implies, with criticisms on art productions generally, has just been commenced in this city. The August number is before us and is copiously illustrated. Among other interesting subjects it contains an adverse criticism on some of the largest and most pretentious statues and other art works in our Central Park. The editor wields a ready pen, and does not seem afraid to express his views pungently on art matters. Office of "The Art Amateur," 571 Broadway, New York city. Terms $3 a year. Montague Marks, editor and publisher.

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 not 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) W. R. writes: 1. Having made an imitation meerschaum pipe from magnesia, oxide of zinc, and curds of new milk, how shall I finish and polish? A. It is usually dipped for a few minutes in melted stearic acid, and finished on a small rag buff wheel. The bowl may be plugged before dipping. 2. Should curds be pulverized? A. Rub into a smooth paste while moist.

(2) B. F. B. asks: How can I make a good ink for marking the backs and fronts of boots? We use kip, split, and grained leather, and some is very greasy and our ink will not strike in. A. According to Dr. Boettger, an excellent marking ink for this purpose is obtained from the anacardium nut (*A. orientale*). The juice contains an oily matter which becomes black upon exposure to the air, and is proof against decolorizers, acids and alkalies, cyanide of potassium and chlorine.

(3) B. A. asks: Can a swelled chromated gelatine film be rendered hard without shrinkage? The swelling is caused by soaking in cold water. A. We know of no practical way of accomplishing this. With care a cast in plaster may be taken, and from this a positive in metal.

(4) J. C. asks: Can you inform me through your columns of any method of extracting the gold and silver from small lots of say 3 to 5 lb. of rich tellurine ores? I have tried the chlorinated method with only partial success. A. If free from lead and copper, stamp to 80-mesh, and thoroughly roast, first at very low heat. If it carries much copper or lead, salt must be added up to 1½ per cent. Lixiviate well with hot water before amalgamating.

(5) Z. writes: 1. The copying ink made as per the receipt in the SCIENTIFIC AMERICAN Reference Book loses its copying properties a few days after kept in the inkstand for use. Could you tell the cause, and how to remedy it? A. Add to the ink a small quantity of glycerine or more sugar. 2. What is the meaning of *q. s.*, used in some of the cement receipts in SUPPLEMENT, No. 158? A. *q. s.* (*quantum sufficit*), a sufficient quantity. 3. How is iron melted for castings? A. For foundry work the pig metal is usually melted in a cupola blast furnace with coke, coal, or wood.

(6) S. & T. ask: What is the rule to compute horse power so as to rent it, and what are the general rules and regulations and prices connected with the renting of power? We give power to a factory in the flat above us by a belt of the average thickness and 4½ inches wide, and at its tightest it will slip when they apply all their machinery at once. A. We do not know of any system or rule in use for renting steam power; the price here ranges from $2 to $3 per horse power per week. The power is more frequently guessed at than measured. For work driven by belts in good working condition estimate by $\frac{W\,V}{800}$ = H. P. W = width of belt in inches. V = velocity of do. in feet per minute.

(7) G. G. W. asks: 1. What is the power of a rotary engine 14 inches diameter of piston, 50 lb. boiler steam pressure, with pressure plate (or bucket) 3 by 7 inches square, with speed of 100 per minute? A. 9·2 horse power, making no allowance for friction. 2. Where can I get good draughting ink for working drawings? A. Get pure India ink from any stationer.

(8) D. & C. ask how to make a cheap varnish of shellac. We have a quantity and want to make it into a varnish for plow stock. A. Shellac dissolves in spirit of wine, in methylic alcohol (wood naphtha), and in water containing borax (water, 10 parts; borax, 1 part; shellac, 4 parts; boil). The latter varnish has the advantage of cheapness, and in that it may be used hot. 2. "Wrinkles and Recipes" says make glue of unslaked lime and linseed oil boiled together. We tried, but did not succeed. Why was it? A. The lime perhaps had absorbed moisture, or too much of it was added.

(9) M. B. writes: In your issue of June 14, 1879, p. 379, question 20, you state that a locomotive is heaviest on the rail when running up a concave grade. Please to state the reason. A. It is constantly changing and increasing its rate of ascent against gravity.

(10) C. A. R. asks: Why will a steamboat run faster in deep water than it will in shallow? A. When the water is shallow it cannot fill in the gap left by the passage of the boat quickly enough, and the head resistance is increased.

(11) T. J. B. asks: 1. Are there any pumps in use known to deliver 97 per cent of their capacity 100 feet high? A. Yes. 2. What is the usual loss in a well constructed pump with a lift of 15 feet and raising water 100 feet above? A. In large pumps it is usual to allow or deduct 5 per cent for loss of action; in a badly proportioned pump this may be increased to 15 per cent. 3. What is the pressure per square inch in a stand pipe 3 feet diameter and 100 feet high? A. 43·36 lb. per square inch on the bottom. 4. What is the most tangible method of measuring the quantity of water delivered 100 feet above the pumps? A. By the work done by the pump and by weir measurement; in important cases both are used as a check against each other. Where the delivery is into a well constructed reservoir, the delivery may be determined by rise of water in the reservoir.

(12) J. W. E. asks: If a solid mass of iron or copper, weighing one ton, is taken out to mid ocean and then cast overboard (taking first into consideration that soundings have never been found), will it go down until it has found bottom, or will it go to a certain depth and float in the water? A. The metal will go to the bottom, as water is so slightly compressible that its specific gravity can never equal that of the metals named.

(13) D. D. asks: How is it when I pack plunger of force pump so that there will be no leak the pump will not work, the receiving valve will not close? It seems as if the valve were floating. But just as soon as I open a pet cock above the receiving valve or at the bottom of pump chamber, as a general thing the pump goes all right. Slackening the gland holders answers same purpose; this occurs with me when the valves are in good condition. It don't matter about the height of the water tank above the pump, as I have had it happen with me where the water is 15 feet above the pump. A. Your trouble was the accumulation of air in the pump, and it would feed better when the pressure of the steam was low than when high; by the use of the pet cock, or by allowing the packing to leak, a portion or all of the air escaped. The design of the pump was probably defective.

(14) E. P. S. writes: 1. I have the lenses used in a sciopticon, two large lenses and two small ones. Can these same lenses be of any use in making a telescope or camera obscura? A. They cannot be used for a telescope, but may be used in a camera obscura. 2. Have you any practical work on optics; if so, what is the price and title? A. Address any of the industrial publishers who advertise in our columns.

(15) E. McI. asks: Which of the following sentences is correct, when the time meant is ten minutes past noon: "This mortgage was recorded on the first day of June 1879, at ten minutes past twelve, meridian;" or, "This mortgage was recorded on the first day of June, 1879, at ten minutes past twelve, post meridian." A. The former. The latter means ten minutes after midnight, and may be expressed in two ways: 12h. 10m. P.M., or 0h. 10m. A.M. The confusion of thought so often arising in cases of this sort appears to be due mainly to the circumstance that we make noon (the meridian) the point of comparison in writing but not in speaking, while we number the hours both from noon and from midnight. For the second hour after noon, we write 2 P.M. For the second hour before noon, however, we write, not 2 A.M., but 10 A.M., the tenth hour after midnight. Again, while we make 12 o'clock the nominal point of departure in numbering, the real point is one o'clock. The tenth minute after noon is not written 0h. 10m. P.M., but 12h. 10m.—what? It will not do to say 12.10 P.M., because from our way of numbering afternoon that word means ten minutes after midnight. It will not do to say 12h. 10m. A.M., for the meridian has been passed. The only escape is to write 12:10 meridian, noon, or midday. We are barred the use of initials, since N. may stand for either noon or night; and M. for either meridian or midnight.

(16) S. J. & J. R.—Gold-beater's skin is prepared from the peritoneal membrane of the cæcum, which, as soon as it is detached, is pulled out to the extent of two feet or upwards, then dried. The dried membrane, which has the appearance of a piece of packthread, is then soaked in a very weak solution of potash, and spread out flat on a frame; another membrane is taken and applied to the other, so that the two surfaces which adhered to the muscular membrane of the intestine may adhere together; they unite perfectly and soon dry. The skins are then glued on a hollow frame, washed with alum water, dried, washed with a solution of isinglass in white wine, to which spices, such as cloves, nutmegs, ginger, etc., have been added, and varnished with white of egg.

(17) L. D. D., Jr., asks: If a train of cars were moving at the rate of 60 miles an hour, and from the rear platform a cannon ball were shot in the opposite direction, the ball having a velocity equal to the car, at the end of an hour where would the ball be, or how far apart would they be? A. Sixty miles, if the ball remained where it fell.

(18) R. W. B. asks how to amalgamate a copper plate for a quartz mill, also how to prevent verdigris from forming on the same. A. Brush the plate with pumice stone and solution of potassium cyanide in water, and immediately apply the mercury. In some mills it is customary to warm the plates so as to quicken the mercury. Go over the plate with fresh quicksilver at least twice. If kept properly amalgamated verdigris will not form.

(19) C. T. writes: Reading an anecdote of Professor Edison's experience while a telegraph operator, I find the following, which I would be pleased to have you explain: "He was put on a 'through' night press wire, and the signals were transmitted so rapidly that Mr. E. had to 'break' very frequently, much to the displeasure of sending operator, who was not backward in letting him know it." "By next night Mr. E. invented a contrivance by which the signals could be reduced to a slow rate, by attaching a second sounder to the line in his office, thereby getting the press report at his ease." If such is possible, I would be thankful to know how it is done? A. The following explanation is given in Professor Edison's own words: The apparatus for accomplishing this object consisted of two Morse registers and a sounder. The first Morse register indented the characters in the paper. This paper passed through the second register, the lever of which was arranged with a platina point to open and close the circuit of a sounder, and this lever was so adjusted that the thickness of the paper intervening between the stylus and roller prevented the lever from closing the sounder circuit; but when an indented character passed the thickness of paper ceased to intervene and the sounder closed. Thus everything recorded on the first register by the press operator at any speed was repeated on the sounder a few minutes after at a higher or lesser speed.

(20) A. B. V. asks what the power will be of two engines built on quarter centers, cylinders 4 inch, stroke 5 inch, with sixty lb. steam, running 350 revolutions per minute. A. 12 horse power less friction, say 25 per cent. 2. What size boiler will it require? A. A boiler with about 90 feet fire surface.

(21) "Neptune" asks: 1. Which is the fastest sailor, a keel or flat bottomed boat? A. If they are equally good model there will be but little difference; the keel boat will lie closer to the wind and work quicker and better. 2. How long above deck should be the mast for a 25 foot boat? Where can I obtain information as to the building of a boat? A. See SUPPLEMENTS Nos. 39 and 42. 3. Why will one boat sail on the rudder harder than another? A. Owing to difference in position of mast and size of sail. 4. What are the chief requisites for making headway against wind and tide? A. Good working model with deep keel, large sail, and good breeze.

(22) W. B. asks (1) if there is any preparation that can be put in boilers in a brewery to take off scales, using the boilers at the same time, and would it be safe. If so, what is it? A. Small quantities of powdered oak bark, sumac, and other substances containing tannin, have been used with good results; also powdered talc or soapstone, and petroleum. See "Petroleum in Steam Boilers," p. 18, current volume of SCIENTIFIC AMERICAN. 2. How long should a safety plug last in a boiler and have plenty of water at all times in the boiler; will they burn out? A. If well put in they should last for years; they will not burn out, except they are made or applied improperly.

(23) A. A. asks whether a naked iron wire fastened along ceilings and walls, and connected with gas or water pipes, and not insulated, forms as good a ground connection for telephones and call bells as a copper insulated wire connected in the same way. A. Yes, but the iron wire should be at least twice as large as the copper one.

(24) J. E. writes: 1. I wish to cut a flat piece of china or stoneware into several pieces; how can I do it? A. Use a thin disk of copper charged with emery and water. Revolve it in a lathe, and apply to it the china with a gentle pressure. 2. How can I take an electro copy of a round earthenware pitcher? Will the copy have seams? A. Make a mould of plaster of Paris. (It will of course consist of several pieces.) Saturate it with wax or paraffine, cover it with blacklead, and proceed as in electrotyping.

(25) W. T. W. asks (1) how the best kind of razor strops are made, such as are used by barbers. A. Apply to the flesh side of a smooth firm piece of leather a little rouge mixed with a small quantity of tallow. 2. What will prevent or remove the rough edge which sometimes comes on a razor when honing it? A. Strap it on a piece of canvas or on a towel.

(26) A. G. asks: 1. What is the best work on strength of materials, especially with reference to metals and experimental data? A. "Anderson on Strength of Materials," and "Kirkaldy's Experiments on Iron and Steel." 2. Has Professor Thurston, of Stevens Institute, published in book form the results of his experiments on the subject? A. We think not. 3. What is the transverse strength (both permanent injury and breaking weight) of a 5 inch wrought iron pipe, such as is commercially known as 5 inch pipe, fixed at one end, loaded at the other? A. We know of no experiments on the transverse strength of such tubes. 4. What is the reaction of a 2 inch nozzle discharging 800 gallons of water per minute? A. 165 lb. nearly.

(27) C. M. A. writes: A little sidewheel steamer was built here last winter, of the following dimensions: Length, 28 feet; beam, 7 feet; paddle wheels, 4 feet 8 inches diameter, with 5 inch by 10 inch float boards; draught, 1 foot loaded. The engine is by B. W. Payne & Sons, Corning, N. Y.; 3½ inch by 4 inch cylinder, geared by belt to paddle shaft, 1 to 5. The boiler is built up of cast iron rings, in a sheet iron jacket, with 100 lb. pressure; this boat makes 5½ to 6 miles per hour. Is not this rather remarkable performance? From the proportion between the engine and boat, no one thought she would be capable of doing more than two miles an hour. A. It is an extraordinary result for a paddle wheel boat.

(28) M. asks: In ring spinning does the bobbin take up faster when it is full than it does when empty? If it does, then it puts less twist in the yarn each revolution of the traverse motion from the empty to full bobbin. A. The take up is automatic and adjusts itself to the size of the cop.

(29) J. R. P. writes: I am about to try the burning of crude petroleum under a boiler. Have the petroleum stored in a tank at a higher level than the boiler, from whence it flows through a pipe, and being met by a steam jet is forced in the form of spray into the fire box. Is there any danger of an explosion occurring, and if there is danger what is the best means of preventing such an explosion? A. We think there will be no danger of explosion if you keep the supply pipe filled. You might pass the petroleum through a fine wire gauze at or near the outlet.

(30) L. H., Jr., writes: I would like to build a small pleasure boat of the catamaran style to go by steam. I wish to know whether to use a screw or a single paddle wheel same as water velocipede described in SCIENTIFIC AMERICAN, No. 3, Vol. XXXVI., January 20, 1877. Let me know the dimensions of boat and engine for about 3 or 4 persons. Would a boat of this style be safe in the East River? A. You can use a single water wheel between the two hulls (as was done in Barden's famous cigar steamer), or you may use a screw. Cylinders 18 inches to 20 inches diameter would probably be large enough. It would be safe, if well built and properly managed.

(31) W. H. A. writes: Half a dozen friends wish to spend next winter cruising down the Mississippi river, and in its tributary waters. We are searching for information in regard to the size and kind of steamboat to have built. We want a boat that will run in moderately shallow waters and navigate tolerably small streams. Will a propeller answer? We want a boat with a cabin, and conveniences necessary to render life aboard comfortable and safe. Please give us dimensions for boat, kind and power of engine, and probable cost of vessel complete. A. A screw propeller from 50 to 60 feet long by 10½ to 12 feet beam, and drawing about 3 feet 6 inches water, would probably answer, with engine equal to 10 inch cylinder by 12 inch stroke. Will cost from $6,000 to $7,000, according to the finish. A stern wheel boat, 60 feet long by 14 feet beam, and drawing 2 feet to 2½ feet water, would suit and probably cost less money. The propeller would be best for rough water.

(32) C. C. H. writes: I wish to build a suspension bridge over a lake near my place of about 350 feet span. I am a practical mechanic and am tolerably conversant with the different methods of framing suspension work, but have no practical knowledge of the methods of sustaining or supporting such work while in process of building. If you can give me any information regarding such work you will place me under many obligations. The lake I mention is formed by the overflow of a river, and has a bayou for its outlet; practically it has no bottom, and is subject to a perpendicular rise of 18 feet. The banks are bluff, with timber on each side. At low water there is no current; at high water the current averages about 5¼ miles per hour; the stream has never been declared navigable. Please give me the name of some book containing methods of estimating the strengths of materials used in building generally. A. Put up your framing to carry the suspension ropes, then fix a drum or sheave on top, and wind your rope from the opposite side of the stream by a windlass. If the weight of your bridge is such as to require a large rope, you can use three or more small ones, binding them together after they are in place. The best works for your use are probably "Boiler on Bridges" and "Anderson on Strength of Materials."

(33) C. E. F. writes: 1. In SCIENTIFIC AMERICAN, for June 14, 1879, is an article on milk made digestible by lime water. As it is a subject that would interest a great many persons, please state how the lime water is made. What proportion added to the milk? A. See p. 75, (2), current volume SCIENTIFIC AMERICAN. Use a spoonful of the clear lime water to a goblet of milk. 2. Will eating lemons soon after milk curdle it? A. Yes.

(34) F. H. P. asks: What shall I apply to a brick tank lined with cement, so that it will hold crude petroleum without leaking? Will soluble glass answer? Would silicate enamel paint be better? A. We do not know that water glass or "silicate enamel paint" has been used successfully for this purpose. A thick aqueous solution of glue has been found serviceable in similar cases, we believe.

(35) C. W. W. A. asks: 1. What is the best process to put cedar posts through to prevent them from rotting when put in the ground? A. Saturate them as far as possible with warm carbolic acid or dead oil (obtained from the distillation of coal tar). Concentrated aqueous solution of zinc chloride has also been used with very good results. 2. Is green or dry cedar the best for the above purpose? A. Seasoned posts are preferable.

(36) S. W. W. asks: In making hard soap for domestic purposes, what is necessary to prevent its shrinking and twisting after cooling? Our recipe is: 4 lb. strained fat, 12 quarts water, 1 box Babbitt's potash, simmer 10 hours, stir frequently. This makes 24 lb. fine white soap, but after being cut in cakes, and allowed to dry 3 or 4 weeks, it shrinks to about 1-3 original size and weight, and assumes all sorts of irregular shapes. A. Add to the hot soap paste a strong hot solution of salt (say 1½ gallons), collect and press the curds which separate.

(37) J. W. asks how to make aniline colors soluble. A. The aniline colors proper are soluble in warm water or a mixture of water and alcohol or wood naphtha (methylic spirit), also in glycerine.

(38) G. T. S.—A mixture of oxygen and hydrogen is instantly exploded by flame or spark. It would be dangerous to experiment with it in a furnace as you propose. Consult some elementary work on chemistry.

(39) C. S. R. will find the process for reproducing writings, etc., in blue, by chemical means, described on pp. 40 and 230, volume 38, SCIENTIFIC AMERICAN.

COMMUNICATIONS RECEIVED.

Danger to Blacksmiths. By G. M. A.
On the Course of a Bullet. By W. S.
On Uniform Time. By H. M.
On Changes in the Earth's Polar Axis. By F. M. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

July 8, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Annunciators, electrical circuit closer for hotel, F. Newhoff ... 217,397
Ash receiver, E. M. Butz ... 217,197
Auger, well, W. W. Jilz (r) ... 8,788
Axle box, car, M. M. Barry ... 217,319
Bag holder and truck, G. L. Price ... 217,403
Bale band tightener, P. N. Johnson ... 217,224
Bale tie, D. F. Agnew ... 217,255
Ball trap, Stock & Morris ... 217,424
Bailing iron, E. A. A. Grange ... 217,309
Barrel hoop, J. Hartsook ... 217,370
Bee hive, J. J. Ward ... 217,206
Blackboard, T. Kane ... 217,389
Boiler feed, automatic, S. S. & T. B. Davis ... 217,346
Bolting reel, W. L. Teter ... 217,303
Bone, etc., treatment of, G. H. Smith ... 217,418
Book cover securer, M. Umbdenstock ... 217,250
Book, etc., carrier, M. S. Drake ... 217,350
Boot and shoe heel, J. M. Whiting ... 217,309
Boot and shoe nailing machine, L. R. Blake ... 217,324
Boot and shoe nailing machine, O. R. Chaplin ... 217,340
Bottle stopper, H. Susemihl ... 217,425
Brick drier, G. A. Carlson ... 217,259
Brick machine, C. Stilwell ... 217,423
Bridge gate, draw, A. Stempel ... 217,440
Bridge side truss, J. W. Riley ... 217,409
Brogan, C. E. Tyler (r) ... 8,791
Bung, H. Holder ... 217,287
Bung, Jones & Sandford ... 217,225
Bung, self-opening and closing, W. Enticott ... 217,274
Button, D. S. Cooke ... 217,269
Button and stud, F. P. Barney ... 217,218
Calendar, E. J. Trum ... 217,453
Calendar, rule, and match case, F. Ratcliff ... 217,406
Candlestick, H. Grom ... 217,266
Car brake and coupler, S. Fairman ... 217,356
Car brake and starter, A. White ... 217,253
Car, coal, L. Hetfield ... 217,286
Car wheels, machine for grinding, J. H. Gowan ... 217,365
Carpet sweeper, M. R. Bissell ... 217,222
Carriage body adjuster, J. Clements ... 217,342
Carriage top standard, J. H. Sanderson ... 217,411
Cartridge capper and loader, D. E. Campbell ... 217,335
Caster, furniture, G. L. Donovan ... 217,349
Chair seat press, R. Fitts ... 217,359
Chuck for boring car brasses, Briggs & Dougherty ... 217,329
Chuck, metal drill, G. M. Pratt (r) ... 8,795
Churn, H. M. Brown ... 217,263
Churn, J. Knox ... 217,387
Cigar bunch maker, R. A. Bright, Jr ... 217,261
Cigar cutter, C. Du Brul ... 217,351
Cigar cutter and match safe, W. C. Shimoneck ... 217,398
Clevis, C. S. Ells ... 217,352
Coffee polisher and separator, J. H. Pendleton ... 217,399
Coffee roaster and oven, W. B. Hinckley ... 217,376
Coffee roaster and purifier, W. T. & S. E. Bown ... 217,258
Coffin, R. J. Howdon ... 217,380
Coffin handle, R. J. Howdon ... 217,381
Coin roller, P. H. Newbill ... 217,396
Collar and cuff fastener, J. Webl ... 217,437
Collar, horse, E. J. Blood ... 217,257
Cooking boiler, W. E. Arnold ... 217,314
Core box, A. T. Whitehouse ... 217,438
Cores, combined chaplet and anchor for horizontal, Quinn & Longacre ... 217,266
Corset, abdominal, M. A. Day ... 217,348
Crucibles and other vessels in plumbago suitable for chemical and metallurgical purposes, manufacture of plumbago, S. A. Peto ... 217,295
Cultivator, R. S. Harris ... 217,282
Cutting gauge, J. W. Newkirk ... 217,226
Damper, stovepipe, J. M. Read (r) ... 8,793
Dental instrument, S. C. Taylor (r) ... 8,795
Dental plugger, C. Schaerff ... 217,412
Dental plugger, J. S. Swartley ... 217,246
Dental polishing and cutting tape, E. T. Starr ... 217,300
Dental vulcanizing flask, A. M. White ... 217,253
Derrick for oil wells, portable, B. F. Asper ... 217,316
Dipper, watering, R. Harrison ... 217,371
Door, sliding, G. R. Kidder (r) ... 8,789
Dough tray, J. L. Campbell ... 217,332
Draught equalizer, I. P. Cadman ... 217,267
Draught hook, J. F. Bednar ... 217,194
Drawer handle, W. F. & G. A. Heiligmann ... 217,375
Drier, wood, etc., T. A. Dowling ... 217,273
Envelope gumming machine, H. J. Wickham ... 217,311
Envelope machine, H. J. Wickham ... 217,310
Fanning mill, T. M. Bales ... 217,317
Faucet, H. W. Fuller ... 217,361
Fence, N. N. Blake ... 217,323
Fence, B. H. Hargrave ... 217,372
Fence, A. J. Marks ... 217,391
Fence wire stretcher, E. M. Crandal ... 217,269
Filter, tea and coffee, H. C. Rice ... 217,408
Firearm, revolving, Hodges & Hull ... 217,218
Fire kindler, P. Scott ... 217,414
Fire tower, portable, N. Zimmermann ... 217,429
Flue, boiler, J. C. Carbine ... 217,338
Forge, portable, A. Burchfield ... 217,265
Friction wheel, T. Hotchkiss (r) ... 8,798
Fruit, etc., drier and bleacher, G. W. Hopkins ... 217,288
Frying pan, W. Hodges ... 217,378
Gas, apparatus for manufacturing illuminating, W. B. West ... 217,308
Gas retorts, apparatus for removing coke from, C. F. Dieterich ... 217,272
Gas scrubber and purifier, G. F. North ... 217,294
Gate, W. G. Alexander ... 217,312
Gate, W. H. Bond ... 217,325
Gate, L. C. Brady ... 217,260
Gilding mouldings, etc., J. C. Hofer (r) ... 8,797
Glass, plunger for pressing, G. W. Wyman (r) ... 8,799
Grain bag and fastening, A. B. Gardner ... 217,362
Grain binder, E. Horton (r) ... 8,787
Hair pin, W. Schultz ... 217,413
Hammer, power, L. Brady ... 217,327
Harrow, metallic, N. Beauregard ... 217,320
Harvester, self-binding, M. A. Keller ... 217,227
Hats, caps, and bonnets, making, J. Heimann ... 217,284
Hay rake, horse, F. Hanson ... 217,369
High chair and carriage, F. Chichester ... 217,341
Horseshoe nail maker, G. J. Capewell ... 217,336
Hub, vehicle wheel, Bultz & Baker ... 217,196
Hydrocarbon burner, liquid, H. A. Bradley ... 217,259
Hydrocarbons and water, apparatus for producing power, heat, and light from, J. M. Hunter ... 217,223
Incubator, J. L. Campbell ... 217,333
Inkstand, H. C. Benson ... 217,256
Insulator, telegraphic, B. Taylor ... 217,427
Jewelry, N. Grant ... 217,279
Jewelry, making stock plate for, J. S. Palmer ... 217,398
Journal box, anti-friction, S. P. M. Tasker ... 217,248
Key board, transposing, A. J. Stafford ... 217,422
Key fastener, W. Metcalf ... 217,231
Knitting machine, S. V. Essick *et al* ... 217,354
Lamp, L. Raphael ... 217,229
Lamp chimney, C. E. Kellogg ... 217,290
Lamp, gas, P. P. Timofeeff ... 217,432
Lamp heater, T. A. Kellett ... 217,228
Lap or carriage robe, T. Goodall ... 217,277
Leather cutting machine, A. Teas ... 217,428
Leather skiving machine, Hadaway & Gott ... 217,212
Letters, figures, and ornaments, compound for forming, J. C. Friedrichs ... 217,360
Lifting jack, P. L. Epler ... 217,226
Lime and cement, manufacture of, J. K. Shinn ... 217,415
Lime, revivifying spent, G. R. Hislop ... 217,377
Loom, J. D. Cottrell ... 217,270
Magneto-electric machine, O. Heikel (r) ... 8,796
Marker, land, S. Ryan ... 217,242
Match box, F. S. Dargerfield ... 217,345
Matting, floor, G. Hayes ... 217,213
Matting, wooden floor, G. Hayes ... 217,214
Meats, canning, J. W. Jones ... 217,226
Metallic can, Green & W. Wilson, Jr ... 217,211
Milk cooler, D. W. Hull ... 217,221
Milk cooler, A. E. Turvey ... 217,434
Milliner's and hatter's iron, V. Henry ... 217,217
Millstone feeder, C. Weaver ... 217,436
Mortar mixing machine, C. T. Rowe ... 217,297
Motor, T. Mayhew ... 217,392
Mower, R. Campbell ... 217,268
Nail cleaner and envelope opener, combined finger, C. P. Tener ... 217,429
Napkin holder, W. L. Bundy ... 217,264
Packing box for hardware, R. J. Howdon ... 217,382
Packing casing for oil wells, J. Q. Miller ... 217,292
Paint, distemper, F. Koskul ... 217,388
Paper cutting machines, clamp for, H. Law ... 217,229
Paper stove platform, R. W. Stilwell ... 217,301
Paper, waxing, S. Hammerschlag ... 217,280
Pickling vats, composition for and construction of, J. H. Dreyer ... 217,335
Pictures or signs, manufacture of transparent, C. Quartley ... 217,404
Pillow, bolster, and mattress, T. S. Sperry ... 217,299
Pipe coupling, S. P. M. Tasker ... 217,249
Pipe threading and cutting-off machine, L. W. Stockwell ... 217,302
Pipe wrench, H. Rhyn ... 217,407
Planing machine, wood, Preble & Peoples ... 217,238
Plant extractor, W. James ... 217,383
Planter, horse corn, A. C. Andre ... 217,191
Planter, seed, A. B. Pierson ... 217,237
Planters, check rower attachment for corn, W. L. Phillips ... 217,401
Plow, A. Backman ... 217,368
Plow and planter, subsoil, L. Kirlin ... 217,386
Plow colters, attaching, F. Gaunt ... 217,363
Pocket book, etc., fastening, J. C. Arms ... 217,315
Pocket, safety, J. M. Hunter ... 217,222
Poke, animal, W. C. Grubb ... 217,367
Potassa, making bitartrate of, E. Muller ... 217,235
Pressing and moulding plastic material, machine for, B. R. Rapp ... 217,405
Pressure regulator, J. E. Watts ... 217,307
Pulley block sheave, W. H. McMillan ... 217,393
Pump, double-acting force, P. Breidenbach ... 217,328
Pump, force, J. J. Finney ... 217,357
Pump, steam, W. Craig ... 217,271
Pump, steam, M. Schultz (r) ... 8,798
Pyroxyline, treating, W. McCaine ... 217,232
Quilting frame, H. T. Davis ... 217,208
Rail joint, H. W. Cappell ... 217,337
Rail joint, J. Meehan ... 217,394
Railway rail cutting device, J. M. Peterson ... 217,400
Railway signal, W. G. Evans ... 217,355
Railway switch, R. S. Miner ... 217,234
Railway switch, W. L. Potter ... 217,402
Range ventilator, kitchen, D. H. Erdman ... 217,353
Reaper attachment, H. Hoover ... 217,219
Rheostat, electrical, J. Butler ... 217,331
Sash fastener, A. A. Armstrong ... 217,313
Sash fastener, F. S. Dains ... 217,302
Sash fastener, S. Taylor ... 217,426
Saw, circular, T. Tripp ... 217,305
Saw, draw, J. Showalter ... 217,416
Semolina, etc., machine for purifying and assorting, Thompson & Williamson ... 217,430
Sewer gate, automatic, S. S. Tilton ... 217,431
Sewing machine fan attach., J. W. Chambers (r) ... 8,792
Sewing machine, straw braid, S. Henshall ... 217,216
Shaft and sleeve coupling, J. F. Appleby ... 217,192
Shawl strap, A. E. Lyman ... 217,230
Shingle cutting machine, H. T. Davis ... 217,209
Silk cleaning apparatus, W. B. Swift ... 217,247
Skirt elevator, A. A. Campbell ... 217,334
Soap, H. G. Robertson ... 217,410
Sole edge trimming tool, J. F. Cunningham ... 217,344
Spectacle bow hinge, J. S. Spencer ... 217,420
Spinning frame, ring, E. T. Lanphear ... 217,389
Spinning mules, automatic clearer for, S. Mock ... 217,233
Stamp affixing apparatus, M. Simon ... 217,244
Station indicator, J. Butcher ... 217,198
Steam boiler indicator, W. Starkey ... 217,245
Steam boiler, upright, W. Spiegel ... 217,421
Steam engine regulator, P. Gately ... 217,275
Stove pipe thimble, M. McQuire ... 217,223
Tally, grain, C. H. Horton ... 217,220
Telegraph pole, J. B. & J. M. Cornell ... 217,343
Telegraphs, application of the condenser to multiple, Thompson & Selden ... 217,304
Telephone, electric, F. A. Gower ... 217,208
Telephone, pneumatic signal, F. A. Gower ... 217,278
Tether, C. E. Yager ... 217,254
Tool, combination, Bennum & Powers ... 217,195
Torpedo, grave, T. N. Howell ... 217,379
Tube cleaner, boiler, C. H. Kelsey ... 217,384
Tube cutter or trimmer, S. L. Davis ... 217,347
Tug loop, hame, M. S. Bettice ... 217,321
Type writing machine, H. M. Grant ... 217,210
Valve, balance steam, Moore & Pertz ... 217,395
Valve, leather flap, W. L. Crawley ... 217,208
Vehicle wheel sand band, G. C. Hill ... 217,374
Velocipede, S. P. Ruggles ... 217,241
Vent, cask, H. Finck ... 217,358
Ventilator, G. Hayes ... 217,215
Violins, insulating attachment for, O. Bull ... 217,330
Vise, pipe, F. P. Goss ... 217,364
Volatile substances, device for the preservation and use of, F. A. Reichardt ... 217,240
Wagon brake, O. A. Kenyon ... 217,385
Wagon brake, automatic, A. M. Van Ness ... 217,435
Wagon rack, W. T. Burrows ... 217,266
Wagon rack, Marsland & Hitchcock ... 217,390
Wagon running gear, D. Gibbens ... 217,278
Wagon spring seat, J. K. Cadwalader ... 217,199
Waste pipe trap, Scarborough & Bates ... 217,243
Watch and clock pinion, F. Lambert ... 217,291
Watch escapement, V. Bousset ... 217,326
Watches, safety center pinion for, J. A. Smith ... 217,419
Weather strip, Browning & Hay ... 217,262
Whiffletree, spring, J. Hill ... 217,375
Wick tip, mineral, J. T. Shuster ... 217,417
Wind engine, J. Hemp ... 217,385
Window bead fastener, C. F. Hanckel ... 217,281
Window screen, W. H. Hazzard ... 217,283
Wrench, O. R. Weaver ... 217,251
Yarn maker, spotted, Archibald & Holcroft ... 217,193
Yarn, machine for warping, etc., E. G. Gibson ... 217,307

TRADE MARKS.

Baking powder, Dunham Manufacturing Company ... 7,489
Boots and shoes, C. H. Fargo & Co ... 7,479
Certain toilet preparations, W. A. L. Knickerbocker ... 7,497
Certain medical compound, C. W. Preston ... 7,498
Cigars, cigarettes, and smoking and chewing tobacco, H. Waldron ... 7,485
Cigars, cigarettes, and smoking and chewing tobacco, Kendall & Clock ... 7,486
Composition for restoring inking rollers of printing presses, R. O. Sweeny ... 7,493
Cotton goods, E. Lyon ... 7,482
Electroplated table ware, W. Rogers ... 7,497
Gloves and mittens, C. Parker ... 7,483
Ground coffee, Basley & McAlvanah ... 7,479
Hams, bacon, etc., F. Link & Son ... 7,481
Laundried shirts, collars, and cuffs, The Wiles Laundering Company (Limited) ... 7,491
Mass licorice, A. Y. Stokes & Co ... 7,488, 7,489
Medicinal preparation, R. W. Robinson & Son ... 7,494
Medicinal teas and pills, Wiener Medizin Company ... 7,492
Medicinal preparation for preventing seasickness, W. Gibbs ... 7,490
Pumps, Mast, Foos & Co ... 7,496
Saw swages, H. Disston & Sons ... 7,495
Shirts, drawers, and overalls, H. Wallach's Sons ... 7,500
Smoking and chewing tobacco, cigars, cigarettes, and snuff, W. S. Carroll ... 7,484
Smoking and chewing tobacco, cigars, and cigarettes, M. Lindheim ... 7,480

DESIGNS.

Carpet, C. Magee ... 11,282
Cooking ranges, W. Burrows ... 11,280
Die for stamping checks and drafts, W. J. Walker ... 11,282
Fender gas stove, W. T. Symons ... 11,290
Inkstand, C. S. Landers ... 11,281
Oil cloth, C. T. & Y. E. Meyer ... 11,283 to 11,288
Spoon and fork handles, G. W. Shiebler ... 11,289
Trimming, J. M. Shanahan ... 11,291
Pepper or salt receptacles, J. W. Hobbs ... 11,293

English Patents Issued to Americans.

From July 11 to July 15, inclusive.

Fire escapes, J. R. Winters *et al.*, Chambersburg, Pa.
Hair clippers, C. Carleton, Providence, R. I.
Motor engines, W. P. Wood *et al.*, Washington, D. C.
Oyster preserving process, D. A. Lorring, N. Y. city.
Piston packing, S. A. Youse, Sutter Creek, Cal.
Railway brakes, O. B. Kendall, Buffalo, N. Y.
Spinning tops, J. C. Johnson, Springfield, Vt.
Steam boilers, W. H. Brown, Waterbury, Conn.
Water meters, C. H. Bacon, Boston, Mass.

SCIENTIFIC AMERICAN

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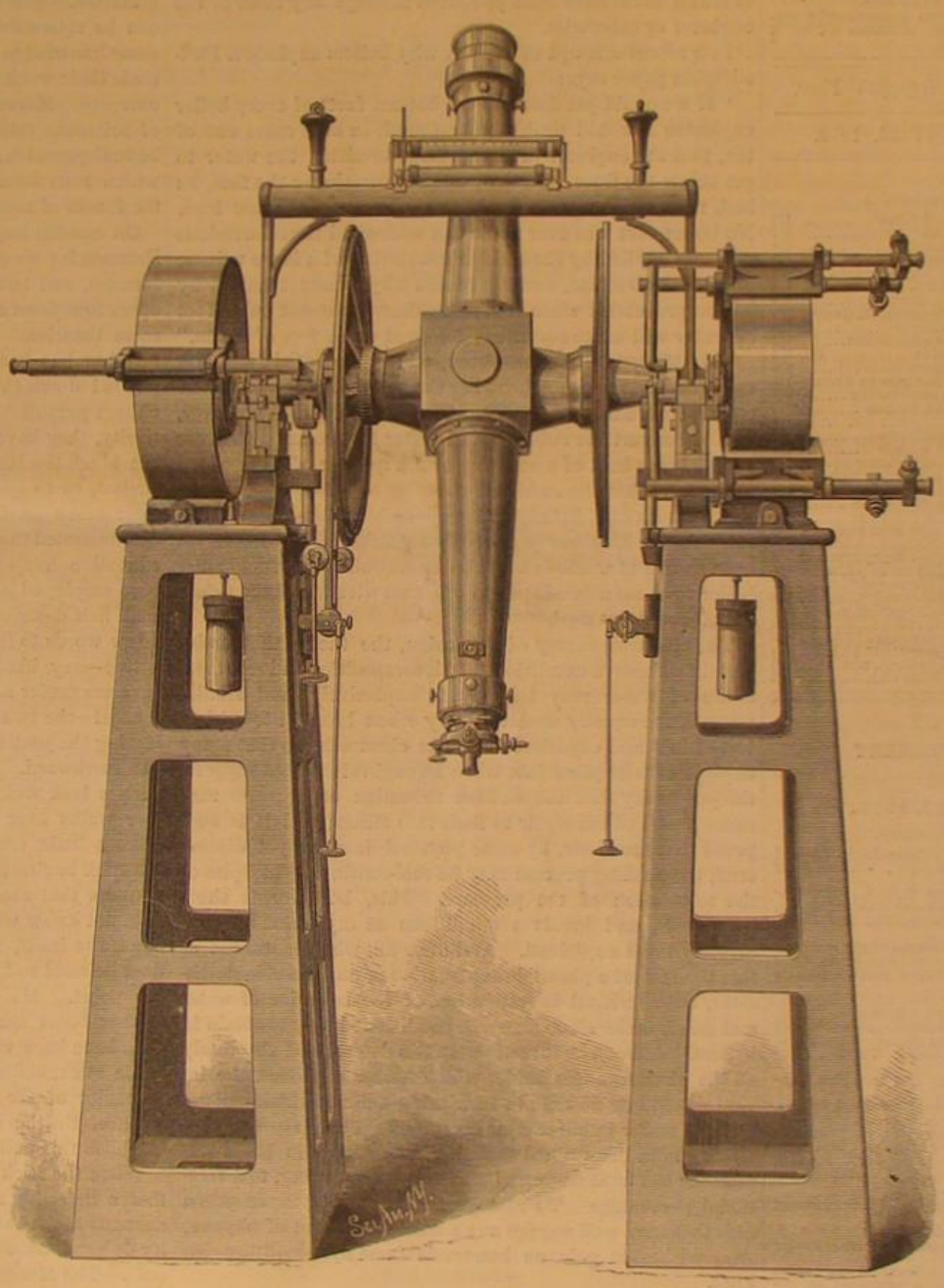
NEW MERIDIAN CIRCLE.

Although telescopes of great size have for some time been manufactured in this country, all large observatory instruments of precision have heretofore been imported from Europe. Three years ago the firm of Fauth & Co., of Washington, D. C., was established and commenced the manufacture of large instruments of precision, and such was their success that they now stand in the front rank of their profession. Our engraving illustrates the large meridian circle made by this firm for Princeton College. A glance at it will show the instrument is very compact and solid; the convenience of the observer has been studiously considered, without interfering with the accuracy of the instrument.

The principal feature of this instrument lies, of course, in the accuracy of its graduated circles, which have a diameter of 25 inches. They are divided into 5 minute spaces, and are read off by means of four micrometer microscopes, which instead of being fixed to the pier, can be moved any desired angular distance. This is especially useful in examining the graduation. The instrument throughout has the latest improvements. Objective and eye-pieces can be interchanged; the bright field illumination can be changed instantly into the dark field with bright wires, the level, which indicates seconds of arc, can be read by means of a mirror. The piers upon which the telescope rests are cast hollow, in one piece, and the counterpoises are arranged within, as shown in the engraving. In use, however, the piers are covered with mahogany and lined with felt to prevent sudden changes of temperature affecting the instrument. For the purpose of reversing the telescope a reversing apparatus running on a railway is provided, which is not shown in cut, and it takes less than a minute to reverse the ponderous instrument, and it can be done with perfect ease.

We intend in coming issues to illustrate other instruments of precision made by the same firm. Messrs. Fauth & Co. manufacture all the instruments used by the United States Coast and Geodetic Survey. Among other matters of interest we expect to furnish our readers with a description of the graduating engine on which the circles of these instruments are divided with such marvelous accuracy.



FAUTH & CO.'S MERIDIAN CIRCLE.

To Attain Long Life.

He who strives after a long and pleasant term of life must seek to attain continual equanimity, and carefully to avoid everything which too violently taxes his feelings. Nothing more quickly consumes the vigor of life than the violence of the emotions of the mind. We know that anxiety and care can destroy the healthiest body: we know that fright and fear, yes, excess of joy, become deadly. They who are naturally cool and of a quiet turn of mind, upon whom nothing can make too powerful an impression, who are not wont to be excited either by great sorrow or great joy, have the best chance of living long and happy after their manner. Preserve, therefore, under all circumstances, counsels *The Sanitarian*, a composure of mind which no happiness, no misfortune, can too much disturb. Love nothing too violently; hate nothing too passionately; fear nothing too strongly.

American Institute Exhibition.

For forty-eight years the American Institute of New York has opened its doors and invited American inventors and manufacturers to exhibit their productions, and again this year it renews its invitation to all. To such as wish to reach the capitalist and consumer, they must admit that New York is the place. For details apply to the General Superintendent, by mail or otherwise.

Huxley on Industrial Education.

If a lad in an elementary school showed signs of special capacity, I would try to provide him with the means of continuing his education after his daily working life had begun. If in the evening classes he developed special capabilities in the direction of science or of drawing, I would try to secure him an apprenticeship to some trade in which those powers would have applicability. Or, if he chose to become a teacher, he should have the chance of so doing. Finally, to the lad of genius, the one in a million, I would make accessible the highest and most complete training the country could afford. Whatever that might cost, depend upon it the investment would be a good one. I weigh my words when I say that, if the nation could purchase a potential Watt or Davy or Faraday, at the cost of a hundred thousand pounds down, he would be dirt cheap at the money. It is a mere commonplace and every day piece of knowledge that what these three men did has produced untold millions of wealth in the narrowest economical sense of the word.—*The Sanitarian.*

Photographic Patterns.

One of the silk manufacturing firms of Lyons, France, are introducing the production of photographic impressions on stuffs. They sent to a recent meeting of the Photographic Society several pieces of silk with a variety of photographic pictures printed thereon, including, among others, a number of large medallions representing pictures of the old masters. The length of the specimens thus exhibited is stated as being no less than 131 feet. The process by which they are produced is not given, but it is believed, says the *Commercial Bulletin*, that the prints are made with salts of silver.

Dephosphorizing Pig Iron—Utilization of Phosphorus.

Professor Wedding, in a paper contributed to a German publication, gives some data on the practical working of Krupp's, or rather Narjes', process for dephosphorizing pig iron. The originator of the process is Mr. Narjes, an engineer connected with Herr Krupp's works at Essen, who, on the 16th and 17th of March, 1877, worked the first heat on a large scale, four tons of pig, holding 0·7 per cent of phosphorus, being reduced to metal running 0·134 per cent, while the percentage of carbon sank only from 3·10 to 3·03 per cent. A patent was applied for and granted on the 2d of July, while Bell's provisional specification was drawn up on the 11th of April.

Narjes' process consists in dephosphorizing and refining the pig without affecting the carbon percentage materially, by oxides of iron and manganese partly used as fettling and partly by additions. The practice at Essen is said to be simple: the pig is melted in a 13 foot cupola with coke in one hour and a half, and then tapped into a furnace similar to the Pernot, heated by the regenerative system. The flat hearth is covered with a layer of almost one foot of iron melted at a very high temperature. Before every heat from 1,500 to 1,700 lb. of ore, also heated until sintered, are added. Another point which has not yet been settled is whether it will be possible, by adding a silicious pig, to fit the refined metal for the Bessemer process, for which, as at present constituted, it is not suitable, as the dephosphorizing process eliminates the silicon simultaneously.

Apropos to the above, the Boston *Journal of Commerce* adds that Mr. Sidney G. Thomas, one of the inventors of another famous dephosphorizing process, not content with having rendered phosphorus—that dreaded impurity of iron and steel—harmless, has gone one step further, and proposes the utilization of the phosphorus which in his process is, as it were, concentrated in the slag. He roasts the cinder obtained in blowing pig with simultaneous additions of lime and oxide of iron, in a reverberatory furnace, in order to convert the protoxides of iron and manganese into insoluble peroxides. After calcination the slag is ground fine, and is treated with cold hydrochloric or sulphuric acid, diluted, or with a cold solution of sulphurous acid, which dissolves the phosphoric acid. With the latter solvent the phosphate will be almost at once precipitated on heating, while the sulphurous acid, which is driven off, may be recovered by condensation. The solution in hydrochloric or sulphuric acid may be completely evaporated, forming a concentrated product which, when the former acid has been used, contains chloride of lime. These, or any other methods practiced for the manufacture of phosphates, may be made use of. As few have an idea of the enormous quantities of phosphorus which are annually wasted in the manufacture of iron, it may be interesting to cite the fact that the phosphorus contained in the iron produced in the Cleveland district of England alone amounts to 30,000 tons. The recovery of phosphorus is not a novel idea, but it is possible that the concentration of phosphoric acid in the slag (7 to 15 per cent) may render it practically attainable.

Carbon Photo Printing.

Mr. F. Gutekunst, 712 Arch street, Philadelphia, has organized a complete establishment for the printing of photographs by the carbon process, that is, in printer's ink that never fades. We have received some specimens of the work done, which are unsurpassed for excellence and reflect credit on the printer. For book illustration and portraiture this method of printing yields the finest results.

Scientific American.

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VOL. XLI., No. 8. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, AUGUST 23, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT
No. 190,
For the Week ending August 23, 1879.

Price 10 cents. For sale by all newsdealers.

A SUBJECT FOR INVESTIGATION.

In another column we reprint a remarkably suggestive article from the London *Engineer* on the mysterious in boiler explosions.

In spite of conviction of the great majority of boiler inspectors, that boilers explode from inherent defects, weakness, or gross misusage, our learned and practical contemporary deems it beyond question that there is yet an element of mystery attending some of the catastrophes of the sort. While ninety-nine in every hundred explosions may be clearly traceable to faults in material or construction, defects due to age or abuse, ignorance, carelessness, or neglect in management, or some other preventable cause, the *Engineer* believes, and is not alone in believing, that in the hundredth case the boiler may suddenly fly to pieces in the absence of all known conditions tending thereto.

The strength or weakness of this position hinges on the circumstance that when a new and strong boiler explodes "mysteriously" it is rarely possible to determine what the immediately antecedent conditions were. The engineer in attendance is usually killed; and there is no means of telling exactly what was the condition of the boiler, or what was going on in it, the moment before the explosion occurred. The recklessness, ignorance, or misconduct of the engineer may have brought about the disaster; but it is not safe to assume his fault in all cases, as the only alternative to indeterminable conditions.

In the Coltness case referred to, for example, "when six boilers out of ten flew away at once like a covey of birds," the boilers are described as strong enough to stand a pressure of 300 pounds, and it is not easy to see how such a pressure of steam could have been produced through any fault of the engineer or otherwise.

In a recent attempt to explain why boilers explode a Philadelphia paper says:

"If we could get down to the bottom facts of every boiler explosion it would probably be found, in nine cases out of ten, that the engineer in charge had permitted the water to get below the flues, and that, upon ascertaining the fact, he had, in his fright, turned cold water in upon the hot iron. No boiler that was ever made can withstand the tremendous pressure applied by the sudden conversion of a large volume of water into steam, and the reason why it cannot may easily be comprehended when it is remembered that one cubic foot of water will make seventeen hundred cubic feet of steam."

This theory is, and has been, widely accepted; and is a very plausible one for throwing the blame on the dead, who cannot contradict the charge. The circumstance, however, that to convert the cubic foot of water into steam would use up the spare heat of something over a quarter of a ton of red hot iron, makes the sudden conversion of a large volume of water into steam, in any ordinary boiler, altogether doubtful. As the *Engineer* pertinently remarks, it has never yet been shown how enough red hot iron could be present in any boiler to cause a development of steam with which the safety valves could not deal.

The electrical theory of explosion, the theory that under certain unknown conditions the decomposition and recomposition of water may take place explosively, and similar guesses, are equally unsatisfactory when brought to critical test of fact and experiments. The circumstance that many explosions take place just when an engine is started suggests the possibility that the sudden reduction of pressure may cause a part of the water to flash into steam; and it is supposed that somehow, by some physical law not yet discovered, the flashing process may be self-continuing in spite of the restoration of the pressure. This, however, is sheer hypothesis, and involves conditions as mysterious as the mystery to be explained. And after all, what is wanted at this time is not a plausible explanation of an unavoidable disaster, but a critical investigation of the behavior of water and steam under all conceivable conditions likely to obtain in boilers. As soon as investigation has determined absolutely all the circumstances under which water explodes, the inventor will lose no time in furnishing a boiler which will not explode under intelligent management. Thanks to what has already been determined the range of mystery in boiler explosions has been narrowed, numerically speaking, to a fractional percentage. To remove the remaining mystery is a task that may well engage any ambitious student of physics, who wishes to gain an honorable fame by benefiting his kind.

STILLÉ ON YELLOW FEVER.

At this time, when public attention is so forcibly drawn to the plague that prevails at Memphis and Havana, and threatens every commercial city of the country, our readers cannot fail to be interested in the critical review of the natural and clinical history of yellow fever, by Dr. Alfred Stillé, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

There is probably no man living whose competence to discuss the subject is more widely recognized; and now that the newspapers are so full of speculation and error in respect to the origin and propagation of the disease, the profession as well as the public will be glad to know from him what he holds to be positively known about it.

Dr. Stillé traces the origin of yellow fever to the West Indies. There it was first discovered; and from West India ports it has, in all instances, spread. It has never originated elsewhere, however favorable the conditions may have been for its rapid extension when once introduced. A high temperature is essential to its propagation; salt water and unsanitary conditions favor it; but the morbid poison must be imported in ships and fomites. A strict quarantine is always efficient in preventing the dissemination of the disease. It is not contagious. Its essential cause has never been isolated or defined, but is assumed to be a specific poison, distinct from all other fever poisons. It is spread by infection. In the system it acts primarily in two ways: by disintegrating the blood and by inflaming the stomach; secondarily, it tends to impair the eliminating function of the kidneys.

The evidence upon which these conclusions are founded, with much exact and timely information as to the character and behavior of the disease, and the effects of different modes of treatment, will be found in Dr. Stillé's lecture, reported specially for the SUPPLEMENT.

A NEW METHOD OF LOCATING LIGHTNING RODS.

The Brockton (Mass.) *Weekly Gazette* contains a long account of a so-called wonderful discovery which has been made by Messrs. George S. and A. R. Prescott, of Merrimac, Mass. These gentlemen have ascertained that "lightning never strikes the earth except in localities directly over what may perhaps be best described as electrical currents on or below its surface, with which currents the electrical discharge invariably communicates. This has been determined by a multitude of tests made in localities widely separated. It follows, therefore, that in places where these currents are not found to exist, no danger need be apprehended, as in upward of four thousand instances, where tests have been made during the past three years, no record can be found of any exception to this universal rule."

This is certainly a wonderful discovery and merits careful attention. The subject is in the domain of science, and it can be reasonably presumed that the Messrs. Prescott have some knowledge of electricity, especially of earth currents, since their work is claimed to be in the detection of such currents. Moreover, these gentlemen must have made use of scientific methods, which past experience has shown to be indispensable; or they must have created a new method which rests on a scientific basis and is not dependent upon the freaks of the observer.

On careful inquiry we have ascertained that the Messrs. Prescott lay no claim to a knowledge of science. They are farmers, and have gained their knowledge of agricultural operations from actual practice in this pursuit, and not from mere theories. Whatever success they have obtained in farming has been due to the experience which has been handed down to them and by a lifetime of labor in their chosen pursuit. Without any knowledge whatever of electricity, they have suddenly made a discovery which puts to the blush the labors of scientific men in meteorology; have curbed, so to speak, the thunderbolts of Jove; have within their reach an immense fortune; and, more than all, have demonstrated that honest ignorance can discover what skilled education has overlooked. Their method also has never been employed or even thought of by scientific men. We shall first describe it in practical operation, and then devote a few words to its theory. Having cut a forked stick from a tree—any kind of wood will answer, although the discoverers prefer a forked stick from an apple tree, an elm, or a hazel—the two forks are grasped firmly with both hands, leaving the portion above the fork projecting skyward and not earthward. With the stick held in this manner, and with a look which may be described as sublunar, the operator walks over the ground to and fro, here a little and there a little, until he perceives that the projecting part of the stick begins to point downward. Then he stops and announces that there is an earth current beneath him. He does not know what an earth current is, nor how it usually manifests itself, nor what tests are usually employed, nor does he need to know, for the green apple tree stick decides the point. He must not, however, wear rubber boots; leather boots are preferable. In this way four thousand tests have been made and repeated; sometimes with a green apple stick, sometimes with an elm stick. Changing the character of the stick, however, appeared to make no difference. Further experiments, however, are needed to clearly establish this point.

When the stick points to the ground it is clear evidence that a lightning rod must be led to this point. If no earth currents are found by this method, the house in this locality is pronounced to be safe, and does not need lightning rods. The Messrs. Prescott form a marked exception to the old adage that "a prophet is not without honor save in his own country and among his own kindred," for no other "lightning rod man" is employed in the neighborhood of their native town, Merrimac, and their fame has spread far and wide. Treasurers and presidents of banks, city engineers, teachers in academies and schools, proclaim that, however impossible it may seem, they have been witnesses to the Messrs. Prescott's skill—perhaps we should say to Mr. Prescott's skill, for one of the brothers excels the other in this matter—and no amount of scientific skepticism can change their faith in Mr. Prescott's discovery. Hundreds of people are ready to testify to the fact that Mr. Prescott has repeatedly discovered places where lightning has struck in the past; and on being led by the oldest inhabitant into places remote from the Prescott homestead, has infallibly proclaimed to the awestruck observers, "Lightning once struck within four feet or less of this point." So much for the practice. Now for the theory.

It is claimed that "the human frame is the most sensitive to electrical influences of any organized form. Indeed, so far as cognizant to the sense and present knowledge, elec

tricity seems to be the factor of the mysterious principle of life in the work of the human system." Mr. Prescott has a wonderfully sensitive organization. He has the hitherto unknown "electric sense," and he can, to speak metaphorically, smell electricity or taste it in the air or earth. He is not, however, the only person who has claimed to have this power. If he and his friends will procure a copy of Baron Charles von Reichenbach's "Physico-Physiological Researches in the Dynamics of Magnetism, Electricity, Crystallization, and Chemism," published in Partridge & Brittain's Spiritual Library, it will be found that Mr. Prescott belongs to the class called sick sensitives; in other words, to a class of persons whose systems are supposed to be peculiarly sensitive from disease to general cosmical phenomena. In the same book will also be found a long account of the use of a forked stick, which use is there called Blétonism, from the name of an agricultural laborer who had great success in its use. It is evident that agriculture is about to assert itself in the cognate field of electricity and magnetism. An account of the forked stick can also be found in Dr. Hutton's Mathematical Recreations, which is a translation with additions of Montucla's improvement of Ozanam's Recreations. An account of the virtues of the forked stick can also be found in Dr. Herbert Mayo's "On the Truths contained in Popular Superstitions" Letter XII. (London, 3d ed., 1851). It may interest Mr. Prescott to know that his forked stick has various names. It has been called divining rod, virgula divina, baculus divinatorious, baquette divinatoire, and the wonders accomplished by its use have been testified to by thousands of people for more than a century. If Mr. Prescott is a reader of fiction, he will also find an account of Douster Swivel's use of the forked stick in Walter Scott's novel "The Antiquary."

It is said by Mr. Prescott's believers that if he did not use such an absurdly simple contrivance as a forked stick he would have more followers and make a greater fortune. Indeed, it has been proposed that he should get up a complicated contrivance with a maze of wheels and electro-magnets, which should have nothing, however, to do with his method; but walking forth in boots (leather), with the stick and the machine, he should attribute the discoveries to the machine. Pessimists claim that he would then be in entire sympathy with the age.

Briefly let us sum up the claims of the Prescotts. We shall put the claims against the evidence in the following table:

CLAIMS.	EVIDENCE.
A forked stick in the hands of a sensitive person is a scientific instrument capable of detecting earth currents.	No evidence has ever been submitted to men capable of judgment on this point. The belief is supported only by invalids, and is an evidence of invalidism.
Mr. Prescott belongs to the class called "sick sensitives."	No medical school of any standing believes in the powers of the "sick sensitives" to discover occult phenomena. No master of his profession believes in such powers.
Earth currents have a determinate direction, and under the action of thunderstorms will always take the same direction.	Earth currents do not have a determinate direction, and the influence of a thunderstorm does not determine their direction.
The electric discharge seeks to unite itself with earth currents.	No evidence. This can only be determined by electrical tests, which Mr. Prescott and his friends are incapable of making, from utter ignorance of the subject of electricity.

The above is our statement of the case, and it is only justice to Mr. Prescott and his followers to state his case in the same manner, with a few comments, which can be taken or rejected.

CLAIMS.	EVIDENCE.
Four thousand test cases, more or less.	Tests made of twigs from three or more kinds of trees, all taken from different localities, and cut by unprejudiced observers.
The testimony of innumerable people, including teachers in high schools, civil engineers, and prominent business men of high standing and respectability. They have seen with their own eyes. They have been convinced beyond all doubt.	Respectability has always had great weight in deciding upon scientific matters. It is reasonable to suppose that if a bank president or cashier maintains his good standing in the community, his judgment on any subject, even on one to which he has paid no attention, is of value. Civil engineers and teachers can be summoned as experts in matters of scientific evidence.
Mr. Prescott has eminently the air of an honest man. He has been known man and boy by his neighbors for many years.	Honest looking men have never deluded themselves or deluded their neighbors.

In conclusion, the use of the forked stick is recommended to mining speculators and prospectors. Thousands of respectable persons in the past have testified to its efficiency in discovering lodes of precious metals, and it is one of the strangest facts in human history that mankind has stubbornly refused to discover precious metals by the use of such a simple means, and have forced themselves into what may be called complicated and theoretical scientific methods.

LABOR AT HOME AND ABROAD.

The reports of American Consuls in Europe, with respect to the conditions of trade in their several districts, have in many instances been laid before the readers of this paper. It will be no news to them, accordingly, to be told that the average condition of industrial communities abroad is far below that which has obtained here, even in the worst of times. The effect of these reports is naturally intensified when they are massed together, with the evidence on which they were based, as they have been in a volume just issued by the Department of State. Covering, as they do, all phases of the labor question in Europe, these reports furnish a telling picture of the condition of the working people of Europe—their continued struggle with adverse circumstances—as compared with the condition of the working people of the United States, and show, as perhaps no single volume has ever done before, the difference between labor disfranchised, degraded, and hopeless, and labor free, honorable, thriving, and an equal sharer in political power.

The following deductions are said by the department to be clearly proved by the reports:

1. That wages in the United States are double those of Belgium, Denmark, France, and England, three times those of Germany, Italy, and Spain, and four times those of the Netherlands.

2. That the prices of the necessaries of life are lower in the United States than in Europe, and that the laborer in the United States, were he satisfied with the scanty and miserable fare upon which the European laborer must live, can purchase like food for less money than it can be purchased for in Europe.

3. That the French working people, with far less wages, are happier than the working people of Great Britain, who receive the highest wages in Europe, on account of the steadiness and the economical habits of the former, and the strikes, drinking habits, and consequent recklessness of the latter.

4. That more misery results from strikes, drinking, socialism, and communism in England and Germany than from all other causes combined, hard times included.

DRAGON FLIES.

"Dragon flies," "mosquito hawks," "devil's darning needles"—these are some of the common names for certain well known neuropterous insects of the family *Libellulidæ*. They are commonly seen skimming in swift flight over the surfaces of ponds and other bodies of still water. The head and thorax are greatly enlarged—the eyes entirely covering the sides of the former—and the hind body is very long and slender, terminating in the male with a pair of clasps for seizing the female. The two pairs of wings are nearly equal in size, transparent, and finely netted, and in many species clouded with broad bands of brown, blue, or crimson. The flies attach their eggs to the submerged leaves of aquatic plants or drop them carelessly upon the surface of the water.

The larvæ are aquatic, living at the bottom of the pool or stream they inhabit, and breathing by means of *tracheæ* situated in the tail. They are further characterized by what is known as a "mask," which is an elbowed extension of the *labium* or under lip, and is armed at the extremity with two sharp hooks for seizing and holding the prey. When not in use this apparatus is folded up over the lower part of the face, but to grasp a victim may be suddenly thrust forward, These dragon fly larvæ feed upon young mosquitoes or "wrigglers" and other aquatic insects, particularly the young of May flies (*Ephemeridæ*. They are active and predacious in the pupa as well as in the larva and perfect states. When about to change into a fly the pupa leaves the water and crawls upon some plant or other object above the surface of the water. After clinging there a short time a rent appears on the top of the thorax, through which the fly emerges.—*Prof. C. V. Riley.*

Louis Favre.

The news of the death of Mr. Louis Favre, the contractor of the Great Tunnel of the St. Gothard, spread through the city of Geneva on Saturday, July 19, calling forth, says the *Swiss Times*, universal expression of sympathy and regret. Louis Favre was a man of more than ordinary merit. He commenced life as a day laborer and won his way up to the front rank by sheer force of will and honest industry. This name will be handed down to posterity in connection with the great enterprise of his life, and his descendants may speak of him with more pride as Favre du Gothard than if he had been born to one of the thousand titles to a *de* or a *von*. At the time of his death he had overcome the great obstacles to the success of his gigantic undertaking, and it is no secret that these obstacles came rather from men than from nature. He falls, as fell Sommelier of the Mont Cenis, after years of persistent and weary warfare at the moment when his labors were to be crowned with honor, riches, and the calm enjoyment of a world-wide reputation which all men love so well.

To those who had the good fortune to meet him in his great natural workshop, the bowels of the St. Gothard, he leaves a remembrance of a lion hearted man, endowed with all the charm which comes from strong will tempered by rich experience and a buoyancy of spirits which nothing could repress.

THE AMERICAN ONION-SMUT IN FRANCE.

According to M. Max. Cornu, in a note recently presented to the French Academy, the onions are being attacked in the vicinity of Paris by a fungus which fills the interior of the bulb-scales and the base of the leaves with a black powder. A longitudinal section of the bulbs attacked (which belong to the early variety of the white onion and the onion of Nancy) shows that the black dust occupies the entire substance of the scales or of the leaves. The presence of the parasite, in addition to the decay which it produces, greatly modifies and alters the normally white appearance of the onions. The black dust, examined with the microscope, is seen to be composed solely of an enormous quantity of spores; and these spores are characteristic of a genus of ustilagineæ, which was first called polycystis by Leveillé, and afterwards urocystis by Robenhorst.

The particular species under consideration is new, not only to France, but to Europe, and is not mentioned in the works of Tulasne. Dr. Farlow, of Harvard College, in his report on the diseases of onions, first called attention to it, and described it as new under the name of urocystis cepulæ. It is only in recent years that the fungus has made its appearance in America, its ravages for a dozen years past having been confined to the States of Connecticut and Massachusetts, where the culture of onions forms an important branch of agriculture. Here it has produced a damage amounting to many thousands of dollars a year. At the date of Dr. Farlow's report the disease was as yet unknown in New York. Dr. Farlow thinks that the fungus has come from some of our wild species of onions. Mixing the seeds with lime or special treatments of the soil have no effect, and it appears that it is necessary to wait four years before commencing onion culture in the same soil again. "It is not the first time," says M. Cornu, "that a new infection has come to us from America. Without citing the phylloxera and dorysphora, insects equally to be feared, I may mention the oidium of the vine, and puccinia malvacearum, the latter of which I first noticed the presence of in Europe."

We are willing to father the potato-bug, the phylloxera, and, perhaps, the onion-smut, since it was first detected here; but the so-called "oidium" of the vine occurs here, not on native vines, but on those of European species raised in hothouses. As for the mallows-brand (puccinia malvacearum), no American mycologist has as yet reported its presence among us; we have seen specimens from Africa, however.

NORDENSKJOLD'S EXPEDITION.

The fact was announced not long since that Professor Nordenskjold's expedition had survived the winter, ice bound near East Cape, Siberia, and that the explorer hoped soon to be able to proceed to Behring Strait, about 400 geographical miles from the Vega's winter quarters. Dispatches from Stockholm and Berlin, August 3 and 4, state that the Vega had got clear of ice and passed the strait; but no information is given of the route through which the alleged intelligence came. On the other hand, the Alaska Fur Company at San Francisco strongly doubt the truth of the report. Their advices from the neighborhood of Behring Strait were to the effect that the season had been very late on the Asiatic side, and that strong east winds had prevailed, piling up the ice so as to make the possible passage of the Vega very doubtful.

Activity in the Iron Trade.

Though it is now midsummer, usually a dull season in the iron trade, the demand for iron is great and prices are tending upward. The intelligent secretary of the Iron and Steel Association of the United States predicts that the product this year will be the largest the country has known. He also believes that the activity which prevails to-day in all branches of the iron and steel trade will continue for at least a year to come. Nearly all the favorably situated rolling mills are in operation, and numbers of these mills, as well as furnaces and steel works, have orders ahead for several months. The truth is the iron industry has been so long under a cloud that the actual need of iron throughout the country is enormous.

MANY persons are puzzled to understand what the terms "fourpenny," "sixpenny," and "tenpenny" mean as applied to nails. "Fourpenny" means four pounds to the thousand nails, or "sixpenny" means six pounds to the thousand, and so on. It is an old English term, and meant at first "ten pound" nails (the thousand being understood), but the old English clipped it to "tenpun," and from that it degenerated until "penny" was substituted for "pounds." When a thousand nails weigh less than one pound they are called tacks, brads, etc., and are reckoned by ounces.

The Paper Makers' Association.

The second annual convention of the Paper Makers' Association of America assembled at the Grand Union Hotel, Saratoga, N. Y., July 30 About forty manufacturers were present. Wellington Smith, of Lee, Mass., presided. He said that although prices were lower than last year the trade was in a better condition, there being an increased demand; that a year ago the trade was in the lowest condition ever known, but now the mills throughout the country were running on full time.

THE HOLLY SYSTEM OF STEAM HEATING.

These are the days of large enterprises, when things are done by wholesale, by a massing of labor and a concentration of capital. Many of our daily wants are supplied not by the simple, single-handed ways of our forefathers, but by a system of supply which economizes labor and lessens expense. Our light comes to us through pipes in the streets; the water used by the thousands of families in any of our large cities comes from a single source of supply; many of our other needs are supplied in a similar way; and now, at last, our dwellings and places of business, our churches and public buildings, are to be heated from a common center.

We have on one or two former occasions alluded to the Holly system of steam heating, controlled by the Holly Steam Combination Company, of Lockport, N. Y., and now we are able to present our readers with engravings representing some of the details of the system. Heating by steam has been practiced for years; but it has been accomplished by placing the steam generator as near the radiators as possible. This has demonstrated the desirability of steam as a heating agent, and at the same time has proved its hygienic and economic superiority over other methods of heating. The Holly system goes a step further and increases the measure of economy and safety, and decreases the labor connected with steam heating by generating the steam at a central station, and supplying a large area with steam for heating, for cooking, and for power, through underground pipes, thoroughly protected against radiation, and provided with expansion joints, steam meters, pressure regulators, and other apparatus necessary to the perfect working of the system.

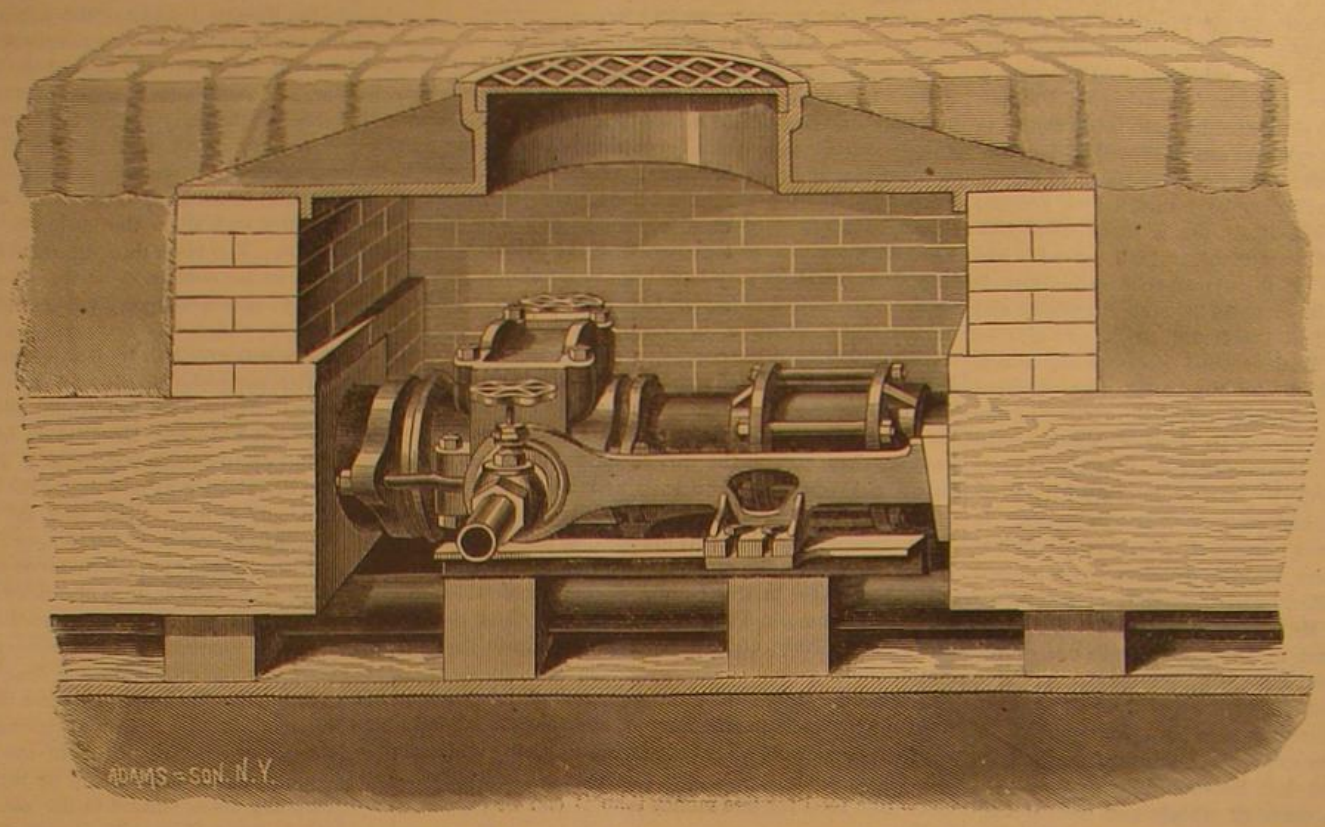


Fig. 1.—EXPANSION SERVICE BOX.

The first experiment on a grand scale was tried in January, 1877, in the city of Lockport. Three miles of underground pipe were employed to thoroughly test the feasibility of the project. It proved a complete success, and the company is now engaged in introducing the system into several of the larger cities in this country.

In the pipes used in this system, an expansion junction service box, Fig. 1, is placed at intervals of 100 to 200 feet. This provides for the free longitudinal expansion and contraction of the mains, and from this box the service pipes are carried underground to the basement of buildings to be heated. The service pipes, having an adjustable hood inside the junction box, may be turned downward, thus taking up the water of condensation as fast as it accumulates, and carrying it forward to the regulator valve inside the cellar walls, as shown in Fig. 2. At this point, the water of condensation being at the degree of heat due to 50 lb. pressure to the square inch, is wire drawn, and by this reduction of pressure it is largely reconverted into steam, and is carried on to the radiators, where it is again condensed. By this device it will be seen that although 50 lb. pressure is carried in the mains, it may be reduced to one or two pounds in the building, and therefore in a house two or three miles distant from the boiler there will be precisely the same result as in a building only a few feet away. The consumer living near the boiler house will have no advantage over the consumer living a mile away, since each will ordinarily carry the same house pressure—and consequently at the same temperature.

This system admits of the use of all kinds of radiators; but the new atmospheric radiator invented by Mr. Holly (shown in Fig. 3) is probably preferable to anything else, as the internal pressure and external atmospheric pressure are equal, admitting of the use of thin sheet metal in their construction. Steam may be admitted to the radiator so that it will cover any proportion of its inner surface, and being very thin, the same amount of surface will give off more heat than the ordinary heavy cast iron or wrought iron radiators.

The distributing pipes are freed from water by a steam trap (Fig. 4) invented by Mr. Holly. The water resulting from condensation in the building is delivered to an accumulator, from which it may be forced by steam pressure at any time to a tank in the attic, to be distributed through the house for general use as it may be required. A vertical section of a dwelling, provided with this heating apparatus, is shown in Fig. 5. The supply pipe and expansion joint are seen under the sidewalk. The regulator stands in the basement, and the radiators are shown in position on the several floors.

The steam used by each consumer makes its own record upon a strip of paper moved by the clockwork of the meter (Fig. 2). The pencil denotes the quantity of steam used, and the time of day at which each radiator in the house was put on or taken off. Thus each consumer pays for what he uses, and for no more. In this way equitable dealing is maintained between the company and its consumers.

The steam may be used to great advantage in cooking. In many large hotels the greater part of the cooking is done by steam and gas, but the apparatus is too expensive to go into general use. A stove, made of sheet copper, galvanized iron, or tin, at a slight cost, is used in connection with this system. The center opening is nine inches, and those around the outside six inches, making seven openings in all. The central steamer may be quite long, extending downward, with compartments, so as to cook several kinds of vegetables at the same time. There are receptacles for cooking oysters, custard, tea, coffee, puddings, etc., all at the same time. Cooking can be done more quickly and better than by a wood or coal stove, and without danger of burning, and avoiding extreme heat in the room during warm weather. The steam made with one pound of coal will cook these articles in less time than it would take to start a good coal fire. The steam can be taken from the air valve of the radiator through a small rubber hose, into the bottom of the central column of the stove.

In addition to the uses already enumerated the steam may be used as a source of power. Steam fire engines used in

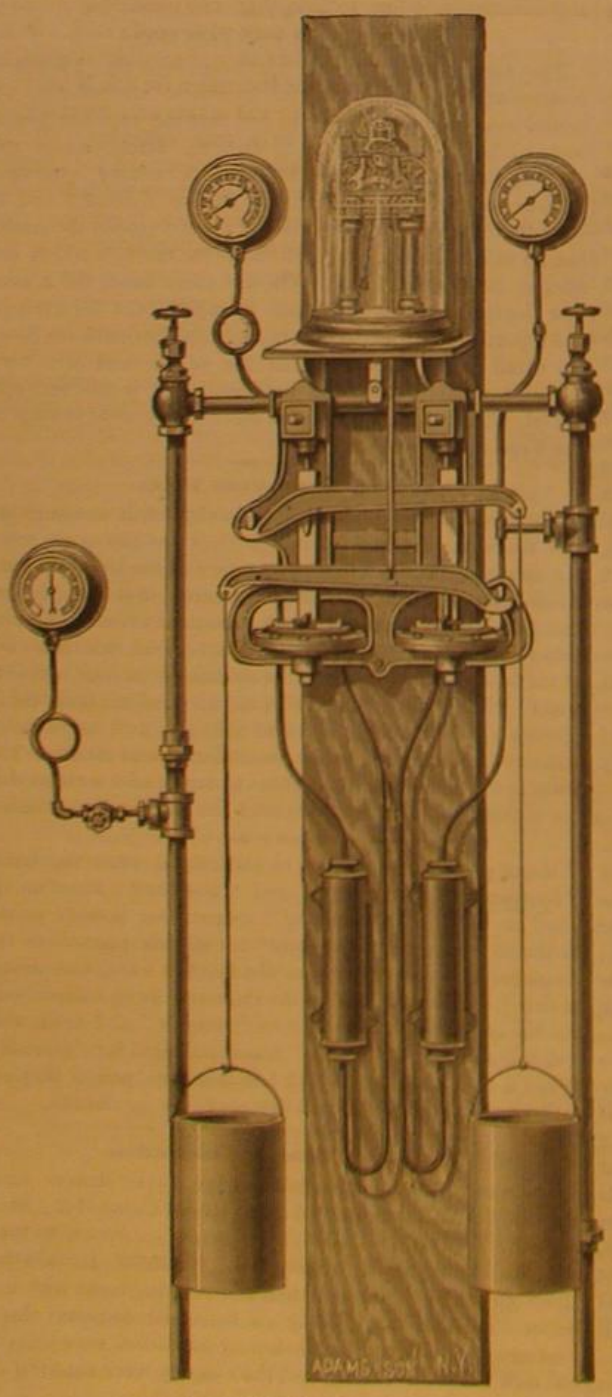


Fig. 2.—REGULATOR AND METER.

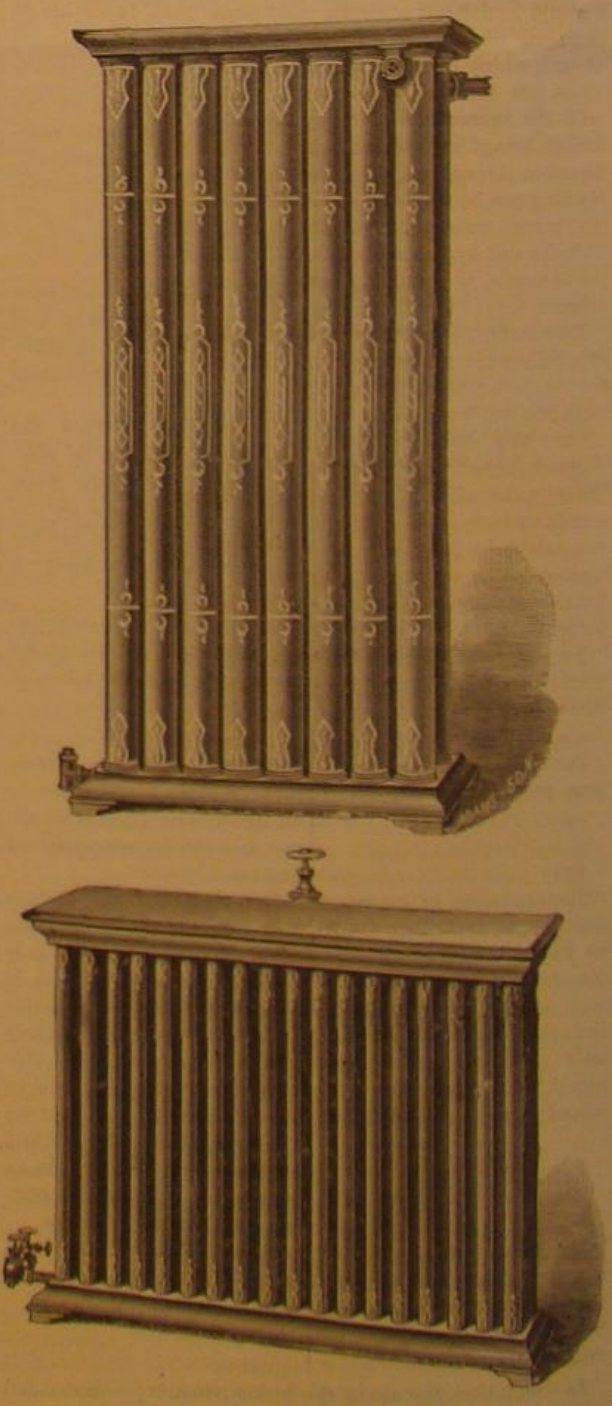


Fig. 3.—HOLLY'S RADIATORS.

connection with the system will need no boiler, and may therefore be made very light and portable, and one of the principal items of expense will be avoided.

Snow and ice can easily and cheaply be removed by steam from streets and sidewalks, where in large cities it is frequently a serious obstacle to ordinary locomotion and traffic. A receptacle one by six feet, near the curbstone, with a steam coil at the bottom, will melt the snow as fast as delivered therein, and the water will be conveyed to the adjacent sewer. Experiments show that the cost in fuel of melting a ton of snow in this manner will not exceed five cents.

The matter of steam supply for large districts is no longer a question of experiment. Two or three years of actual test have established this system as one of the institutions that conduce to the comfort and safety of the masses; and we may expect at no distant day to see the inhabitants of our cities and villages enjoying the comforts of an equable temperature, a healthy atmosphere, and a safe and convenient power for driving machinery either small or large.

European Railway Speeds.

A paper has been published in Germany showing the different rates of velocity at which railway trains travel in different countries. According to this table, the swiftest runs are in England, between London and Dover, London and York, London and Hastings, where the average reaches 80 kilos—50 miles—an hour. In Belgium some trains travel as fast as 67 kilos—nearly 42 miles. The express trains from Paris to Bordeaux, Orleans line, average 63 kilos—39½ miles; the same speed is attained by the express trains between Berlin and Cologne. Between Bologna and Brindisi the average maximum is 50 kilos—nearly 31¼ miles. The average Austrian express speed is from 40 to 48 kilos—25 to 30 miles. On the Moscow and St. Petersburg line one travels at the rate of 43 kilos—nearly 27 miles—per hour; the same speed is observed in Switzerland between Geneva and Lausanne, and between Zurich and Romanshorn. But on the other Swiss lines one must be content with a slower pace. Thus from Zurich to Basel the highest speed is 38 kilos, and between Basel and Berne, 34—nay, between Soleure and Bergdorf the moderate gait of 25 kilos, or a little more than 15½ miles an hour, is observed. There are in Switzerland no purely "through" trains.

Havana the Pest-Breeding Place.

Dr. Chaillè, chairman of the Havana Commission, has lately written to the National Board of Health as follows:

As to the sanitary condition of Havana and of its harbor it would be difficult to devise conditions more favorable to propagate disease. Built upon a thin layer of earth which covers extremely porous coral rocks, this foundation is deeply saturated with the excrements of many thousands of human beings and of animals, continuously deposited throughout a long series of years. Nothing can be worse or more offensive than the privy system of Havana. Associated with the evil hygienic conditions of the city the harbor is, if possible, in even fouler condition.

This harbor, about one mile long, two thirds of a mile wide, and some thirty feet deep in the deepest places, has a difference between its minimum low and its maximum high tide of less than two feet; and into this almost stagnant pond is daily poured the sewage of the city, the offal of the slaughter houses, and the refuse from at least two large hospitals habitually infected with yellow fever and located on the very edge of the harbor. The fœcal odor from this harbor is often distinctly perceptible.

Among other things done, at the suggestion of Dr. Daniel M. Burgess, of Havana, to whom I owe much, I have inspected the ballast sold to and transported by ships from this port. Repeatedly has the ballast from this port been accused of causing outbreaks of yellow fever in ports of the United States, and as repeatedly has this been discredited. I have no hesitation in asserting, as the result of personal examination, that if there be anything whatever which can serve as fomites to transport yellow fever poison, the ballast from this port appears to be eminently fitted for this purpose. In my opinion, the National Board of Health should at once adopt such measures as may be needful to protect our ports against the dangerous risks they are subjected to by all ballast from this port.

New Use for Cocoanut Milk.

Dr. George M. Sternberg, Secretary of the National Health Commission, now at Havana, says:

I find that the air of our laboratory is loaded by minute spherical organisms, and contains bacteria not distinguishable from *bacterium termo*. I have made some experiments for testing apparatus designed for the purpose of keeping putrible fluids germ-proof, using for my test the liquor from the interior of an unripe cocoanut. This liquor possesses properties which will, I believe, make it of great value. . . . It is transparent as water when the nut is not too ripe, is contained in a germ-proof receptacle (the cocoanut), and when exposed to the air, bacteria and other organisms develop with astonishing rapidity. In my first experiment two portions from the

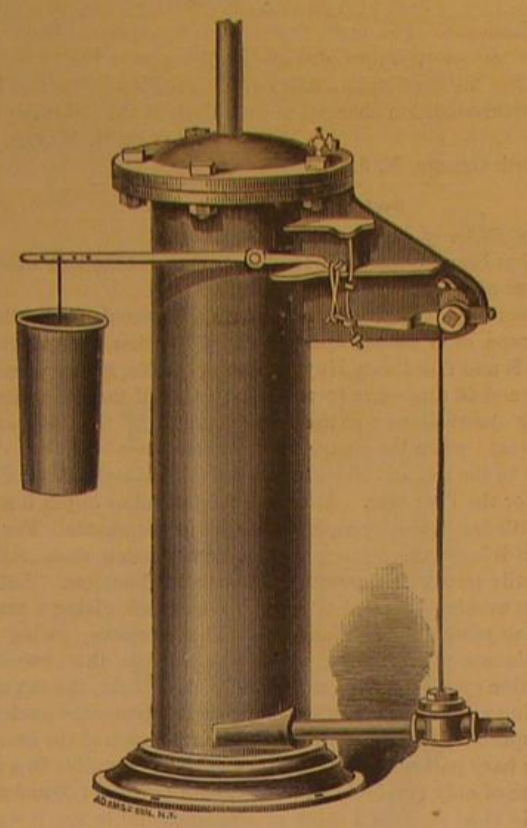


Fig. 4.—STEAM TRAP.

same nut were placed in small beakers, one exposed to the air and the other protected by the glass cover and bell jar (Lister's apparatus), with previous precaution of heating apparatus to 320°. The following morning the portion exposed to the air was milky in appearance and loaded with bacteria large and small, and had upon its surface a pellicle containing the cells of some fungus; the portion under the bell jar was clear as water. I have succeeded in keeping this liquor in quantity for three days in a Florence flask, made germ proof by heating to 320° Fah., and provided with a cotton germ filter. I have made several good negatives of bacteria developed in cocoanut liquor for the purpose of testing my lenses and apparatus. I propose to continue the experiments commenced during the ensuing week.

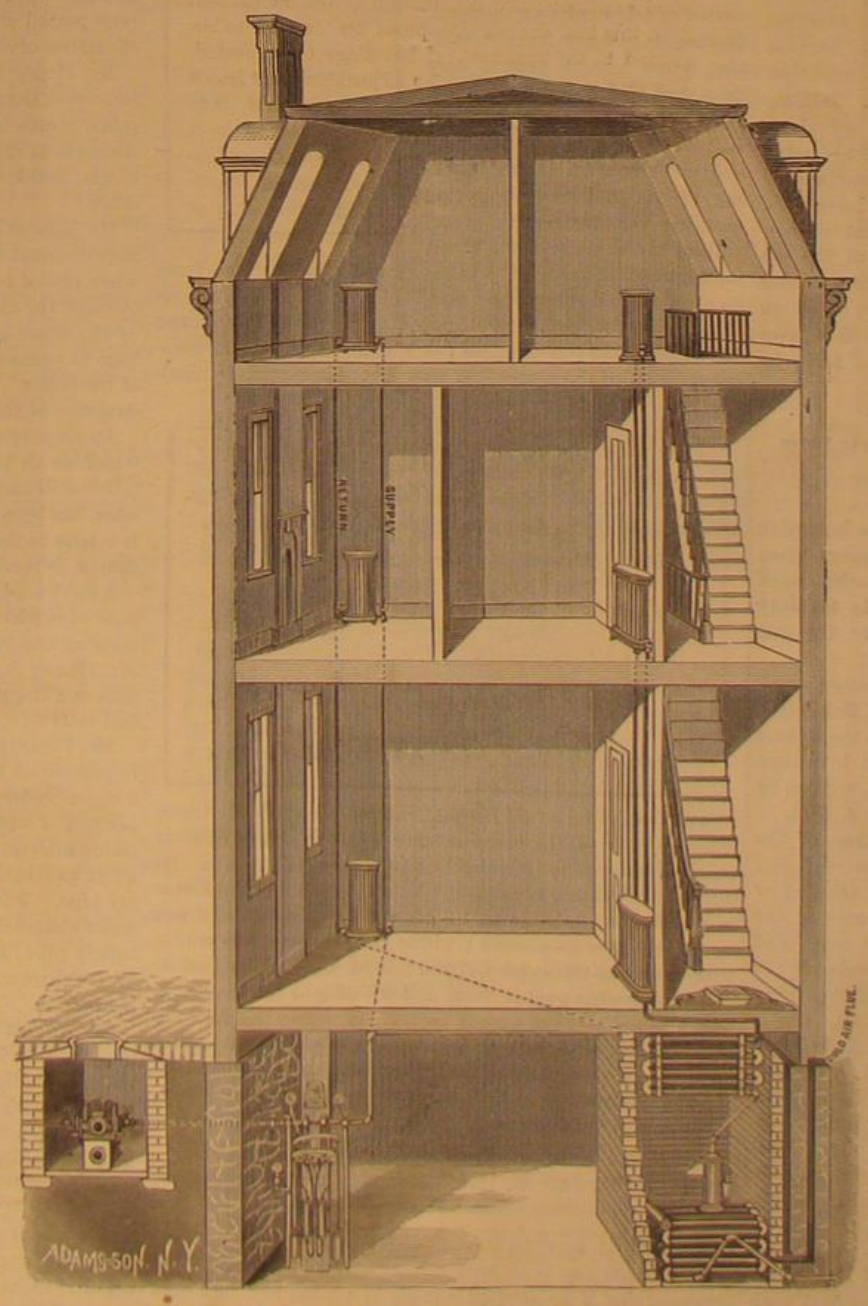


Fig. 5.—INTERIOR ARRANGEMENT OF HEATING APPARATUS.

Hollway's Metallurgical Process.

The Council of the Society of Arts, London, in their annual report, state that, looking at the character of all the papers brought before the Society during the year, the Council feels that they will compare favorably with those of any previous session. It would take too long to discuss the respective merits of all the papers which have been read since Christmas, they were all of considerable value; but amongst them are some deserving special mention, and in Mr. Hollway's paper on "A New Process in Metallurgy" were embodied the results of some of the most important experiments which have recently been made in that science. Mr. Hollway proposes to reduce metallic sulphides by using the ore itself as the chief fuel for the reduction. This is done by forcing a current of air through the molten sulphides. At first the combustion is started by using coke, but afterwards it is found that sufficient heat is generated by the oxidation of the sulphides, without any further addition of carbon. The process has not yet passed beyond the experimental stage, but should it prove a commercial success, it will effect a most important economy in one of the largest industries in this kingdom. So great was the interest aroused by Mr. Hollway's paper, that it became necessary to devote a second evening to its discussion; on both occasions the room was crowded, and the discussion was of an important and influential character, the opinions expressed being almost uniformly favorable. Of all the papers read before the Society during the year, Mr. Hollway's is the one the Council consider the most remarkable and the most important. Should the process at all carry out the expectations of its inventor—and he is supported by some of our leading chemists—it will add one more to the many great inventions which it has been the constant aim of this Society to introduce to the world.

Gelatine.

Gelatine, it is said, has a peculiar action on gum; if gum be added to gelatine, and the mixture sensitized with ammoniacal potassium bichromate, the behavior of the latter substance is very little altered by the addition of the former. Its solubility in hot water is somewhat increased, and to obtain the same degree of insolubility for the image as with pure gelatine the exposure must be longer. But if the mixture be acidulated with acetic acid, the film after exposure and desiccation is less soluble than one consisting of chromated gelatine only with acetic acid. Gum, therefore, renders an acid solution of gelatine less soluble, and the reason for this is believed to be that glutin and arabic acid form a compound solid only with difficulty Borax thickens a gelatine solution, and the alkaline reaction of the same substance tends to render the chromated gelatine more insoluble. Calcium nitrate gives to gum an enormous power of adhesiveness.

Gas Lighting Experiments.

Colonel Haywood, C E , the engineer to the City Commissioners of Sewers, London, has reported to them the results of an experiment now being made in a portion of Queen Victoria street, between Mansion House Station and the Poultry, with new gas burners, by the Gas Light and Coke Company, at their own expense.

The experiments commenced on the 6th March. The new lamps are fitted with Sugg's London Argand "Governor" burners, with glass chimneys. They are of two sizes—one consuming 22 cubic feet of gas per hour, the other 50 cubic feet. The gas is consumed in the smaller burners in two concentric columns or rings of flame, and in the larger burners in three rings. The burners are so arranged as to be self-lighting when the gas is fully turned on. They are in lanterns of an improved description, the smaller in lanterns octagonal in plan, and the larger in twelve-sided lanterns. Both lanterns are larger than those ordinarily used, and have the upper parts glazed with a new kind of white glass, which partly reflects and partly transmits the light. The lower portions are glazed with ordinary clear glass.

Proper means are provided for ventilation and preventing down draughts. There are 30 of the smaller and 5 of the larger lamps, and they supersede 55 ordinary lamps. The length of the street lighted is 353 yards. The burners consuming 22 feet of gas per hour have an estimated illuminating power of 80 candles, and thus 30 lamps are equal to 2,400 candles. The 50 foot burners have a power of 200 candles, and five lamps are thus equal to 1,000 candles. The ordinary lamps temporarily superseded are equal to 770 candles, or 4½ times less than the experimental lamps. The cost of the 55 ordinary lamps superseded is £4 17*s.* 6*d.* each per annum, or £268 2*s.* 6*d.*

in all. The cost of the smaller experimental lamps is £19 1s. each per year, and of the larger £41 2s. 6d., or £777 2s. 6d. in all. The new system, therefore, is nearly three times more costly than the old. The general result, therefore, is that the new system gives nearly 4½ times as much light as that in general use, and costs about three times as much. It should be added that the experiment is being conducted at the sole cost of the company.

Correspondence.

An Invention Called For.

To the Editor of the Scientific American:

There is one invention which is very much needed by the farmers of America, one which would add millions to their income, millions to the commerce of our country, and one which, if it can be invented and successfully operated, will make the inventor a millionaire. It is some kind of a machine by which the loss in the wheat crop will be reduced to, say, one fifth of the crop.

I will give you an idea of the loss in the crop by stating an experiment which I have tried this summer to test the loss. A neighbor had a field of 85 acres near my house, which was judged to make 10 to 20 bushels per acre. When fully ripe I selected one square yard, which I was sure was less than an average of the field, cut, dried, and rubbed it out very carefully. It weighed 6 oz. Calculating from that datum, the field made 2,571 bushels. When the crop was cut it was saved as clean as is usual, and was as cleanly thrashed as any I ever saw; and yet he only got 1,050 bushels, which shows a clear loss of 1,521 bushels; in other words, he saved about two fifths and lost three fifths of the crop.

I have never known more than one half of a crop saved even by the most careful management. It seems to me that one fifth, or 500 bushels, in 2,500 would be a heavy loss, but when it is 1,500 in a crop of 2,500, it is unbearable.

I think if you will present this subject, through the SCIENTIFIC AMERICAN, to the inventive geniuses of our country, that some of them will probably invent machinery by which this tremendous loss will be at least greatly reduced. It may be proper to say that the wheat was cut with cradles, and cut very clean, the field thoroughly raked, and it was thrashed by an A No. 1 steam thrasher. Will the farmers who see this try similar experiments next harvest and note their losses?

Very respectfully,
F. W. CONNOR.

King George Co., Va., July 29, 1879.

[The foregoing is suggestive, to say the least; and we should be glad to hear of further experiments to determine the amount and the occasion of the discrepancy described. The loss of ripe grain by the depredation of birds, squirrels, rats, mice, and other vermin, is unquestionably considerable. There is a further loss by wastage in the process of harvesting, especially when any portion of the crop is over-ripe, due to tardy harvesting or to irregular ripening. But the assertion that three fifths of an entire crop—the actual returns of which exceeded the farmer's expectation—should be lost in harvesting, or that more than half our annual wheat crops are regularly lost that way, is simply incredible. We fear—no, not that; we are glad to believe—that our correspondent has but added another illustration of the too common habit of drawing sweeping conclusions from slender observation. One square yard is too small an area on which to base a judgment of the yield of over 400,000 square yards; as a test for the probable loss on millions of acres its value is inappreciable.—EDS.]

The Inductive Action of Lightning.—A Note from Professor Mayer.

To the Editor of the Scientific American:

The following account of experiments on the inductive actions of lightning, may be interesting to your readers, when viewed in connection with the remarkable experiments of Mr. George M. Hopkins, which were described in the July 19 number of the SCIENTIFIC AMERICAN, under the title "The Telephone as a Lightning Indicator."

These experiments of mine were made at my mother's residence, in the northwestern portion of the city of Baltimore, during the summer of 1863. The account of them here given is taken from a review of Professor Rood's investigations on the time of duration of the electric spark, written by me for the New York *Evening Post* of September 8, 1871.

Astonishing as is the fact of the concentration of the power of a lightning flash into such a minute interval, yet, as wonderful is the extent of the earth's surface affected by it; as will be seen from the following experiments of the writer, never before published: A galvanometer consists of a delicately suspended magnetic needle surrounded by a coil of copper wire, through which a current of electricity can pass; whenever this passage takes place the needle rapidly turns around its point of suspension. This being understood, I connected one end of the wire coil of the galvanometer with the water pipes of Baltimore, while the other end of the wire coil was joined to a gas pipe of the house which is situate in the northwestern part of the city. Thus a vast system of metallic wires stretched away three miles to the northwest, to the reservoir, and also extended to the gas works, distant two to three miles to the southeast.

A thunder storm was raging at the time, at so great a distance in the north that only the illumination of the clouds told when a flash occurred. Yet, whenever that flash took place, the needle of the galvanometer was instantly deflected through 10 to 20 degrees. The two occurrences were simultaneous, apparently, for I could detect no difference in the instant of their manifestation. Indeed, so sure an indicator of the flash was the galvanometer, that when I shut myself up in a dark room, signaling to an observer of the storm when the needle moved, and receiving from him a signal when a flash of lightning occurred, our signals were simultaneous. The next day it was ascertained that the storm was twelve miles distant to the north; therefore, at least five hundred square miles of the earth's surface had its electrical condition changed at each flash of the lightning.

ALFRED M. MAYER.

South Orange, N. J.

Swift's Comet of 1879.

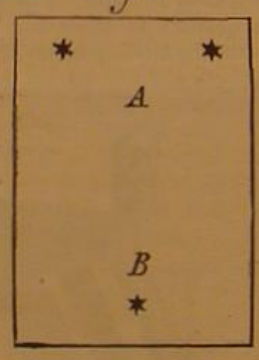
To the Editor of the Scientific American:

It has been my pleasure to obtain several excellent observations of Dr. Swift's comet of 1879.

Observations have been made with a Newtonian reflecting telescope of 5 inches aperture and 50 inches focal length, with B and C ordinary Huyghenian eyepieces, giving powers of 40 and 60 diameters respectively. One of the most interesting observations was made on the night of the 16th and 17th inst., when the comet was between three and four degrees to the left and slightly upward (at midnight) from Polaris or the Pole Star. Although a faint, misty object it was nevertheless quite conspicuous and unmistakable. For a comet it bears magnifying well, as it was much more satisfactorily seen with a power of 60 than 40 diameters. Later in the evening I applied a "solid" E eyepiece, giving a magnifying power of 140 diameters. This eyepiece, owing to the absence of reflections, which take place in the ordinary negative eyepiece, gives an intensely dark field, the sky appearing an almost jet black, and under this power the nucleus was quite bright and sparkling, although much of the outer, more hazy part was lost. The comet was also visible in a reflector of only two inches aperture, with powers of 30 and 45; and in clear weather I think no one could fail to see it with this aperture if possessed with keen eyesight, although I consider it a severe test with ordinary eyepieces.

During the three hours in which I had the comet under observation (with only occasional rests to render the eye more sensitive to details) I had a most beautiful and awe-inspiring view of its motion among the stars. The observations extended from 10 o'clock P.M. to 1 o'clock A.M. When first seen it formed, with three faint stars, a rather condensed Y, the comet being at the center or fork, but at 1 o'clock it had moved to the foot of the same, thus: A (Fig. 1) shows its first position and B at the close of observations. This was the inverted or telescopic appearance. During its passage from A to B the comet passed over a very faint star, which, although somewhat dimmed thereby, could still be seen through the hazy body of the comet. On the morning of the 23d inst. and this morning very interesting observations were made from about midnight until 1 o'clock. It has moved some distance from its position first referred to, and is now on a line drawn from the Pole Star to Beta Ursa Minor, and pointed at by Zeta and Eta of the same constellation (see Fig. 2). C shows the present position of the comet. It was first discovered 5° north

Fig. 1.



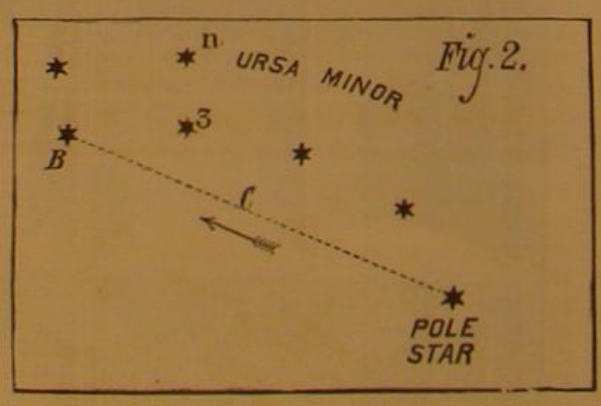


Fig. 2.

of the Great Cluster in Perseus, moving toward the north celestial pole of the heavens, over which it almost directly passed between the 13th and 14th of the present month. Its direction of motion is indicated by the dotted line and arrow in Fig. 2. It is moving a little more than 1 degree daily, and by taking C for its present position (25th of July) any reader with moderate telescopic aid and careful search may find it.

It is somewhat oval in form and with slight condensation, which to me does not appear central but nearer the forward or preceding limb. It is also my impression that under large apertures like the Washington telescope a somewhat blunted tail must be visible, the same cut away in the center, in other words double.

WILLIAM ROBERT BROOKS.

Red House Observatory,
Phelps, N. Y., July 25, 1879.

ELECTRICAL LETTER BOXES.—Among the recent applications of electricity is an attachment to street letter boxes, so arranged that if an attempt is made to rob the box an alarm will be instantly sounded at the nearest police station.

MISCELLANEOUS INVENTIONS.

Mr. Edwin N. Cowdery, of Kalamazoo, Mich., has invented a windmill having its wheel and vane hung upon horizontal trunnions, so that the wheel will be balanced normally by the vane, and may be swung to present the edge of the wheel more or less to the wind. A weighted arm is connected to the vane-staff so as to move with the staff and wheel, and balance the parts in whatever position they may be turned by the wind.

A device for preventing saws when they are in motion from deviating from their proper course, and thereby producing boards of irregular thickness, has been patented by Messrs. I. N. Kendall, of Buckingham, and R. Hall, of Gatineau Mills, Quebec, Canada.

An improved cigar-box has been patented by Mr. Charles Heylmann, of Chicago, Ill. This invention relates to an improved construction of cigar-boxes, by which the cigars may be more advantageously exhibited for retailing, and the boxes arranged without any loss of space or inconvenience in the show-case.

Mr. William H. Allen, of No. 18 West 11th Street, New York city, has patented an improved automatic grain weigher and register for weighing grain, flour, and other similar substances as they flow from a spout into a hopper or receiver. The apparatus is so constructed as to deliver the substance in exact and uniform quantities and accurately register the quantity delivered. The invention consists in an arrangement of an open bottomed suspended vessel having a pivoted partition and supported upon a scale beam of peculiar construction. The relation of the supply spout and pivoted partition is such that the latter is held in position by the former until the vessel contains the required amount, when the downward movement of the vessel releases the pivoted partition, the grain escapes, and the recording mechanism is operated. The parts automatically regain their normal position and the vessel again fills and discharges.

Mr. Emanuel J. Trum, of Brooklyn, N. Y., has patented an improved calendar, which will display two successive months and days of the week in their proper order opposite figures indicating the days of the month. The invention consists in placing the figures of the calendar on a card, and above and below these strips of paper or card, on which are printed the month, year, and days of the week, one strip indicating the month last past and the other the current month.

Mr. William Wilmington, of Toledo, Ohio, has patented improvements in the moulds used in casting car wheels. The invention consists in inclosing the outer periphery and a portion of the bottom of the chill in a suitable ring, while a portion of the top of the chill is embraced by the bottom of the cope, provided with mechanical devices that will retain the chill in place when moulding the wheel, and at a later period will permit the chill to expand freely during the operation of casting.

Mr. Henry R. Robbins, of Baltimore, Md., has patented an improved letter box of the kind ordinarily located upon lamp-posts, which indicates the time of the collection of the mails throughout the day, provides an increased security for the letters, and keeps the letters and papers separate from each other.

Mr. Zelotes McKinley, of Camden, Mich., has invented an improvement in the class of washboilers constructed so that when placed over a fire a circulation of water is induced through the clothes, the hot water from below being raised by the steam and poured over the clothes in a stream or cascade to again find its way back to the chamber in the bottom of the boiler. The invention consists in the peculiar construction of the false bottom of the boiler.

An improvement in the class of middlings purifiers, in which an air blast passes through a sieve or screen for the purpose of carrying off the dust, fuzz, and light particles of bran, has been patented by Mr. Jacob Fitz, of Hanover, Pa. It relates to the construction and arrangement of parts, which cannot be readily described without an engraving.

A device adapted for attachment to a churn for the purpose of catching the cream that escapes through the dash opening and returning it to the churn, has been patented by Mr. Homer A. Noe, of Republic, Mo. The invention consists in a trapping device that is placed upon the dash rod and rests on the churn cover.

Mr. Fredrique R. Lewis, of Troy, N. Y., has invented an improvement in water coolers, which consists in furnishing a water cooler with a central water tube or chamber, the upper end of which is carried to the side wall of the cooler, and communicates through an aperture in the inside lining with a box provided with a filter and connected with a water supply pipe. The space between the walls of the cooler and the water chamber receives the ice. The water passes from the supply pipe through the filter to the water chamber, is cooled by the surrounding ice, and drawn off through a faucet in the bottom.

Mr. August Witte, of Kansas City, Mo., has invented an improved device for holding a door open, which consists in the combination of a base plate provided with lugs, a pawl provided with an arm and a hook, and a catch-plate provided with the flange, the parts being arranged so that the device may be readily operated by the foot.

In an improvement in extension stovepipes, patented by Mr. Robert R. Pattison, of Terre Haute, Ind., the inventor makes use of pipe in lengths, fitted together to move telescopically upon each other, and fitted with a spring catch of peculiar construction, whereby the pipes are held securely in any position to which they are adjusted.

Mr James W. Winn, of Haverhill, Mass., has invented an improved boot and shoe protector, which saves the sole of the shoe from wear, as it does not allow it to come in contact with the ground at all. It prevents mud, gravel, dirt, etc., from getting in the seam between the upper and sole, and thus protects the seam from the cutting and wearing action; and it protects the lower part of the upper and the toe from rubbing against the gravel, stones, etc.

Mr. James Robertson, of East Cambridge, Mass., has invented an improved hook for securing and controlling animals for slaughter and for other purposes. It is so constructed that the struggles of the animal to escape after being secured will only cause the device to hold with more certainty.

Mr Ephraim S. Morton, of Plymouth, Mass., has patented an improvement in bows, which consists in making the bow in two parts and connecting these parts by a hinge joint, so that when the bow is bent the hinge is opened, and held in that position by the string.

Messrs. Robert B. and Henry H. Russell, of Orange, Tex., have patented an improved method of packing shingles, consisting in arranging them in alternate longitudinal and transverse layers, so as to create air spaces throughout the pack. The pack is secured together with two crossbars, of wood, drawn tightly upon its center by tin or sheet iron bands.

Mr. Henry A. Robertson, of Haskins, Ohio, has devised an elastic prop or bearing for carriage tops for supporting them when turned back; and the object of the improvement is to preserve the framework of the top.

An improvement in gates has been patented by Mr. George W. Addis, of Clarkston, Mich. The improvements relate to the class of gates which are fitted to roll back part way and then swing at right angles. The gate is inexpensive and durable; there is but little liability of sagging or racking, and it is easily operated.

Mr. John P. Simons, of San Francisco, Cal., has invented an improved gun-wiper, which consists of a helical spring, the fixed end attached to a metal stock that screws into the end of the ramrod. To the spring is attached the cloth forming the swab, so that when entered into the barrel the spring retracts, but at the same time exerts a continued pressure, and thus causes the swab to take up and remove all accumulations. When used as a scraper the swab is removed, and the free knife edge of the spring acts on the surface of the barrel and takes off the lead.

A tablet designed for the use of penmen, engravers, and all persons who have lettering to do, is the invention of Mr. Herbert W. Kibbe, of Utica, N Y It is a self-instructor in lettering. Every letter in the alphabet can be formed complete with it, and with no more skill than is required in the use of a common ruler.

Mr. Amaud Van De Wiele, of Brussels, Belgium, has invented an improved combined open grate and blower. The object of this invention is to modify or increase the draught in open fire grates by a movable blower that may be lowered upon the basket of the grate or elevated out of sight by simply turning a button attached to the front of the grate.

An improved camp chair, which is so constructed that it may be readily adjusted in an erect position, or at any desired inclination, which may be so compactly folded as to require no more space than the thickness of one of its frame timbers, is the invention of Messrs. William H. Gifford and William M. Bates, of Poughkeepsie, N. Y.

An improved device for attachment to windows to serve as a guard to the window when open to prevent children from falling out through it, has been patented by Mr. Solomon Weinhandler, of New York city. It is so constructed that it will rise out of the way when not required for use.

Mr. Charles A. J. Campbell, of Brooklyn, E. D., N. Y., has patented an improved detachable shoe for horses that may be attached as a temporary substitute in case a horse casts a shoe while on the road; they may be changed in width to suit any sized foot.

Mr. George W. Swain, of Brooklyn, N. Y., has patented an improved nursery chair, adapted to be used as a high or low chair, or as a carriage. It is readily changed from one form to the other, and is complete when used as a high or low chair.

Mr. James L. McKeever, of New York city, has patented an improved bed or cot, having parallel sides and rounded ends, and in a hinged cover of wire or other netting supported by a frame which is similar in form to the frame of the bed. The object of the invention is to construct a light strong bed having a protective covering of wire netting, to be used in hospitals and sick-rooms for the protection of patients against flies and other insects. It is also intended for use as an outdoor bed in warm countries.

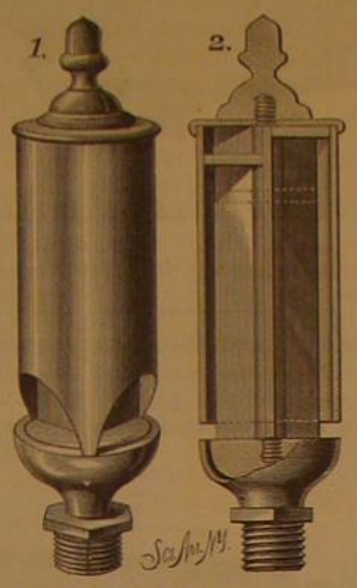
Mr. Amandus Getzschmann, of Omaha, Neb., has patented an improved device for stopping runaway horses, which consists of a movable sleeve sliding on two guide rails that project from the sides of the carriage or wagon pole. The sleeve is held in position by a stout hook that is pivoted in a slot in the pole, which engages in the corresponding hole in the sleeve. This hook is also provided with an eye, to which a strap is attached. This strap is led to the seat of the driver, so that he can at any moment unhook the sleeve and allow it to slide freely on the pole. Should the horses attempt to run away, the driver will pull the line, the sleeve is unhitched and slides forward, and a strap is drawn in the opposite direction, causing the bit straps to operate on the bits and bring the horses to a standstill.

Mr. Frank Imhof, of New York city, has patented a paper box for banjos, violins, guitars, and other similar instruments. The improvement consists in making the bottom and top and also the sides in separate parts, so as to avoid the trouble and difficulty of bending the sides around the edges for the whole length of the box

Mr Augustus B. Wood, of Fountain Hill, Ark., has patented an improved matchbox or case for carrying matches in the pocket, which is so constructed that the matches may be forced out one at a time, as required, and at the same time ignited.

IMPROVED STEAM WHISTLE.

The whistle shown in the accompanying engraving is divided longitudinally into three or more compartments of different lengths, each compartment being provided with an aperture for receiving steam and with the usual mouth. The object is to produce three or more sounds simultaneously. The usual way of doing this is to attach three or

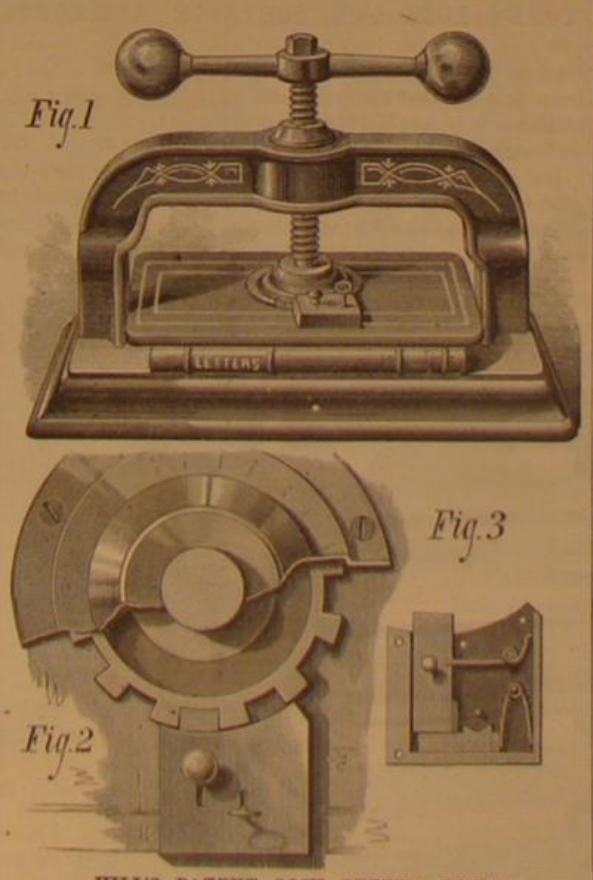


EINIG'S STEAM WHISTLE.

more steam whistles to a single pipe and admit steam to them all through a single valve, but this incurs the expense of three whistles and wastes an appreciable quantity of steam. The whistle shown in the accompanying engraving costs but little if any more than one of ordinary construction. More or less than three compartments may be formed in the same shell or tube, and the whistle may be made in either of the forms shown in the engraving. This whistle was recently patented by Mr. John Einig, of Jacksonville, Fla.

LOCK LETTER PRESS.

The letter press represented in the engraving secures letter copy books against abstraction and the curiosity of meddlers employed in or frequenting business offices. A toothed



HILL'S PATENT LOCK LETTER PRESS.

wheel is attached to the lower end of the screw, and to the platen is secured a lock the bolt of which enters between the teeth of the wheel on the screw.

When the platen is screwed down upon the letter book and the bolt of the lock is projected into the wheel on the screw as before indicated it will be impossible to turn the screw so as to release the book. The lock is so constructed that by pressing against a knob the press will be locked without the use of a key; but to unlock it a key is required.

The details of the lock are shown in Figs. 2 and 3. The operation of the lock is as follows: The inner spring presses the main bolt away from the gear, while the outer spring presses the supplemental bolt against the side of main bolt. When the main bolt is pressed into a recess in the toothed wheel the supplementary bolt at once springs past the end of the main bolt, and the press is locked. To unlock it, the key is inserted and the supplemental bolt is pressed away from the outer end of the main bolt, when that bolt instantly disengages itself by the action of the inner spring, and so remains unlocked until pressure is again applied to the key when it is desired to lock it.

This improvement is simple and inexpensive, and commends itself to any one having use for such an article. The patent was obtained July 9, 1878. For further information address the inventor, Mr. John Hill, of Columbus, Georgia.

Petroleum.

When we are told that at the present time over 1,800,000 gallons of petroleum or earth oil are brought to the surface every day in the oil regions of Pennsylvania alone, the mind is staggered by the contemplation of the magnitude of this comparatively new industry. So lavish is Mother Earth of her hidden stores of oil that it is sent to the surface much faster than it can be taken care of, or stored, and at the present time 300,000 gallons, at the lowest estimate, run to waste every day. The great United Pipe Line, and other methods of conveyance, utterly fail to convey the oil to markets, and the enormous tanks for storage are full to overflowing. There are tanks owned by companies which hold 5,000,000 barrels of oil, and all of them are full. The wooden tanks owned by individuals and private concerns amount in their aggregate capacity to as large a number of barrels, and these also are full.

Thus it will be understood that there are great lakes of oil above ground, as well as below; but there is good reason to believe that the subterranean deposits may with greater propriety be called oceans rather than lakes. The oil workers are evidently pumping from inexhaustible supplies in the rock chambers below, and what are called the "spouting wells" deliver their vast currents with the same impetuosity as when the drills first tapped the pent-up stores. An interesting inquiry arises as regards what becomes of the oil that cannot be secured; into what does it flow, and where is its final resting place? Any one who has visited the oil regions will know of the nature of the country, and readily understand that much of the oil flows into brooks or small rivers, and in time finds its way into the large rivers, and is lost ultimately in the Gulf of Mexico or the Atlantic Ocean. Still larger quantities are absorbed by the earth in ravines and marshy places, and thus it is lost to view. In the famous district one is led to exclaim, "Oil, oil everywhere, and no untainted water to drink." There is oil in the soil; oil in the springs; oil on the bushes and trees; oil in the atmosphere, apparently; oil on the clothing, and in the mouth, eyes, and hair of the workmen; the bread and coffee of the region have the odor of oil, and the beds are saturated with it.

How wonderful is all this! Well do we remember when the first vial of "rock oil" fell into our hands. It was called "Seneca oil," and it was claimed to be a most efficacious remedy for a variety of ills to which the human body is subject. The statement that it flowed spontaneously from a spring in Pennsylvania was received at first with much incredulity, as that was regarded as impossible; but in a short space of time the truth was known, and the oil was no longer regarded as a mixture devised by human hands.

American petroleum oil is now used as a source of artificial illumination in nearly all parts of the world. It goes along with rum, powder, and muskets to the savage tribes of Africa, and the mud houses on the banks of the rivers of the interior are illuminated by its combustion; it is found in the interior of the Turkish Empire, in Persia, in Egypt, in Palestine, in China, in Japan, and in the remote islands of the sea. For the paltry sum of fifteen cents we can purchase a gallon of the clear refined oil, and the cost of the light afforded, in comparison with gas as furnished at the lowest cost in cities, is as one to twenty in its favor. It is just now the most formidable antagonist of gas, and we can scarcely hope in the utilization of electrical force in the future, to secure light at a lower expense.—*Boston Journal of Chemistry.*

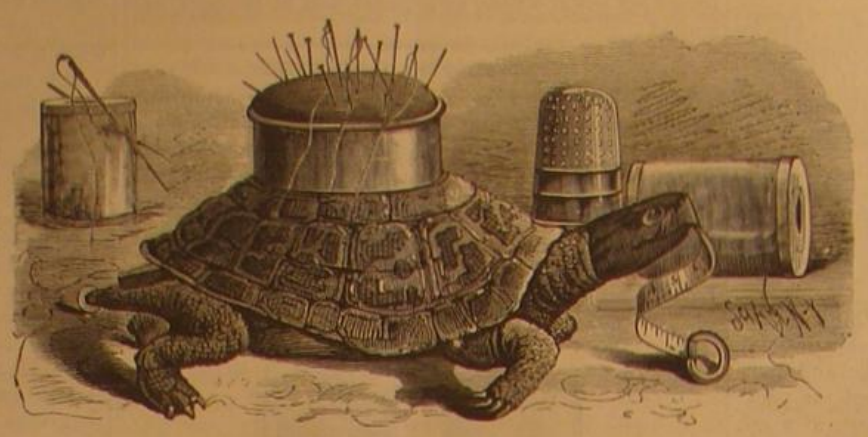
A 1,500 Horse Power Hoister.

The new hoisting machinery for the Yellow Jacket shaft, now being constructed in San Francisco, will be surpassed by nothing of the kind on the Comstock. It will be a double cylinder, direct acting hoist. Each engine will have a stroke of eight feet, cylinders 28 inches in diameter, and will be of a non-condensing character. They are to work at a steam pressure of 120 lb. to the square inch, and at 50 revolutions per minute will have a piston speed of 800 feet. While hoisting from a depth of 4,000 feet each will exert 1,500 horse power. A flat steel rope, 7 inches wide, ½ inch thick, and 4,000 feet long, will be used in hoisting. The Union shaft is now supplied with hoisting works, and will soon be furnished with pumping machinery superior to any now in use on the Comstock. The new pumping engine will be of the compound condensing style, the initial cylinder being 64 inches in diameter, with a stroke of 7 feet. The expansion cylinder is 100 inches in diameter and 8 feet stroke. It will have 8 strokes a minute and 136 feet of piston speed in the same time, and will exert about 1,500 horse power. It will operate a double line of 14 inch pumps, having a stroke of 10 feet.—*Virginia Enterprise.*

NOVEL WORK TABLE IMPLEMENT.

In the novel combination shown in the accompanying engraving the body of the implement, which represents a walking turtle, forms a paper weight. It is hollow and contains a spring acted drum upon which is wound a tape measure of three or more feet in length. The end of the measure extends through the mouth of the turtle, and is provided with the usual ring. Upon the back of the turtle there is a pin cushion, and just above the base of the tail there is a very hard beveled piece of steel, against which knives and scissors may be drawn to sharpen them. In the end of the tail there is a hardened steel wheel that is used as a glass cutter.

This combination of devices was recently patented in the United States and Canada by Mr. E. S. Heath, of Clintonville, Pa. It is one of those little articles that will be found useful in every household.



HEATH'S WORK TABLE IMPLEMENT.

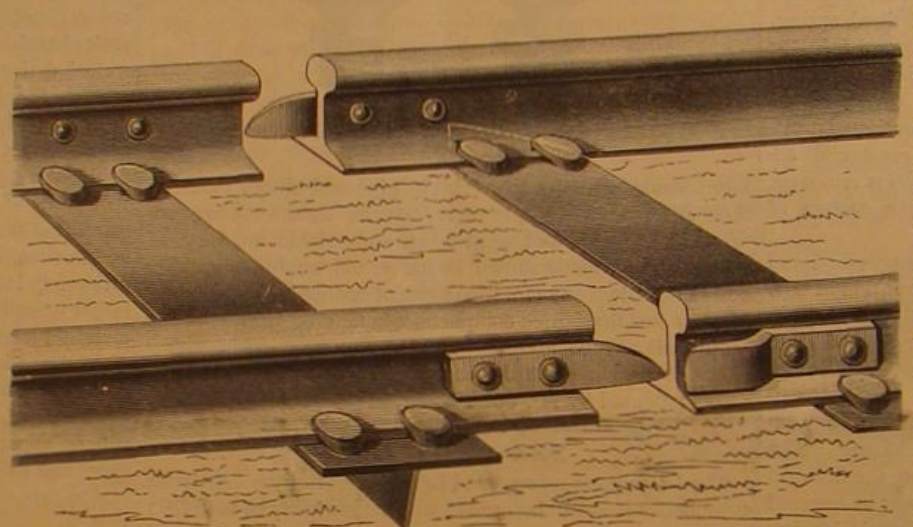
IMPROVED PORTABLE RAILROAD LOCK.

The portable railroad shown in the accompanying engraving is made in sections ten feet long; the two rails being firmly connected together by tie iron which is riveted to the rails. The sections thus formed are very light and yet strong and durable and capable of adapting itself to any surface. It may be used in hilly countries as well as upon flat lands.

The principal feature in this railroad is the locking device which secures the ends of the rails. As will be observed by reference to the engraving, it consists of a pointed piece of iron attached to one end of the rail and projecting a short distance beyond the rail end, so that it may be received by a mortise formed between a piece of iron attached to the end of the adjacent rail and offset, as shown in the engraving.

This lock holds the ends of the rails firmly, and at the same time admits of easily breaking the connections to insert a curve or a switch at any point without disturbing the whole road. For sugar plantations, mines, and quarries a road of this kind is invaluable; it is fast superseding cattle and carts, being much more economical.

Further information may be obtained from the patentee, Mr. John Turl, Turl's Iron Works, foot of West 28th street, New York.



TURL'S LOCK FOR PORTABLE RAILROADS.

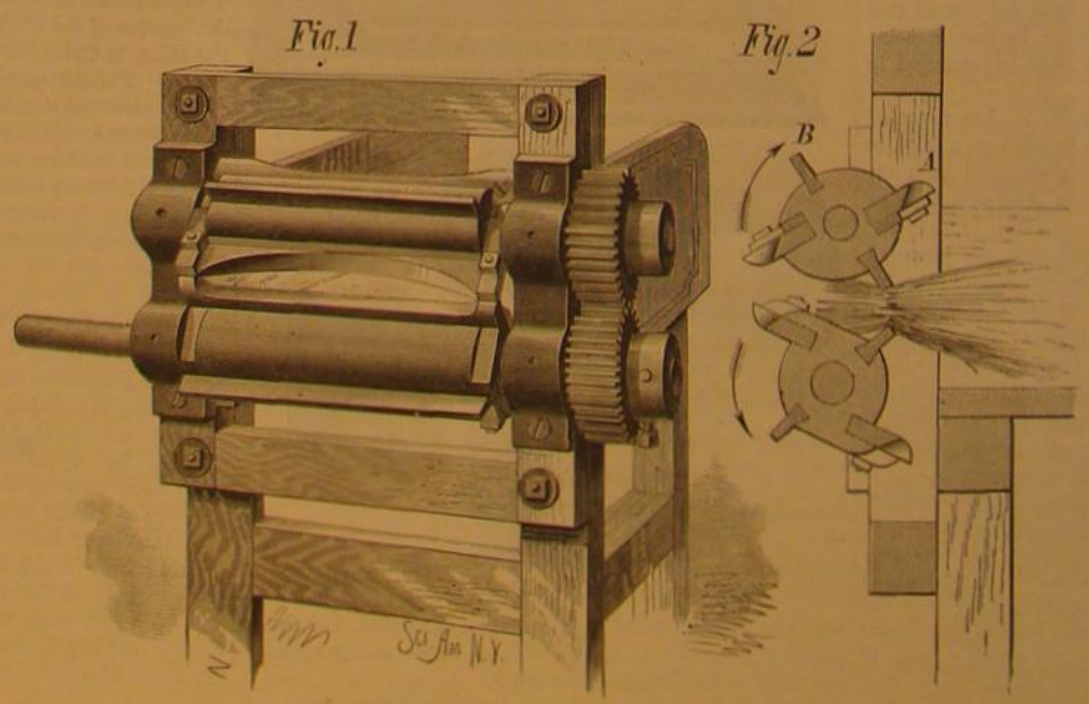
The Coal Crop.

In 1877 the anthracite regions of Pennsylvania yielded 21,000,000 tons, and although in 1878 the demand was curtailed to 17,000,000 tons, it is expected that close upon 30,000,000 tons will be required this year. Up to date 12,750,000 tons have been mined, against 7,300,000 tons for the corresponding period last year. The full average production is estimated at 500,000 tons a week, and it has reached on one occasion 655,000 tons. For the week ending July 12 the production was 531,613 tons, against 239,613 tons for the corresponding week of last year.

IMPROVED STRAW CUTTER.

We give herewith an engraving of a straw cutter invented by Mr. Charles G. Biedinger, of San Francisco, Cal., which possesses considerable novelty.

The cylinders carrying the cutters are geared together so that they revolve in opposite directions; each cylinder carries two knives, B, of peculiar form, arranged longitudinally and parallel with the shaft. The knives are concaved in the direction of their length, and the faces of the upper knives, which are straight, meet at every revolution the faces of the lower knives—which are rounded off toward the edge—so that the upper and lower knives may be said to roll together like the teeth of a gear wheel. As they come together the sliding of one over the other makes a shear that cuts whatever comes between easily and cleanly. These knives also draw forward the feed a certain distance at each revolution. When a longer feed is required than can be obtained by the knives alone, the rubber strips, A, are placed between the knives, and opposite each other, so that as the machine revolves a greater length of hay or straw will be drawn through. The knives being concaved lengthwise, the shearing cut will be from the ends of the cutters toward the center of the machine, conforming to the natural arrangement of the straw as it passes through the machine, the straw being thickest in the middle.



BIEDINGER'S STRAW CUTTER.

A good idea of the form of the knives and the arrangement of the rubber strips may be formed from the engravings, Fig. 1 being a perspective view and Fig. 2 a transverse section through the cutter heads.

Further information may be obtained by addressing the inventor, at 28 Sansome street, San Francisco, California.

RECENT MECHANICAL INVENTIONS.

An improved horseshoe machine has been patented by Mr. David H. Hatlee, of Clifton Park, N. Y. In letters patent granted to the same inventor, August 6, 1878, No. 206,726, a machine for making horseshoes is described. It has a horizontal bed that has a movable portion, and carries dies around which the shoe is formed. The present invention is an improvement on the former patent.

Mr. Charles W. Cannon, of Helena, Montana Ter., has patented an improved combination tool designed for use in preparing giant powder and other powder cartridges, so as to avoid the necessity of having to use a number of tools for this purpose. It consists in a combination tool formed of the handles pivoted to each other, and having a tack puller and a screwdriver formed upon their ends, the curved jaws having half round notches formed in their edges, and the blades or cutters attached to their sides.

An improved tire setter and fastener has been patented by Mr. David Fairbanks, of Rockingham, Vt. It is well known that a majority of blacksmiths cannot measure and weld a tire without making mistakes in its length of from one eighth to one fourth of an inch, and commonly they have to make several trials before succeeding in making a proper fit. The object of this invention is to insure perfect accuracy, to fit and tighten the tire at little expense, and in a manner which shall preclude all possibility of a mistake or misfit.

Mr. Frank A. Bowen, of Putnam, Conn., has invented an improved stripper spring for carding engines, which consists in combining a socket, base, sleeve, and rubber spring for receiving the impact of the flat. In carding machines at present the flat, when it is raised, bears against two steel springs attached to the crossbar; but these springs frequently break, causing loss of time, and sometimes tear the clothing of the cards. This invention is intended to remedy these defects, and to furnish a steadier and better spring for the purpose.

Mr. George William Schaefer, of St. Louis, Mo., has invented an improved machine for paring horses' hoofs, by which the hoofs may be pared with safety and with greater ease to the operator than when the paring is done in the usual way. It leaves the hoof level, so that no burning will be required to get a firm seat for the shoe.

An improvement in running gears for wagons has been patented by Mr. Joseph C. Fowler, of Arcola, Texas, in which the inventor makes use of a ball-and-socket coupling device applied back of the front axle, so that the forward axle is not weakened by boring to insert a king bolt, and the vehicle may be turned shorter and with less strain than when the joint is in line with the axle.

An improvement in looms has been patented by Mr. Paul W. Green, of Philadelphia, Pa., It consists of a box adapted to fit over the rods on which the picker moves, and to receive the elliptical rubber springs or cushions having at one end a solid bottom and at the opposite end, adjacent to the heads in which the rods are held, a movable bottom adapted to slide within it, and a spindle supporting bracket of a construction to permit the necessary movement of the bottom. The springs are held between the two bottoms, and the box slips over the movable bottom when struck by the picker.

Mr. Benjamin N. Shelley, of Anderson, Ind., has patented an improved carriage axle and axle box, which consists, mainly, in combining a shaft having one or more grooves around it with a packing and two clamping nuts or washers arranged upon opposite sides of said packing, so that when said washers or nuts are drawn together they force the packing down into the groove in the shaft and form a flange or collar fitting in the groove, that both prevents the escape of oil and serves to hold the shaft and bearing against longitudinal movement.

An improved machine for making paper boxes from pulp has been patented by Mr. Peter Cook, of Mattapan, Mass. It is so constructed that the formers may be cleaned immediately after being used and without stopping the machine. It will make the boxes rapidly and of uniform thickness, and will allow any kind of stock and chemicals to be used.

Mr. R. S. Munger, of Mexia, Texas, has patented an improved cotton gin saw cleaner, having a series of slotted knives or scrapers of peculiar shape, adjustably attached to a movable revolving support, and adapted to be thrust against the saws when cleaning is to be done.

An improved machine for printing paper hangings has been patented by Mr. Jacob J. Janeway, of New Brunswick, N. J. It is so constructed that the ground color and the other colors may be applied to the paper while passing once through the machine. It is simple and effective.

Mr. C. G. Damaschky, of Brooklyn, N. Y., has invented an improved station indicator, consisting in a revolving wheel fitted with radial indicating cards that are capable of radial movement, combined with a supporting frame that retains the cards inward, and is slotted for permitting the under card to drop by gravity to a position where it may be seen; also in sliding tongues and pawls for raising the cards and turning the wheel for bringing any one into position.

THE FLYING DRAGON.

This beautiful little animal has, according to the measurements made by Cantor, a length of not more than eight inches, of which four and three-fourths inches belong to the long, slim tail. The nostrils are on the side and are directed upward, and the tympanum is not covered. The male animal has a neck comb, and both sexes have a small lump back of the eyes. Small scales of about equal size cover the body, and larger ones cover the sides. As in all dragons the color varies considerably, not only in different parts of the body, but also in one and the same scale. Their beauty is beyond all description. The head of the living animal is of a metallic brown or green color, and is ornamented with a black spot between the eyes. The back and the inner half of the wing consist of a mixture of metallic dark-brown and pink, in some cases in alternating stripes, with numerous black spots and curiously wound lines. The color of the outer half of the wing varies between orange yellow and pink red, and has numerous irregular black spots and a silver edge. The members and the tail are covered with alternating stripes of pink and brown, and the eyelids are covered with radiating black lines. The neck is very light yellow, and the breast is of the same color covered with black spots. The flying dragon is found on the Sunda Islands, in Penang, and Singapore. Like other dragons it lives in trees entirely, and probably never comes to the earth unless forced to do so. Lacépède says that it is able to climb, walk, fly, and swim, but no proof of this assertion has been given. They generally rest on the tops of the trees, watching for insects, and as soon as they spy one they will leap for it, descending to the bough below; for although they can fly through the air in descending, they are not able to rise by means of their wings.

The female lays three or four yellowish white eggs, of about three eighths of an inch in length, which it is said they deposit in the holes in the bark of the trees. No further details are known.

THE FLYING DRAGON.—(*Draco volans.*)

The Insect Enemies of Books.

Dr. H. A. Hagen, according to the *Science News*, has recently made the insect pests of libraries the subject of an interesting lecture. Dr. Hagen admits the important fact that the white ant is present in Cambridge, and "everywhere else in the United States," and furthermore, that there have been two instances in this country of this insect causing a great destruction of books. Fourteen years ago, at Springfield, Ill., the bound copies of State papers were put aside in a room of the State House, which was not opened for a considerable period. When it was examined every book was found to have been more or less mutilated by ants. A Boston lady, a teacher in one of the Freedmen's schools in South Carolina, had even a more striking evidence of the destructive power of the insect. During the lady's absence from the school, in a vacation of six weeks, the ants ate through an entire library. A few of the least damaged specimens were saved as curiosities of literature and sent to Dr. Hagen. The volumes devoured were chiefly Bibles and prayer books.

The white ant is an uncertain danger. It may suddenly spring into activity and destructiveness, as it did here in the instance mentioned; as it did in France, where it all at once became formidable; or as it always does in Mexico, where old books and manuscripts are consequently rare. On the other hand, it may reserve its power for use in our native forests indefinitely, until some more tempting fare is provided by books locked up and not in use. Such books, however, are frequently of great value, and their bindings may be costly.

The other insect pests most known are the beetles belonging to the family *Ptinidæ*, and of these the larvæ of the genus *anobium* constitute the true "book worm." The ordinary methods used for destroying these may prove also injurious to the finer kinds of binding. Dr. Hagen suggests, as a beetle remedy, that the volumes be placed under the bell of an air pump and kept for a short time in the vacuum produced by the withdrawal of the air therefrom.

Dr. Hagen dismisses the cockroach (*Blatta orientalis*) with the remark that "libraries will not often be stored in cellars." In regard to the more recently imported ally of this species, the "croton bug" (*Ectobia germanica*), the editor of the *Science News* remarks that it is capable of doing damage upstairs as well as down. He says: "We have before us a volume, originally possessed of a bright red binding, which now has a speckled cover of white and brown blotches. The croton bugs ate off the red color almost wholly, and in some places penetrated a darker color, which seems to have been under the red. Probably the glue or the oil in the pigment of the binding proved attractive. The book lay outside, on a desk in an editorial 'sanctum,' far removed from the cellar, and was in occasional use during the period of its disfigurement. This instance does not stand alone; we have seen books that had been similarly attacked on the back, while standing on the shelves of libraries."

Before leaving this subject we may state that an interesting illustrated article, written for the SCIENTIFIC AMERICAN, on the subject of the various insects that are known to destroy books, may be found in our SUPPLEMENT, No. 138.

A Humming Bird's Nest.

Recently a humming bird's nest was found by some persons who had sufficient natural curiosity to overcome their compassion, and who captured the nest, two young hummers and the old one, took them home and had them stuffed. They are to be sent to a museum of natural curiosities in London. The nest is built on a little twig, and scarcely the size of half an English walnut. Both nest and twig are covered with little patches of lichen until it is almost impossible to tell one from the other, and the nest looks like a kind of natural excrescence on the twig. The nest is pliable, like a tiny cup of velvet, and the inside is lined with a white substance, as rich and soft as white silk. The little birds are about the size of bumble bees, very pretty, and they sit on a little perch just outside the nest, with open bills, while the old bird hovers over them to feed them.—*Elizabeth (N. J.) Journal.*

The Chemistry and Physiology of Aquaria.

An interesting and valuable paper has recently been written by Dr. W. Hinds on this subject; and, as the *Gardener's Chronicle* says, is deserving of wider acquaintance among physiologists than will probably be secured for it in the journal in which it appeared (Birmingham *Medical Review*). The author first alludes to the ideas prevalent as to the importance of purifying the water of aquaria; one being that a balance must be preserved between water plants and the animals, that the former may utilize the carbon dioxide expired by the latter. Another opinion considers that the chief means of aerating the water must be effected by agitation, which is only supplemented by the assimilating process of plants. Dr. Hinds proposes to examine into the questions: 1. The time required for water to redissolve or take up air after exhaustion; 2. The ultimate destruction of carbonic acid dissolved in water at ordinary pressure and temperature. 3. The relation of the law of atmospheric mutual diffusion of gases to the air taken up by water. By a series of interesting experiments he shows that carbon dioxide, instead of accumulating in the water, is continually being got rid of by its escaping from the water into the air. A jar holding about half a liter of tap water had six small fishes placed in it. They became exhausted in four hours, but the water then gave no trace of carbon dioxide. He found also that this same water regained its normal 2·5 per cent of air on exposure for four hours. A jar one foot deep and six inches in diameter, charged with carbonic dioxide, left in a close room, with gas burning, etc., so as to render it as unfavorable as possible, required seventy hours to liberate itself of the gas; while the same jar lost it in twenty minutes under the constant agitation of pouring it backward and forward from one vessel to another. The higher the temperature the more rapidly does the gas escape, nearly twice the length of time being required on a cold snowy day.

Dr. Hinds finally comes to the conclusion that the law of the mutual diffusion of gases hitherto applied to gases in air holds true as well for gases dissolved in water. The practical conclusion is, that no trouble need be taken about freeing an aquarium of carbon dioxide, but only as to resupplying it with air; and to do this he suggests jets of air (not water) in a minute state of division, combined with extensive and slow contact, as being more effective than the method now adopted in large public aquaria. Dr. Hinds' results seem parallel in a remarkable way to the conclusion of Schlösing as to the diffusion of ammonia. That physiologist regards the tropical seas as the great reservoir of ammonia, brought down from the continents by large rivers. The sea parts with its ammonia to the air at the high tropical temperature; but when it circulates and arrives at temperate regions, the air being cooled parts with it to the rain, which brings it to the earth. One still desires to know why oxygen should be absorbed at all, and why carbon dioxide is liberated by water; but the facts are obviously of vital importance as far as the maintenance of aquatic animal life is concerned.

The Best Kind of Silkworm to Rear.

According to the *Zoölogist*, Dr. Wallace (a well known authority on the silkworm) remarked at a recent meeting of the London Entomological Society that he had experimented with nearly every kind of silkworm which had been introduced into Europe, and that he had come to the conclusion that the only one which would pay to cultivate in England was the *Bombyx mori*. It was true that the ailantus moth and others would produce a silk; but inasmuch as manufacturers, brokers, and silk merchants had invested large sums in the produce of *B. mori* they were not disposed to look with an eye of favor upon any other produce, which certainly would require much alteration in machinery and in the arrangements for business now extant. Moreover, the product of *B. mori* was a very superior article to that produced by any other worm.

It was true that in India, China, and elsewhere native products were prepared from the cocoons of indigenous moths, as, for instance, the Tusser silks from *Antheræa paphia;*

Moonga silk from *A. assama;* Pongees, from China and Japan, from the cocoons of the ailantus moth and of *Bombyx pernyi;* likewise a very valuable silk from the Japanese oak feeding *B. yama-mai;* and he thought that the cocoons of species feeding on the gum trees near Adelaide, New South Wales, which were exhibited that evening to the society, might be utilized in a similar manner. But none of these silks were adapted to the machinery now in use in Europe, and therefore it would be better to allow native industry to collect the produce and fabricate the silks in the countries where produced.

MOLECULAR CHEMISTRY.—No. 5.

Besides the labors of Kopp and Schroeder, described in the last two articles, extensive researches have been made in molecular chemistry by numerous European investigators, notably by Loewig, Boullay, Filhol, and more recently Petterssen; but their work is not now of sufficient general importance to claim our attention.

In 1870 West read a curious memoir before the Société Chimique of Paris, in which he makes the old equivalents O = 200, H = 12·5, C = 150, etc., the basis of his investigations. To find the volumes of bodies, West compares them not at a common temperature, but at temperatures at which they expand equally when further heated. His standard of expansion is that of water at its maximum density, and to this standard the bodies to be compared are reduced to find the temperatures at which their densities give comparable volumes. Where the rate of expansion is not experimentally determined, West employs an assumed rate and looks to the concordance of his results for its confirmation. By this method he finds the molecular volumes of 29 of the elements to be multiples of 2·8125; each of them, moreover, has several volumes. Oxygen, for example, occurs with volumes equal to 12, 24, and 48 times 2·8125, to which he assigns the names of microtome, mesotome, and megatome respectively. Potassium, whose equivalent, according to this system, is 487·5, has three volumes, which are 72, 144, and 288 times 2·8125.

West enumerates 63 amorphous compounds of oxygen, hydrogen, and carbon, whose volumes are equal to the sum of the volumes of their constituents when calculated according to his method. He finds that when carbon is present as a megatome it is tetratomic, *i. e.*, it will combine with four equivalents of another body; when it is present as a mesotome it combines with only two equivalents. Nearly 200 examples are given in illustration. Again, the volume of oxygen determines the chemical properties of a body; the microtome produces acidity, the mesotome neutrality, and the megatome a tendency to combine with more oxygen.

In this country the credit of paving the way for further discovery belongs to Prof. F. W. Clarke, of the University of Cincinnati, the author of a work entitled "Constants of Nature," and published by the Smithsonian Institution in 1873. This book, which has now become indispensable to the chemist, contains not only the densities, the boiling and melting points, and formulas of all substances that have been studied, but provides for the correction of unavoidable inaccuracies by its references to the original authorities.

In December, 1874, Clarke published an important memoir in the *American Journal of Science*, with the object of determining the nature of the difference between water of constitution and water of crystallization; that is, between water intimately combined with a substance and water that may be driven off by heat without destroying the compound. To discover, in the first place, whether water of crystallization had a constant volume or whether it differed for different compounds, he determined the volumes of 31 salts, both when hydrated and when deprived of their water, from a great number of density determinations, and then proceeded as follows: The molecular volume of hydrated chloride of calcium, $CaCl_2 + 6H_2O$, is 133·9; that of the anhydrous, $CaCl_2$, is 49·6. Subtracting the latter from the former, 133·9 − 49·6 = 84·3, the molecular volume of $6H_2O$; dividing by 6 we have 14·05, the volume of water of crystallization in this salt, provided that no change takes place in the volume of $CaCl_2$ in combining or parting with its water. The other 30 salts, which contained from 2 to 18 equivalents of water of crystallization, yielded volumes ranging between the narrow limits of 13 and 15, and averaging 13·76. From this it is evident not only that water of crystallization has a definite volume, but also that no change of volume takes place in the rest of the salt when it combines with such water.

On the other hand, when H_2O is present as water of constitution a great diversity of values is found for its volume in different salts. Thus, the volume of potassium hydrate, K_2O,H_2O, is 54·8; that of the anhydride, K_2O, is 35·4; subtracting we have for H_2O the volume 19·4. Again, in iron sesquioxide we have for the hydrate, Fe_2O_3,H_2O, and the anhydride, Fe_2O_3, a difference of volume equal to 9·0. Hence we may reasonably conclude that when water combines in this intimate manner with a salt *both* undergo a change of volume.

In the *American Journal of Sciences* for April, 1877, Clarke published a list of the fluorides, chlorides, bromides, and iodides of lithium, sodium, potassium, and rubidium, 16 compounds in all, whose volumes proved to be almost exact multiples of 5·5. It was from this list that Schroeder derived some of the data for the support of his steric law.

It was reserved for the genius of Dr. Henry Wurtz, of Hoboken, to evolve entirely new and fertile ideas from the enormous mass of material which had accumulated for the study of molecular volumes. Availing himself of the density determinations collected by Clarke, and verifying them by reference to the original authorities, Wurtz subjected the views of Kopp, Schroeder, and others to the test of accurate computation. A vast number of bodies, simple and compound, organic and inorganic, were examined in this way, and the results showed discrepancies that could not be reconciled with each other or with the chemical relations of the bodies in question. While engaged in this work it struck Wurtz that, as all the molecules of a homogeneous body must occupy equal spaces or volumes, there should exist not simple multiple but *cubic relations* between the molecules of different bodies, especially when they are compared at some uniform temperature. This novel idea he afterward established, to his own satisfaction, by a long chain of evidence.

Before giving his proofs it will be well to state his method of interpreting the very considerable discrepancies that are often found in the densities of the same body by the most accurate experimenters, and that have proved a snare to many investigators of molecular volumes, who did not resist a very natural partiality for such numbers as would agree with their preconceived views. Wurtz believes that we are not warranted in rejecting any density determinations by reputable experimenters on the ground of personal errors or of impurities present in their specimens. In the case of common salt, NaCl, for example, we have the following densities: By Playfair and Joule, 2·011; Unger, 2·03; Sterry Hunt, 2·135; Stolba, 2·163; Hassenfratz, 2·2; Filhol, 2·24; Mohs, 2·26. He considers such variations of density as due to real differences of molecular volume produced by divers causes, such as the temperature at which the body was formed, the condition of the liquid from which it crystallized, etc. That he does not stand alone in this opinion is shown by the remark of Favre and Valson in the *Comptes Rendus* of the French Academy of Sciences for 1873, who were led to believe by their researches in crystalline dissociation "that the density of a salt is not an absolutely fixed element, but that it may vary slightly with the circumstances of its formation, *e. g.*, according as it has crystallized slowly or has been precipitated more or less rapidly from the mother liquor." As regards the figures just given for common salt, Wurtz believes that we have here a number of modifications or allotropes of the same substance, and also that the tendency to vary in density and consequently in volume is almost universal throughout the whole range of chemistry.

Another noteworthy feature in the mode of operation of this investigator is an attempt at obtaining greater accuracy in the comparison of the various density figures of two different compounds for the purpose of arriving at the value of some constituent common to both. Instead of simply averaging each series, each individual number of one is compared with all the numbers of the other. Thus, if there are four densities given of one body and six of another, twenty-four values are obtained, which are then averaged.

The starting point for the new system was found in the density of peroxide of hydrogen, $H_2O_2 = 1·452$ by Thénard. This specimen contained 2·6325 per cent of water. On making allowance for this impurity the density becomes 1·4642, and this divided into the equivalent of $H_2O_2 = 34$ gives us 23·220 for the volume. Now we have only to subtract the volume of water, $H_2O = 18·000$, to obtain the volume of the extra equivalent of O contained in the peroxide: $H_2O_2 - H_2O = O = 23·220 - 18·000 = 5·220$. Again, on the supposition that the two volumes of oxygen in H_2O_2 are equal, we have only to subtract their value from the volume of H_2O_2 to obtain, $23·220 - 2 \times 5·220 = 12·780$, the value of H_2, and this divided by 2 gives us for the hydrogen volume 6·390. Subsequent research proved these values to be slightly inaccurate, and 5·184 was definitively settled upon for the oxygen and 6·1408 for the hydrogen volume. It will suffice to select one among the many means of verifying these figures. The volume of liquid N_2O is 47·913, that of liquid N_2O_4 is 63·4625; difference, $O_2 = 15·5495$, and O = 5 1832.

When the new oxygen volume was substituted in a number of carbonates, the volume of carbon was found in nearly all cases to come out almost exactly 8. The approximations in these and other computations were the closer the nearer to 0° C. the densities had been determined. Now, 8 is the cube of 2.

Perhaps the reason that no one had before observed the close approximation of some volumic values to even cubes lies in the fact that they all contain a decimal point. The density of the diamond, for example, is 3·55. Dividing this into the equivalent 12, we find that carbon in this form has a volume of 3·380. Now, *we have only to omit the decimal point* to see that we have here as close an approximation to the cube of 15 = 3375 as we have any right to expect from the unavoidable imperfection of our experimental processes. If we make the equivalent of hydrogen 1,000 instead of 1, and thus multiply all the equivalent numbers by 1,000, all our volumes will come out as whole numbers, and cubic relations will at once become apparent.

Bunsen found the density of ice to be 0·91674. Its molecular volume is, therefore, the equivalent 18·000 divided by 0·91674 or 19,635. The cube of 27 is 19,683.

When Kopp found the volume of $CH_2 = 22 = 21·8$ at zero, if he had multiplied by 1,000 he would have obtained 21,800, which is not very far from $28^3 = 21,952$.

Clarke's volume for water of crystallization = 13·76, treated in the same way, becomes 13,760, and suggests the cube of 24 = 13,824.

The carbon volume 8, alluded to above, when multiplied by 1,000 is exactly the cube of 20.

As solids are to each other as the cubes of their diameters, the numbers obtained by extracting the cube roots of volumes may be regarded as molecular *diameters.* Thus, 20 represents the diameter of the carbon molecule in carbonates, 15 that of the diamond molecule, 27 that of the ice molecule, etc. This conception gives rise to a new system of notation, in which the numbers expressing diameters are placed directly under the symbols of the substances designated. To represent the common salt of Filhol and Mohs, Wurtz writes:

$$\underset{23}{Na} \cdot \underset{24}{Cl} = 2·251.$$

This means that the volume of Na is $23^3 = 12,167$, and that of Cl is $24^3 = 13,824$. Their sum, 25,991, divided into 58,500, the molecular weight of NaCl, gives us the density 2·251. (The density of a substance is its weight divided by its volume.)

We cannot do more here than indicate the vast amount of labor performed in these researches by simply stating that every important class of chemical compounds has been studied, tabulated, and shown to conform to the laws presently to be explained. For detailed information we refer to a memoir entitled "Geometrical Chemistry," in the *American Chemist* for March, 1876, and to later and more accurate publications in the last edition of "Johnson's Cyclopedia," chiefly under the head of "Volumes, Molecular." Since then Wurtz has continued his investigations with unremitting zeal, not satisfied with his generalizations until he had convinced himself of their universal application.

He found, in the first place, that the diameters of elementary molecules had a limited range of variation throughout the compounds into which they enter, and that their tendency to vary is directly as their basicity or electro-positive attitude toward the elements with which they are associated. In the different varieties of common salt, for instance, the sodium diameter will vary, while that of the chlorine remains constant. Stolba's variety is represented by

$$\left(\begin{smallmatrix} Na & Na \\ 23 & 24 \end{smallmatrix}\right) \quad {}^{Cl}_{24} = 2·181.$$

Hydrogen, the most electro-positive element, has a range of 16 to 28, while oxygen, the most electro-negative of all, *never varies*, but always has the fixed volume 5,184, which is not an even cube, but curiously enough 3×12^3.

The diameters of some of the other common substances are: Chlorine in chlorates 20, in chlorides 24 or 28; sulphur in most metallic sulphides 20 in sulphates 24; carbon in hydrocarbons and carbonates 20; nitrogen 20, in cyanogen 24; silicon 20.

It the case of allotropes like the two varieties of common salt whose formulas have been given, and of organic homologues—that is, of series whose members differ in composition by the successive addition of the same elements—the tendency of the added molecule is to assume a diameter already present, or a diameter next above or below one already present. To understand this more fully compare the following volumic formulas for some members of the alcohol series:

Wood spirit, $\underset{27}{Hd} \cdot \underset{27}{Hm}$

Spirit of wine, $\underset{27}{Hd} \quad \underset{27}{Hm} \cdot \underset{26}{Hm}$

Propionic alcohol, $\underset{27}{Hd} \quad \underset{27}{Hm} \cdot \underset{26}{Hm} \cdot \left(\begin{smallmatrix} Hm & Hm \\ 25 & 26 \end{smallmatrix}\right)$

In these formulas Hd stands for H_2O with the ice diameter, and Hm for H_2C. In the former Wurtz gives the name of hydor and to the latter that of homologen. Observe that the diameter of each additional molecule shows the tendency just mentioned. It was at first supposed that this tendency, to which the name of engymmetry was given, applied also to other classes of compounds; but it afterward turned out that they exhibited a remarkable regularity of a different kind. Before taking up this subject it will be expedient to learn Wurtz's views with regard to the nature of the components designated by him as Hd and Hm. In constructing his volumic formulas he found very numerous instances in which the calculated densities could not be made to agree with those obtained experimentally, except on the theory that in these bodies certain ones of the elements were more intimately combined with each other than with the other constituents, and that they formed groups expanding and contracting *as a whole.* Of such groups, or radicals as he calls them, he at first found only four, viz., cyanogen, ammonium, Hm and Hd; but he now holds that others may be formed from the last two by substitution. Such a view, of course, sweeps away a great army of hypothetical radicals in organic chemistry—a proceeding which chemists will be very loth to permit.

When the formulas of organic bodies are examined according to the method just indicated, and the volumes of Hm and Hd have been subtracted, there will be found remaining a carbon nucleus consisting of C in alcohols, ethers, and fatty acids, of 3C in aldehydes, of 4C in benzoles and olefines, of 4C in sugars and starches, etc. The variations in diameter of these carbon molecules appear to be connected with the liquidity and solidity of a body, and also with its boiling point. Thus, in the paraffine series we have:

Butane,	$\underset{24}{C}\ 3\underset{24}{Hm} \cdot 4\underset{22}{H}$ = Density	·593.	Observed density	·600
Pentane,	$\underset{24}{C}\ 4\underset{24}{Hm} \cdot 4\underset{22}{H}$ = "	·6445.	" "	·6413
Solid paraffine,	$\underset{20}{C} \cdot 19\underset{24}{Hm} \quad 4\underset{22}{H}$ = "	·9002.	" "	·89

The first two are liquids and have C = 24; in the third, which is solid, C = 20. Between them there are 14 members of the series which furnish concordant formulas.

The 16 specimens of butyric alcohol, $C_4H_{10}O_2$, whose densities have been determined by different chemists, may be

divided into four varieties or isomeres, boiling respectively at 116°, 108°, 98°, and 82·5°. Their volumic formulas would be as follows:

1. $\frac{C}{20} \cdot \frac{Hm}{24} \cdot \frac{Hd}{24} \cdot \frac{H\ H}{28\ 29}$ = Density ·8279. Observed mean of 6 = ·8235
2. $\frac{C}{24} \cdot \frac{Hm}{24} \cdot \frac{Hd}{24} \cdot \frac{H}{28}$ = " ·8125. " " " 6 = ·8161
3. $\frac{C}{28} \cdot \frac{Hm}{24} \cdot \frac{Hd}{24} \cdot \frac{H}{25}$ = " ·8333. " " " 2 = ·8385
4. $\frac{C}{28} \cdot \frac{Hm}{24} \cdot \frac{Hd}{24} \cdot \frac{H\ H}{26\ 27}$ = " ·806 " (solid) 1 = ·8075
$\frac{C}{32} \cdot \frac{Hm}{24} \cdot \frac{Hd}{24} \cdot \frac{H}{25}$ = " ·7854 " (melted) 2 = ·7849

Here the carbon varies through the series 20, 24, 28, 32, and in the last example it expands from 28 to 32 when the body changes from the solid to the liquid state.

Upon examining the above examples and those which are to follow, it will be observed that *there is a tendency to assume diameters divisible by four.* The second butyric alcohol is a perfect example. It must be remembered, however, that these and other volumic formulas are constructed to represent the *means* of all available density determinations of any given body There is every probability that there exists in every case an isomere whose density will lead to a perfectly normal formula in which all the diameters are multiples of four, while other specimens of the body exhibit only more or less perfect approximations. This probability has the support of hundreds upon hundreds of instances. We can only give a few to show the different phases of this tendency.

Where inorganic compounds are found with varying densities this variation is caused by the most positive or basylic constituent.

Sulphate of potash, $O_4 \cdot \frac{S}{24} \cdot \frac{K}{23}$ = 2·888. Maximum observed D. = 2·88

" " " $O_4 \cdot \frac{S}{24} \cdot \frac{K\ K}{26\ 27}$ = 2·433. Minimum " D. = 2·407

The potassium alone varies, and the variation is here nearly 4 diameters. This is often the case between maxima and minima, while the intermediate isomeres differ by half or whole diameters. The densest carbon, diamond = $\frac{C}{15}$ = 3·556, while the lightest, lampblack = $\frac{C}{19}$ = 1·75; difference = 4 diameters. Again, we have.

Quartz, = $O_2 \cdot \frac{Si}{23}$ = 2·662. Observed density, 2·663

Lightest silica known = $O_2 \cdot \frac{Si}{27}$ = 1·83. " " 1·815

The latter is obtained by the ignition of opal.

When an electro-negative unites with different positives of the same group, the positives increase by 4 or 4*n* diameters.

Chloride of lithium, $\frac{Cl}{24} \cdot \frac{Li}{19} \cdot \frac{Li}{20}$ = 1·999. Observed D., 1·998

Chloride of sodium, $\frac{Cl}{24} \cdot \frac{Na}{23} \cdot \frac{Na}{24}$ = 2·181. " D., 2·172

Here the negative chlorine remains the same, while Na is greater by 4 diameters than Li.

When a positive unites with several negatives of the same group, the resulting series will show a variation of the positive through 4 or 4*n* diameters.

Chloride of sodium, $\frac{Cl}{24} \cdot \frac{Na}{23} \cdot \frac{Na}{24}$ = 2·181. Observed density, 2·172

Bromide of sodium, $\frac{Br}{24} \cdot \frac{Na}{27} \cdot \frac{Na}{28}$ = 2·973. " " 2·952

Changes from solidity to liquidity and from color to blackness are accompanied by variations of 4 or 4*n* diameters. Examples of organic bodies illustrating the first of these changes have already been given.

Tin chloride, solid = $\frac{Cl}{24} \cdot \frac{Hd}{24} \cdot \frac{Sn}{29}$ = 2·82. Observed D. = 2·76

" " fused = $\frac{Cl}{28} \cdot \frac{Hd}{24} \cdot \frac{Sn}{25}$ = 2·581. " " = 2·588

Elements uncombined change only through half or whole diameters instead of 4*n*:

Solid potassium = $\frac{K}{35} \cdot \frac{K}{36}$ = ·871 Observed D. = ·87

Melted " = $\frac{K}{36}$ = ·836. " " = ·842

To illustrate the change from color to blackness, we have:

Cinnabar red cryst., $\frac{S}{24} \cdot \frac{Hg}{24} \cdot \frac{Hg}{25}$ = 8·127. Observed D. = 8·124

Meta-cinnabar black cryst., $\frac{S}{20} \cdot \frac{Hg}{23}$ = 7·746. " " = 7·748

Such are, in brief, the results of this latest and most extensive of the researches into molecular volumes. It is not the writer's purpose at present to discuss the reasoning or the methods pursued by the different investigators, but simply to present for the first time their work and their views in a connected form, with the hope that a knowledge of the subject may thus be promoted among those who are sufficiently interested in theoretical chemistry to give it their careful attention. C. F. K.

Is it Education or Accident?

Technical education supposes that a child must be educated for the sphere he is expected to occupy in life. Advocates of a purely technical education use frequently such phrases as "laboring classes," "station in life," "educated classes," "cultured society," "upper classes." Whether this is wise in republican America as in monarchical Europe remains to be seen. Experience has shown that it is exceedingly unwise to suppose that a certain boy is to make a Congressman, while another will peg boots. The issue usually shows that the young lawmaker makes a cobbler, while the predestinated bootmaker becomes a foreign minister. Some of our very best and most learned men were not intended by their parents to occupy very high stations in life. It is dangerous to "suppose" very much in reference to any boy, continues *Barnes Educational Monthly*, in this enlightened age.

ENGINEERING INVENTIONS.

Mr. Joseph R. Winters, of Chambersburg, Pa., has patented in this country, also in England, Canada, France, Germany, and Belgium, an improved fire escape ladder and hose conductor, which may be easily raised to any required height within the limits of the capacity of the machine, and it may be inclined at any desired angle. It carries the hose up with it, and is arranged so that it may be used in lowering timid or infirm persons, or articles of furniture. The invention consists in a novel and ingenious arrangement of devices, which cannot be readily described without an engraving.

An improvement in the class of car couplings, whose engaging devices are pivoted hooks or draw bars, has been patented by Mr William W Scott, of Sumner, Iowa It consists in the employment of coupling hooks or draw bars, having pivoted heads to adapt them for engagement with bumpers having slotted heads, which are inclined, the object being to enable cars of different heights to be coupled

An improved car coupling, designed to obviate the necessity and its attendant danger of going between the cars, is the invention of Mr. Charles Abrenbeck, of Navasota, Texas. The improvement consists in the particular means applied to an ordinary draw bar for holding and centering the ordinary form of link, and elevating the same so as to enter the opposite draw bar.

A coupling for cars that will automatically couple them at all times, whether the latch is up or down, and which is arranged so that the draught at no time falls upon the pin or pivot of the latch, but is borne directly by the draw head, has been patented by Mr. Patrick M. Bracelin, of Davenport, Iowa. This invention obviates the necessity of going between the cars either to uncouple or couple them.

Mr Robert Hay, of Mineral Point, Wis., has invented an improved draw bar, which consists of a frame adapted to be connected with the tender, and provided with a coupling bar carrying cross heads and a spiral spring within the frame, so that when drawn or pushed it is cushioned by the spring, and thus relieves the shock and strain on the engine

Messrs. Robert M. Pringle and William D. Robb, of Elizabethtown, Ky., have patented an improvement in safety valves, which consists in changing the form of valve in common use, so as to make it extremely sensitive to any variations in steam pressure, and so that the escaping steam shall assist in closing as well as in opening the valve, and in inclosing it in a case provided with a set screw and jam nut, in order to adjust and secure the valve at will.

Mr. Charles A. Mentry, of Newhall Station, Cal., has invented an expanding reamer for increasing the bore of oil and other deep wells, that can be let down through the tube and expanded when it reaches the proper point for the reaming to begin. It consists of a forked reamer incasing an expanding spring plunger projecting through its head, where it is provided with a needle controlled by a trigger, from which a halyard leads up to the surface.

An improvement in the class of coupling devices which consist of pivoted hooks, has been patented by Messrs Seth S. Watrous and William Gerber, of Fremont Center, Mich. The improvement consists in the combination of the two cams projecting in opposite directions, with the coupling hooks pivoted within the draw head on vertical pins, but in different horizontal planes, the cams being arranged in relation to the hooks, so that the latter may be spread when the cams are turned.

A Runaway Railway Wheel.

A most singular railroad accident lately occurred on the Erie Railway at Middletown, N. Y. The train known as the steamboat express, one of the fastest on the road, had just left the station and attained its full speed, when the forward wheel of the front truck of the locomotive became detached and started down the track by itself. Such was its impetus that it ran fully a hundred yards, then left the track and ran through the brick wall of Bunnell's lumber yard before it came to a standstill. The cause of the accident was a heated and worn out journal. Travel was delayed on the eastward bound track nearly four hours in consequence.

Foreign Fruit Trade of New York.

According to the annual report of the inspector of customs the value of the green fruit imported at this port during 1878 was as follows:

Varieties of fruit.	Per centum duty.	Value. Dollars.	Amount of duty. Dollars
Oranges and lemons	20	2,802,966	560,593.20
Grapes	20	232,004	46,400.80
Pineapples	20	87,666	17,533.20
Bananas	10	395,619	39,561.90
Limes	10	3,564	356.40
Grape fruit, shaddocks, mangoes, plantains, watermelons, cantaloupe melons, and a few other varieties of green fruit not named	10	15,711	1,567.60
Cocoanuts	Free.	197,520	
Total, 1878		$3,735,050	$666,016.60
Total, 1877		$3,148,992	$564,140.30
Increase of value and duty for 1878		$586,058	$101,876.30

There was a large increase in the quantity of fruit imported from the West Indies, except in the case of oranges and pineapples. The falling off in pineapples is supposed to be due to the establishment of large canning factories in the West Indies. An extraordinary increase, amounting to two and a quarter millions, occurred in the importation of cocoanuts. Of Mediterranean fruit, the importations in 1878 were lightly in excess of those of the preceding year. Of grapes, the number of packages was largely in excess of those of any previous year, namely, 45,000 barrels and 12,000 half barrels. The pomegranates numbered 200 cases. The Mediterranean oranges and lemons number 1,254,802 boxes and cases. The average loss on oranges was 36 per centum, and on lemons 20 per centum.

From the West Indies, 12,942,675 oranges were imported, with an average loss of 45 per cent. Of bananas there were 560,837 bunches imported—an increase of 157,916 bunches over 1877. Twenty-three per cent of the 2,704,773 pineapples perished on the voyage. Nearly 10,000,000 cocoanuts were imported, with an average loss of 9 per cent.

Overland Boating.

The proposed construction of a ship railway across the Isthmus of Panama has called to mind the similar though smaller portage system formerly employed by the State of Pennsylvania. For many years the system was used in transporting canal-boats (built in sections) from the canal between Conemaugh (near Johnstown, Penn.) on the western side of the Allegheny Mountains, and Hollidaysburg on the eastern side. By this arrangement boats without breaking bulk were passed between Pittsburg and Philadelphia via Columbia. The portage of the mountains was made by means of inclined planes, at the top of which were stationary engines to draw up or let down the cars or trucks, using a heavy hemp rope running over pulleys between the rails to keep it from the ground. After reaching the top of the plane a small locomotive was used along the "levels," as they were called, until the next plane was reached. By this means transit was quick, and the expense of handling the cargo twice was avoided. After the construction of the Pennsylvania Railroad, and the introduction of locomotives that could draw loads up grades that years before were only capable of ascent by means of ropes and stationary engines, the old portage road of the State, becoming the property of the Pennsylvania Railroad Company by purchase, was abandoned; and now the traveler can see, as he is whirled along in a palace car, only the ruins of what was forty years ago one of the most wonderful public improvements of the age.

A similar system is still employed in New Jersey for changing canal-boats laden with coal from one canal system to another.

The Export Trade in Staves, Shooks, and Hoops.

"The great majority of the sugar and molasses hogsheads which are emptied of their contents in this city," says the Boston *Commercial Bulletin*, "find their way back to the West Indies again. The hogsheads are purchased from the refiners by an enterprising firm, who take them apart, clean the staves and bundle them up into shooks, and export them, together with their heads, to Cuba. This firm have one yard in South Boston in which they thus prepare 2,000 hogsheads per week for export. The export trade in new shooks to the West Indies is also an important one, these last selling at from $1 to $1.75, while the second-hand shooks bring but 50 to 75 cents. The stave trade of Boston is nearly all in the hands of one firm; and as more than $300,000 worth of cooperage stock of various kinds are exported, in addition to what is used in this vicinity, their business is a large one. The staves, which are so largely exported from Boston to the Mediterranean and to England, are white oak. Sugar barrels are also made from elm, and in New York are being made of a single piece, cut out for the purpose. The oak staves come from the West, largely from Michigan. Staves are usually exported in the rough or unfinished state, and range all the way from $60 to $150 per thousand for hogshead staves, and $80 to $200 per thousand for pipe staves."

Another Railway Bridge for Niagara River.

In 1849 the Lewiston Suspension Bridge Company and the Queenston Suspension Bridge Company were organized, the first on this side and the second on the Canada side of the Niagara River. They built a highway suspension bridge at Lewiston, and maintained it for some time. It blew over one day and was never repaired. The ruins of the structure still remain in the form of masonry on each side of the river, and one cable still suspended. The Oswego *Palladium* says that the Rome, Watertown and Ogdensburg and the Great Western (Canada) railway companies have bought the stock of the old companies above named and formed a company with $1,000,000 capital to build a bridge at Lewiston. The work will be begun immediately. The bridge will be one of the finest of the kind in the world. The river at the point to be crossed is 600 feet wide. The bridge will be a steel truss structure of one span, and will be a railroad and highway bridge. The object of the parties in interest is to accommodate the local trade of the Rome, Watertown and Ogdensburg road and that of Northern New England and the West.

Coupe Cars for London.

An order for fifty two-horse cars for use in South London, England, was recently completed by a firm of car builders in this city. The same company are now building for the same market a number of one-horse cars of the "bob-tail" pattern. In London they will be known as coupés. These cars are provided with pay boxes, have horse guards at the dashboard, and life guards in front of the wheels, and are hung on Mr. Stephenson's new method, which makes the riding easy. They are finished in hard woods, and the seats are upholstered in fancy carpets. American cars are preferred in England for their superior strength and lightness.

RECENT DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

By the U. S. Circuit Court.—Eastern District of Missouri.

MANUFACTURE OF ENAMELED IRON WARE.—ST. LOUIS STAMPING COMPANY *vs.* QUINBY *et al.*

1. Where the original patent described a process of enameling iron, the gist of which consisted in a certain preparation of the iron and the application of any well known enameling mixture, it was not at variance nor incompatible with the invention described to insert in the reissue of such patent a formula as to an enameling mixture which could work out the result.

2. If the specification contains such a description as will enable one skilled in the art to accomplish the desired result, it is sufficient without attempting to speculate as to the philosophy of its action.

3. The testimony of a witness as to prior use by him of the invention patented is rendered unreliable and incompetent by the circumstance that his employers, after having the benefit of his skill, sought the right to use the patented process as soon as they heard of it; and the further fact that the specimens produced were very different from those made under the patent.

4. Reissued Letters Patent No. 7,779, granted July 3, 1877, to F. G. & W. F. Niedringhaus, for improvement in the manufacture of enameled iron ware, are for the same invention as the original patent and valid.

The St. Louis Stamping Company is the assignee of reissued Letters Patent No. 7,779, granted to Frederick G. & William F. Niedringhaus, July 3, 1877, for "improvement in the manufacture of enameled iron ware."

The claims in the original patent are as follows:

1. The herein described process of enameling iron ware by oxidizing the iron during the process of the drying of the glaze, substantially as set forth.

That phraseology is not changed in the reissued patent.

The second claim is:

A new manufacture of enamel sheet iron ware, enameled substantially as described.

In the reissue the phraseology is:

As a new manufacture, mottled enameled sheet iron ware having the oxidized base fused with the surface glaze.

By the Commissioner of Patents.

TRADE MARK.—EX PARTE THE SAFETY POWDER COMPANY.

The term "safety," applied to powder, fuse lighters, and explosive caps, naturally suggests that these explosives may be used with comparative safety, and is therefore descriptive, and is not registrable as a trade mark.

TRADE MARK.—EX PARTE THOMPSON, DERBY & CO.

The word "swing," when applied to the socket of a scythe snath which moves on a pivot, each point describing the arc of a circle, and is made fast in different positions, indicates the peculiarity of the socket with sufficient precision to be descriptive, and cannot be registered as a trade mark.

WHEEL PLOWS.—LAPHAM *vs.* BETTENDORF.

Under Rules 7 and 57 the party to an interference who first files a completed application, including petition, specification, oath, drawings, model or specimens (when required), and first fee, is deemed to be the first inventor, in the absence of all proof to the contrary, and the testimony of the other parties is to be taken first.

LUBRICATOR PATENT OF NICHOLAS SEIBERT.—APPLICATION FOR REISSUE.

1. The machine for which Letters Patent No. 94,780 were granted September 14, 1869, to Nicholas Seibert, in the form in which he constructed it, necessarily involved the use of hydrostatic pressure as a force for the expulsion of the lubricant from the lubricating cylinder; but it was designed to be a steam lubricator, and the presence of hydrostatic pressure in the device, as an operative force, was not known or suspected by Seibert until after he had obtained his patent.

2. As he who, by a lucky accident, discovers a new art, is, under the law, as much entitled to a patent as he who, by an effort of genius, invents a new machine, however inferior in merit his work may be, so, also, is he who invents a machine which accomplishes its object entitled to a patent for it, whether he does or does not correctly understand the law or philosophy of its operation.

3. Seibert's lubricator, which was operated by hydrostatic as well as by steam pressure, was his invention, although he did not fully understand the law of its operation; and he is entitled to a patent for this particular machine, whether it operates as a steam lubricator, or as a hydrostatic lubricator, or as both combined.

By the Acting Commissioner of Patents.

MACHINE FOR CLEANING SILK THREAD.—TAYLOR *vs.* MARTIN.

When the evidence in an interference develops the fact that the contesting parties are not independent inventors, but jointly devised the invention, judgment of priority cannot be had in favor of either party, but the interference will be dissolved.

SHADE HOLDER FOR LAMPS.—MARSHALL *vs.* FISH *et al.*

1. Certain motions to strike out, not the final judgments of the Examiner of Interferences and the Examiner-in-Chief, but the views properly expressed by those tribunals in arriving at such judgments, denied.

2. The sole purpose of section 4,904 Revised Statutes being to enable the Commissioner to determine, by a proceeding known as an interference, whether he will grant a patent to an applicant, notwithstanding a patent for the same invention has been previously issued, or to which one of two or more contending applicants a patent shall issue, the question of priority between two or more patentees who may be parties to the proceeding need not and cannot be determined, after judgment therein has been rendered against the applicants who acquiesce in such judgment.

APPLICATION FOR REFRIGERATOR PATENT.—BATES.

1. A machine and a product, a process and a composition, an art and an article, and a "method and the means," each constitute distinct patentable subject matter, and but one of them can be the subject of a single claim.

2. Where the improvement made consists of an apparatus, it alone should be claimed, and not its functions, nor should the apparatus be claimed as "means" for accomplishing the result.

APPLICATION FOR A DESIGN PATENT FOR SPOON HANDLE.—BEATTIE.

More than one separate and independent design cannot be claimed in the same application; but, where the design is an entirety, a claim for the entire design, as well as claims for sub-combinations of the parts, is allowable.

The Mysterious in Boiler Explosions.

There is beyond question an element of mystery attending certain boiler explosions. At one time all explosions of boilers, save those which obviously resulted from shortness of water or extensive corrosion of plates, were regarded as mysterious and remarkable. Theories have been formed almost without number to account for their occurrence—in a word, to solve the mystery. The spheroidal theory of Boutigny d'Evreux may be cited as an example. When water is dropped on a hot plate it assumes the spheroidal condition, runs about in drops, and evaporates slowly. The drops are really not in contact with the plate at the time, each drop being enveloped in an atmosphere of its own vapor. When the plate cools the water touches it and flashes into steam. It was supposed that under certain circumstances water assumed the spheroidal condition in normal steam generators, and that a great development of steam ensued when the furnace plates cooled a little; so much steam being made thus in a few seconds that the boiler burst. This idea is now well known to be fallacious.

Another theory was that if a boiler was heated red hot and cold water pumped in it would infallibly explode; this is obviously the tail end of the speroidal theory. Inasmuch as the specific heat of iron is but one ninth that of water, in round numbers it follows that nine pounds of iron heated to about 1,500° must give up their heat to make one pound of steam; and it has never yet been shown how enough red hot iron could be present in a boiler to cause a development of steam with which the safety valve could not deal. Many experiments have been carried out to test the point, with negative results as far as explosions are concerned.

The electrical theory was broached. What this meant we never understood, nor did we ever meet any one who did. One gentleman promised to prevent all explosions from this cause by incasing every boiler in thin sheet copper. Another proposed to fit conducting wires to put boilers in communication with the earth. The notion that water was decomposed into oxygen and hydrogen, and subsequently recomposed with a terrible explosion, kept its ground for a long time. We believe we may say that no engineer possessing a moderate knowledge of chemistry holds such a theory now The inspecting engineers of the various boiler insurance and assurance companies were the first to place the whole subject on a sound footing. They showed as a result of their experience that boilers burst because they were too weak to withstand the strains brought on them by the internal pressure. They proved that in the vast majority of cases furrowing, and grooving, and corrosion in all their multifarious forms, were the agents operating to bring about boiler explosions, and they carried back such catastrophes from the regions of romance to those of everyday life. There is some reason, however, to fear that these gentlemen have gone a little too far; and that by assigning all boiler explosions to one cause they are doing harm and stopping inquiry into certain secrets of nature about which we do not know quite so much as is desirable.

That by far the larger number of explosions which occur every year in England are due to weakness of the boilers which give way, either congenital or acquired, we should be the last to dispute. But it is equally indisputable that events take place now and then which quite upset all conclusions based on the idea that explosions always take place because a boiler is too weak to withstand normal strains, and these said events apparently contradict much that sound scientific authorities teach. Thus, for example, although the entrance of cold water into a red hot boiler ought not to cause an explosion, yet there is one case at least on record in which, on a pail of cold water being poured suddenly into a red hot kitchen boiler, a most violent and disastrous explosion took place. The weight of metal engaged here was, however, very great as compared with that of the water. It is also shown that explosions have ensued when water was pumped into plain cylindrical externally fired boilers, which had been allowed to run short.

On the other hand, boilers patched and re-patched, and seemingly worthless, have by the hundred done their duty for years without a catastrophe, while boilers as well made as possible, and in excellent condition—nearly new in fact—have exploded with disastrous results. So long as furrowing and corrosion are present it is easy to account for the failure of a boiler. It is when explosions of strong boilers occur that inspectors are at fault, differences of opinion arise, and we become enveloped in an atmosphere of mystery out of which it is difficult to find the path which leads to certainty. Two notable examples of this have been recently recorded in our columns: one is the Coltness explosion, when six boilers out of ten flew away at once like a covey of birds; the other is the Kersley explosion, when one boiler out of eight burst, leaving the rest intact.

As regards the Coltness explosion, that, as is well known, has been explained by Mr. Fletcher on the theory that one boiler which exploded first had the steam pipe plugged up, and consequently gave way from a sheer accumulation of pressure. We cannot find that one tittle of definite evidence was adduced to show that any such plugging took place. Mr. Fletcher is, no doubt, satisfied on this point, but we are not. In fact his theory is based on pure assumption. But, granting that he was right, how are we to account for the explosion of the remaining five boilers? One explanation is that the boilers were bedded so close that they rested against each other, and that each boiler as it gave way staved in the side of the next one to it. To make this an intelligible cause of explosion, it must be assumed that the sudden reduction of pressure on the outrush of steam through the side of the broken boiler caused so large a portion of the contained water to flash into steam that the boiler flew into pieces before the steam so produced could escape. But it is well known that the Coltness boilers were strong enough to stand a pressure of 300 pounds on the square inch, and it is difficult, if not impossible, to see how steam of any pressure like this could be produced. Only as much water would be converted into steam as would suffice to restore the pressure in the boiler to something less than what it was before the rent took place. To assume anything else is also to assume that once the process of flashing is established it will go on regardless of the pressure set up. This is a very important assumption; nay, more, it is a complete begging of the question. If it can be shown conclusively that the stored-up energy in a boiler can all be expended in flashing water into steam, if flashing is once fairly set up, without any consideration for the accumulation of that pressure which is inimical to the operation of the flashing function, then we are face to face with a new physical law which would clear away much mystery, and set boiler explosions, like that at Coltness, in a totally new light. It is a notorious fact that a great many explosions take place just when an engine is started. If we may assume that the sudden reduction of pressure sets up flashing, and that the process is continued by, if we may use the words, its own *vis viva*, then it is easy to understand why a sudden reduction in pressure may cause an explosion; but until some definite statement of facts is available, we must hold this idea to be pure, little supported, theory, and nothing else. If we are asked, how, if we reject the theories of Mr. Fletcher and others, we explain the Coltness explosion, we reply that we cannot explain it, because there is not sufficient evidence available on which to base an opinion.

In the Kersley explosion we have a boiler, insured, carefully looked after, and apparently sound, going to pieces without having given warning in the way of leakage. Here again we find boiler inspectors dealing largely in pure assumption. Mr. Hiller, the engineer of the National Insurance Company, took it for granted that an elbow pipe was broken off and let the water run out. But there is not a scrap of evidence that a cast iron pipe was broken as supposed. Mr. Baldwin, another boiler inspecting engineer, holds that Mr. Hiller is quite wrong, and that the boiler burst because the plates had become weakened by age; that they had "lost their nature," to use a word well known among iron makers. But even Mr. Baldwin finds all the plates he tested so strong that the boiler should have withstood on the lowest calculation double the pressure at which it was worked. It is to be presumed that the inspecting engineers of boiler insurance companies are the greatest authorities in existence on all that pertains to the life and death of steam generators. When we find any one of these gentlemen unable to form any opinion concerning certain catastrophes, which is not flatly contradicted by a professional brother, it would be folly to deny that there are mysterious boiler explosions—that is to say, explosions which occur from some cause or causes unascertainable. That we shall always remain in our present ignorance is very improbable. But we venture to think that the solution of our difficulties will come, not from the boilermaker or the engineer, but from an elaborate process of physical research into the laws which govern the generation and evolution from heated liquids of their steams or vapors. Many suggestive phenomena have been recorded which might serve to direct an inquirer. For example, the behavior of water heated under oil is, as shown by Dr. Frost many years ago, very curious and suggestive. Again, water may have its boiling point altered by various conditions other than those of pressure. It is not too much to say that although the more prominent aspects of evaporation and ebullition have been carefully studied, a great deal remains to be learned concerning the real nature of processes about which men speak all the more glibly the less they really know.—*The Engineer.*

Among the novel applications of glass is the invention of Hamilton L. Bucknill, of England, who has recently patented in this country a railway sleeper made of cast glass.

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.

NEW BOOKS AND PUBLICATIONS.

AROUND THE WORLD WITH GENERAL GRANT. By John Russell Young. New York: Subscription Book Department of the American News Company. Published in 20 parts. Each 68 pp. 8vo. Illustrated. 50 cents.

Parts I. and II. of this splendid record of travel cover the experiences of General Grant in England. No traveler was ever received with so much distinction by the leaders of thought and action the world over, or ever saw, under more favorable conditions, the best that the civilized world has to offer. The narrative of his journey is cleverly told and lavishly illustrated; and, so far as published, amply fulfills the promise of the publishers to make it the finest record yet printed of a tour of the world. With such a wealth of superior material to choose from Mr. Young could scarcely fail to make an interesting volume; his skill and experience as a journalist left no doubt of his making good use of his opportunities. It is not likely that any other writer will ever have a story to tell involving so many brilliant scenes or containing so much to gratify American pride.

BIRDS OF THE COLORADO VALLEY. By Elliott Coues. Part First, Passeres to Laniidæ. Washington: Government Printing Office.

It is rare that a book, more especially an official document, is so much more than it professes to be as this admirable report of Dr. Coues. The value of the bibliographical appendix it is impossible to overestimate. The whole subject of the bibliography of North American ornithology and of the synonomy of North American birds has been worked up anew from the very beginning, every point being verified by personal investigation. It is by far the best work ever done in this department.

THE ART INTERCHANGE. Volume II. January to June, 1879. New York: The Art Interchange Publishing Company. Price $1.50 a year.

This unpretending but sensible and admirably edited household journal deserves the cordial support of every one who cares for the promotion of the polite arts. It is not only an art newspaper of a fine and discriminating character, but a periodical instruction book giving theoretical and practical lessons in art methods, which will be found of value in every refined household. It is published fortnightly, and each number has twelve pages, with an occasional illustrated supplement.

ORGANIC CHEMISTRY, PRACTICAL AND THEORETICAL. By Hugh Clements. London: Blackie & Son, 16mo, cl., pp. 283.

Specially designed for the students in the Science and Art Department, South Kensington. The descriptive portion appeared originally in a series of articles in the *English Mechanic*, to which has been added some fifty pages on the identification of organic substances, a short chapter on fixed and essential oils, a brief description of apparatus used in this department of chemistry, a list of practical questions and exercises, and eighty or more pages of papers set in organic chemistry at the Kensington examinations (with answers) for the ten years ending 1878.

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 not 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.

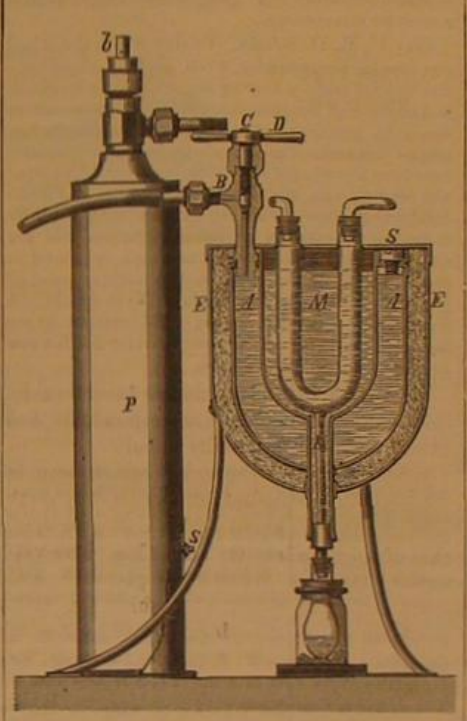
Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

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

(1) S. S. H. asks: 1. What effect would the explosion of one pound of dynamite, 40 fathoms beneath the surface, have upon the larger fish in the immediate neighborhood? A. Those within the immediate vicinity of the explosion would be killed through the rupture of the air bladder and intestines; they would sink at once to the bottom. Those at a distance would be simply stunned, and would rise to the surface after a time. 2. If the effect is destructive, what would be the probable diameter of the circle of death? A. Perhaps within a radius of 50 yards. 3. Measuring from the surface, to what depth would the concussion be sensibly felt? A. The shock of the explosion would be felt most severely downwards—it is difficult to estimate. The disturbance would reach the surface, but the concussion there would be comparatively slight. 4. Do fish caught in this way become unfit for food; if so, in what way? A. No.

(2) D. H. H. writes: 1. I have been getting up a collection of entomological specimens for the past 3 or 4 years, and I have found that my specimens are eaten by a small grub which spoils a great many of them. I think they must generate in the specimens, as some of them are not exposed to the air. Will you please inform me what I can put on the insect that will prevent these moths hatching and not injure the specimen? Would corrosive sublimate do to paint them with? A. Impregnate the specimens with a solution of arsenious acid in dilute alcohol. See p. 11 (40), volume 38, SCIENTIFIC AMERICAN. 2. Will equal parts of alcohol and water preserve zoological specimens as well as pure alcohol? A. No. 3. Will you please inform me also what is the latest illustrated work published on American insects and reptiles suitable to classify and study up entomological and zoological specimens? A. Consult Packard's "Guide to the Study of Insects," Westwood's "Thesaurus Entomologicus Oxoniensis," Nicholson's Zoology, and Owen's "Vertebrate Animals."

(3) G. M. asks how methyl chloride can be used in the production of ice. A. Methyl chloride, which is used in the manufacture of green and violet aniline colors, was employed for this purpose some years since by Raoul Pictet, and lately Mr. Camille Vincent, of Paris, has used it to produce very low temperature. If compressed methyl chloride is liberated from this overpressure it will begin to boil, and the temperature will fall to −8° Fah. This boiling will then stop, and the fluid methyl chloride will remain quiet without evaporating any further. By means of an air pump the temperature can be reduced to −67°. The small machine that Mr. Vincent uses for this purpose consists of a double walled copper vessel, between which two walls the methyl chloride enters at A. The space, M, contains some non-congealable liquid—alcohol, for instance. The space, E, is filled with some non-conductor of heat, as mineral



wax, etc. B is a stopcock which is opened and closed by turning D. P is a wrought iron receptacle containing the fluid methyl chloride. In order to conduct the methyl chloride into A, the side opening of the receptacle is connected with the rubber hose that is attached to B, the receptacle is raised and its stopcock is opened. That part of the methyl chloride that evaporates escapes through the opening, S. As soon as the temperature has fallen to −8° (the boiling point of methyl chloride), the opening, S, is closed. If it is desired to lower the temperature to −67°, an air pump must be attached to B. In this way a quart of alcohol can be kept at a temperature of −67° for several hours.

(4) U. R. N. G. writes: I have about $5 gold (pure) dissolved in hydrochloric acid; after acid is dried on fire, the gold is redissolved in solution of bichromate potassium. Do you think it is ready for gilding in electrotype battery? My battery is bichromate potassium and sulphuric acid for carbon, and weak sulphuric acid for zinc. The matter for gilding is hung on the zinc by a copper wire, and the gold is hung on the carbon by a copper wire. Will that do? If not, how is that done? A. Purify the gold by fusing it with 10 parts of borax glass in a black-lead or French clay crucible; dissolve it by aid of heat in a mixture of 3 parts hydrochloric and 1 part nitric acids, and evaporate the solution cautiously over a water bath nearly to dryness. Proceed as directed under head of "Electro Gilding," p. 2,540, No. 160, SCIENTIFIC AMERICAN SUPPLEMENT. 2. I have a big gutta percha dish, one corner of which is broken; can you tell me how I can repair it? A. Melt together equal parts of pitch and gutta percha, and add ¼ part of powdered shellac. This should be well stirred together. Use hot, and clamp the parts well together until the cement has hardened. 3. How are electrotypes taken from the gelatine mould? A. It is necessary to take a plaster cast of the gelatine mould. From this a positive cast can readily be obtained.

(5) F. N. L. asks how the bright gold and silver lettering is done on glass. A. The size is prepared by dissolving one ounce isinglass in just enough water to cover it; when dissolved add a pint of rectified wine spirit and make up to a quart with water. Give the clean glass a flowing coat of this, and carefully lay on the leaf, which will then readily adhere to the glass. Let it remain 24 hours to dry. The design or letter is drawn on paper, and the lines pricked with needle holes. Place this against the gilded surface and dust it thoroughly with powdered whiting. When the paper is removed there will remain a correct copy of the design or letter on the gold. Now fill up the outline with oil gold size in which has been ground some orange chrome, thinned somewhat with boiled oil and turpentine. When this has thoroughly dried wash off the surplus gold with water and a piece of cotton wool. Silvering may be done with the leaf, but it is better to use a dry amalgam. See p. 315, Spon's Workshop Receipts.

(6) J. D. M. asks how sperm oil can be divested of its gum and prepared for use on the sewing machine and other delicate machinery. A. Allow the oil to remain in contact with a quantity of lead turnings or clippings for several weeks (usually six weeks is required), then decant and strain through linen or a sand filter. See p. 1670, No. 105, SCIENTIFIC AMERICAN SUPPLEMENT.

(7) F. C. E. asks (1) how to bore a 3x4 inch cylinder for steam engine. A. You can bore it in an ordinary slide lathe, with boring bar and cutter. 2. How to make a permanent deposit of bright silver in desired places which cannot be reached by the hand, on the inner surface of bottles. A. Silver nitrate, 1 ounce; distilled water, 1 pint; strong aqua ammonia, *q. s.*, added gradually to first precipitate, and then redissolve the silver; honey, ¼ ounce. Pour this solution into the bottles, etc., immerse them in water and boil for 10 to 30 minutes, or until properly coated. See article "Silvering Glass," No. 105, SCIENTIFIC AMERICAN SUPPLEMENT. 3. Do most scientists of the present day, who have looked into the subject, believe in phrenology? A. No.

(8) S. E. writes: 1. I wish to turn a block, composed of a number of different kinds of wood; what is best to glue them with? I also wish to glue very thin strips of wood to linen; what is the best glue for the purpose? A. A fine animal glue is as good as anything for these purposes. 2. Where can I get an automatic tide register, and about what would one cost? A. Insert an advertisement in "Business and Personal" column. 3. How many people have obtained American patents? A. See the numbers in patent list on another page.

(9) H. L. B. asks: What size of steam pump would be required to force water through a 3 inch main a distance of 3,000 feet, with 50 feet elevation at end? A. You can use any size of pump you please; it must be determined by the quantity of water you wish to lift in a given time.

(10) H. M. H. asks: 1. What pressure of steam will a boiler stand made like the one described in SUPPLEMENT, No. 182, page 2891? A. If well put together, 150 lbs. per square inch. 2. Where should the water stand in it? A. One to two inches below top of lower flasks

(11) W. M. asks: 1. Will a boiler of 20 inches diameter, 20 inches high, ¼ inch iron, hold 350 lb. of steam to the square inch? A. Make it at least 5-16 inch thick. 2. How thick should the cylinder be, 3½ inch bore, by 6 inch stroke, to make 400 revolutions per minute, boiler pressure 300 lb.? A. ½ inch when finished.

(12) C. J. B. asks: What is the greatest depth in which any submarine diver has successfully operated? A. We think about 120 feet, at a wreck on Lake Erie.

(13) W. G. R. asks (1) how to make a preparation to dip packages in to give them a coating that will keep them waterproof and airtight, packages covered with brown paper. A. You may try the following: Shellac, 4 parts; borax, 1 part; water, *q. s.*, to form on boiling a very thin sirup. If required to dry very quickly, use hot. Or use a solution of shellac in wood naphtha containing a small quantity of boiled oil. 2. What will make a good cheap washing crystal? How is bluing put in washing crystal, and what kind of blue is used? A. "Washing crystal" is common commercial carbonate of soda, subcarbonate of soda. The bluing is either ultramarine or aniline blue (BB), added during the crystallization. 3. Can you get me a compound analyzed of a vegetable kind and tell me what it contains, and what would be your charge? A. Yes; the cost depends upon the nature of the compound.

(14) W. S. J. asks: 1. Which is the best deep sea sounding apparatus in use? A. That used by the United States Coast Survey. 2. What are its defects? A. This is probably as near perfect as any in use.

(15) W. asks: What acid can be used (if any) in making a monogram type upon copper, to eat away the surplus metal, leaving the letters stand out in relief, and the surface smooth? Please describe the process or give some other good method. A. Use nitric acid diluted with about 3 volumes of water. Cover the portions to remain untouched with paraffine. The sand blast may be advantageously used instead of acid in some cases.

(16) Our correspondent C. N. writes: Is it known what is the actual difference in the amount of fuel required to run a stationary boiler (doing substantially the same work) in winter as against the summer season, caused by the difference in temperature alone? Perhaps some of your readers can give the amount of fuel that was required to run a boiler that was exposed to the weather, for each of the twelve months, doing comparatively the same service. The result of a twelve months' performance of a small portable engine and boiler, used for sawing wood, would be a fair test, as the exposure of it to atmospheric changes would be unquestionable. [Perhaps some of our readers will be able to furnish the information desired by C. N.]

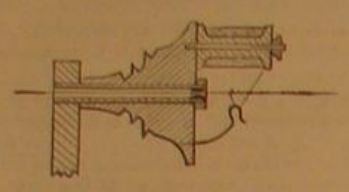
(17) F. B. asks: 1. In the dynamo-electric machine described in SUPPLEMENT 161, can the cores of the electro-magnets be cast of common cast iron, or would that be too hard? A. Soft cast iron will do. 2. How long ought a bichromate battery work without attention? A. It depends on how much is required of it. Ordinarily two weeks. 3. What is vulcanite? A. Hard rubber.

(18) A. M. W. asks: What metallic or non-metallic substance, heated to a red or white heat, will retain that degree of heat longest after it has been removed from within the flame, and which will, for occasional use each day will probably sustain the heat for 1 effects of the flame longest without requiring it to remit by placed? A. Common fire brick will prove, 37 Park your purpose best.

(19) R. K. writes: 1. I am about building a screw propeller launch, 25 feet long and 5 feet beam, to be run by an engine with cylinder 2x5 inches. About how many miles an hour, with 150 lb. of steam on, would she run, with a 3-16 inch steel boiler, size 20x35 inches? A. If boat has good model, probably 4½ or 5 miles per hour. 2. Where and at what price could I get a complete description of the electro-magnetic engine? A. The back numbers of the SCIENTIFIC AMERICAN and SUPPLEMENT contain all of the recent information on this subject. 3. What is the cost of running a magnetic engine as compared with a steam engine of the same power? A. The cost of running a magnetic engine is about 50 times as great as steam. 4. About what is the price of a six horse power magnetic engine? A. We think there are no engines in market of that size.

(20) D. L. M. writes: In a fire engine at work, throwing water through 200 feet of hose with an inch nozzle, where is the greatest pressure of water: as it leaves the engine, or at the inch hole at the end of the nozzle? A. At the pump.

(21) J. F.—A simple device for covering wire is shown in the annexed engraving. A ⅜ tube



having a smooth exterior is screwed into a wooden standard, and supports a wooden pulley that carries a spool containing the silk or cotton with which the wire is wrapped. The thread passes from the spool through the small wire guide hook, thence to the wire to be covered, which is drawn slowly through the tube as the pulley revolves. The pulley may be turned by connection with a lathe, or it may be driven by a belt from the driving wheel of a sewing machine. The wire being covered may be drawn through the machine by hand, or a reel may be easily attached and arranged to take motion from the pulley.

(22) W. P. asks: 1. If a sulky or gig is being run around a course or a circle, with a horse hitched to the same, which way will it upset, or which way is it liable to upset: towards the center of ring or the outside? A. Toward the outside. 2. If a locomotive is running around a sharp curve, do not the driving wheels on the inside of curve have to slip on the rail? A. One or both wheels must slip. 3. What will I put on common paper to make impression paper for transferring patterns on wood? A. See p. 283 (23), Vol. 40, of SCIENTIFIC AMERICAN.

(23) F. R. R. writes: 1. In the SCIENTIFIC AMERICAN of August 9, page 91, communication (10), H. W. F. describes a cheap battery. I wish to ask: 1. What is the battery fluid? A. 2 parts of bichromate of potash dissolved in 20 parts of hot water. When cold add 1 part of sulphuric acid. 2. Where can the gas carbon be obtained, and how prepared? A. It is obtained from the retorts of gas works. It may be chipped or sawed into shape, but it is usually pulverized, mixed with soft coal dust, and calcined in iron moulds. Plates of this kind may be had from any dealer in electrical supplies. 3. Can it be made from lampblack? A. No. 4. Is the amalgamated zinc the same as that commonly used in plumbing, roofing, etc.? A. No, it is not as pure as it should be; however, it may answer your purpose.

(24) R. W. D. asks: 1. What chemical should I use to saturate paper to be used on a chemical telegraph? A. Nitrate ammonia, 2 lb.; muriate ammonia, 2 lb.; ferri-cyan. potassium, 1 ounce; water, 1 gallon. 2. Also, is there sufficient resistance in above paper to keep current from passing through it? A. No; the current must pass to make the mark. 3. How can I gild iron to resemble brass, inexpensively? A. Clean the iron by scouring, and rub it with sawdust slightly moistened with a dilute acid solution of copper sulphate. Rinse, dry, and lacquer if necessary. 4. What is the resistance of one mile of No. 14 galvanized iron wire? A. 51 ohms.

(25) C. C. H. asks how to arrange connections on a telephonic line having three telephones and using electric alarm bells as calls. A. Use single stroke bells on a closed circuit. Have a switch to throw the bell out, and the telephone into the circuit after the alarm.

(26) C. A., Jr., asks: 1. Is there any particular rule for cutting threads with simple or compound gearing, given only the number of threads in feed screw; if so, what are they? A. $\frac{T\,S}{t\,t'}\,I = N$; $\frac{t\,t'}{I\,T} = S$. T representing the number of teeth in traverse screw wheel; S number in stud wheel gearing in mandrel; t number in wheel upon mandrel, and t' number in gearing upon stud pinion, gearing in T; I number of threads per inch upon traverse screw; N number to be cut. 2. We have for one engine two horizontal boilers and one steam drum. What is the gain by having a safety valve on each boiler and one on the drum? Why couldn't we do with only the one on the steam drum? A. If there are shut off valves to your boilers, you should, for safety, have a safety valve to each boiler; none is necessary to the drum if the communication to the boilers is free.

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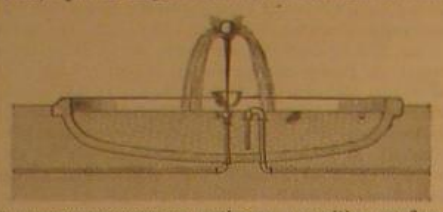
(28) J. W. W writes: I inclose you section of small fountain reservoir, with (I think) a novel automatic siphon. We built two small fountains in a portion of the yard where the inmates have access to them, and fearing the overflow pipe would be tampered with, I put in a siphon overflow as shown in the cut.



It answers two purposes, acting as a positive overflow, and, when it is desirable to clean the basin, the entire body of water can be siphoned out by putting a small wood plug in the air hole at the bend. This device has been working about two months under a variable pressure of water, and the water line never gets above the return elbow, or below the bottom of air hole.

(29) E. H. M. asks how to obtain crystals of bismuth. A. This is effected most easily by melting two to four pounds of the metal in a hemispherical iron ladle, allowing it to cool slowly until a crust is formed on the surface, then breaking this with a wire and pouring out quickly the still fluid metal from within. This yields, if not always large crystals, at least faces, from which project the corners of numberless cubes. Fine large crystals, with beautiful stair-like arrangement, can be obtained only by making the bismuth chemically pure, which is a tedious operation.

(30) P. H. V. asks whether one billion represents one thousand millions or one hundred millions; please put the figures the way they should be written to represent one billion. A. 1,000,000,000. French method correct for this country.

(31) C. M. D. writes: To-day when the wind was blowing pretty briskly, I felt, as I sat at my window in sixth story, a tingling sensation in my forehead, just above and between my eyes, such as would be caused by application of one of poles of an electric battery to that part. Can you account for it? Could there have been a current of electricity in the air? The wind was blowing from Western Union building and across hundreds of wires toward me. I have some curiosity to find out the cause of the sensation, which was not unpleasant, and which was not neuralgic or painful in the least. A. We think the sensation experienced by you could hardly have been produced by electricity. It was probably due to the cooling of the forehead by the rapid evaporation of perspiration; however this is a subject that will bear investigation.

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

A. S. C.—It is a titaniferous iron ore; it cannot be smelted to advantage.—G. F.—A. The pyrrhotine is not nickeliferous and cannot be profitably worked for the small amount of gold which it carries. B. is not free milling—it contains too much galena, though not enough for smelting. It must be roasted.—H. W. McC.—Impure kaolin, or porcelain clay, if properly washed may be useful in the manufacture of cheap white ware, etc.—N. G. F. B.—They are tourmaline, muscovite in quartzite, and biotite.—W. M. H.—No. 1. Missing. No. 2 contains 80 per cent of lead. No. 3 is also rich in lead, carrying about 5 ounces of silver per ton. It may be smelted in the simple blast furnace; few smelters desilverize their lead. It is sold as base bullion on assay.—J. E. B.—No. 1 is plumbago; if properly washed and purified, worth about 7 cents per lb.—B. F. J.—It is a bituminous shale; it will yield oil, gas, and tar upon distillation. No. 2 is a jaspery hematite. No. 3 is an impure limonite. No. 4 is a silicious limestone, and if properly burned will doubtless yield a good hydraulic cement.—F. J. R.—No. 1 is chalcopyrite, a copper ore. No. 2, the gray part is fibrous zeolite. No. 3 is hornblende and quartz. No. 4, fibrous amphibole. No. 5 is leucopyrite or arsenide of iron.—S. A. S.—The vine sent is the climbing wild hemp (*mikania scandens*), common in the middle Southern States.—J. E. T.—The box contains fragments of semi decomposed orthoclase and sandstone, serpentine rock and impure manganite, or ferromanganese.—J. M.—It is nodular iron pyrites, iron sulphide.

COMMUNICATIONS RECEIVED.

On the Cause of Boiler Explosions. By A. J. P.
On the Wheel Question. By J. K.
On the Movement of Light in Space. By A. S.
On Easily made Slide Valve. By F. O.
On Diet. By T. B. McC.
On the New Optical Delusion. By C. L., H. W. F. A. O., R. H. B.
On Safety Appliance for Boilers. By P. C. F.
On Optical Delusion. By G. A. S.
On Diffusion. By S. R. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

July 15, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Agricultural implement, E. Schlag ... 217,491
Aluminous cake, manufacture of, T. S. Harrison ... 217,460
Ammunition case, O. K. Buckhout ... 217,508
Animal trap, W. N. Fort ... 217,602
Awl handle, S. F. Merritt ... 217,668
Axle and axle box, carriage, B. N. Shelley ... 217,492
Barrel stand, L. D. West ... 217,568
Basket, E. D. Ballou ... 217,572
Bath tub, F. W. Ningard ... 217,635
Bed, J. L. McKeever ... 217,633
Bell ringer, steam, G. N. Osgood (r) ... 8,813
Bellows, Wiese & Roder ... 217,661
Blind slat retainer, P. N. Horsley ... 217,464
Boot and shoe heel, S. M. Richardson ... 217,485, 217,486
Boot crimper, M. S. Love ... 217,469
Bottle wrapper, I. Swope ... 217,559
Box nailing machine, H. Messer ... 217,472
Bracelets, etc., stock for, C. Downs ... 217,453
Brush, blacking, M. V. White ... 217,564
Bucket, metal, M. Campbell (r) ... 8,800
Buckle, trace, M. Ross ... 217,488
Buckwheat hulling apparatus, G. S. Cranson ... 217,513
Burglar alarm, T. D. Lockwood ... 217,543
Burglar alarm, A. P. Sims ... 217,556
Can box, swinging, H. Acker ... 217,568
Car brake, automatic, D. A. Hopkins ... 217,618
Car brake, automatic, B. F. Stewart ... 217,649
Car coupling, J. F. Wright ... 217,501
Carding engine stripper spring, F. A. Bowen ... 217,575
Carding machine, G. Estes ... 217,598
Carriage coupling, A. B. Webster ... 217,498
Carrige top, adjustable, W. Davis ... 217,590
Carriage top joint and rail, Goddard & Burrows ... 217,527
Cart, barrel, Adair & Palmer ... 217,503
Cartridge, pyrotechnic, E. S. Hunt ... 217,534
Casting metals and the alloy, preventing crystallization and blow holes in, T. Fleitmann ... 217,523
Check, bank, D. D. Gregory ... 217,478
Churn, J. M. Parker ... 217,637
Clothes drier, G. Dame ... 217,515
Coach wrench, H. A. Webber ... 217,658
Coal hod, Holzner & Winstandley ... 217,616
Cork holder, O. Zwietusch ... 217,567
Corset, M. Cohn ... 217,512
Cotton, etc., press for, R. Farley ... 217,520
Cotton wing sweep, C. E. Estes ... 217,597
Crucible and pottery mould, W. Driscoll ... 217,593
Crusher and grinder, rock, etc., W. C. Morison ... 217,474
Curtain fixture, Buckley & Sawyer ... 217,578
Cutlery, pocket, J. D. Frary ... 217,603
Cutlery, pocket, J. B. H. Leonard ... 217,623
Decoy for wild fowl, E. Redmond ... 217,483
Dish, covered, W. E. Hawkins ... 217,461
Draw bar, R. Hay ... 217,615
Drawing frames, etc., composition roller for, J. M. Smith ... 217,557
Drip pipe, C. R. Joyce ... 217,538
Door check, T. P. White ... 217,565
Door spring, H. R. Clark ... 217,585
Dough tray, A. D. Hay ... 217,462
Electric induction coil, J. L. Le Conte ... 217,466
Electric motor, J. Hoover ... 217,617
Elevator bucket, Burdine & Cowgill ... 217,580
Eye shade, W. B. White ... 217,500
Fanning mill, D. B. Seibert ... 217,645
Feed water cleaner, J. T. Bryant ... 217,577
Feed water heater, J. Scholes ... 217,644
Fence wires, machine for barbing, A. Cary ... 217,667
Fences, metallic post for wire, R. E. Dietz ... 217,516
Fertilizer distributer feed cup, Marks & Jessup ... 217,628
Fibrous substances, etc., treating vegetable, W. Courtenay ... 217,448
Fifth wheel, vehicle, Grier & Barr ... 217,611
Firearm, magazine, D. B. Wesson ... 217,562
Fire back, J. E. Boyer ... 217,443
Fire extinguisher, Garfield & Pattison ... 217,456
Fire extinguisher, automatic, Brown & Fosket (r) ... 8,812
Fire extinguishing engine, J. Pattison ... 217,477
Flood gate, W. B. Akers ... 217,571
Flue cleaner boiler, Aitchison & Doolittle ... 217,570
Folding chair, Gifford & Bates ... 217,608
Foot rest, H. Jungmann ... 217,621
Fruit drier, W. Butts ... 217,510
Furnace fuel feeder, H. Swindell ... 217,654
Furnace grate bar, J. C. Furness ... 217,525
Gate opener and closer, M. T. & A. B. Reeves ... 217,484
Grain binder, Emerson & Case ... 217,596
Grain binder, W. A. Kirby ... 217,541
Grain meter, C. H. Schmincke ... 217,553
Grate and blower, open, A. Van De Wiele ... 217,496
Grate bar, C. F. Curwen ... 217,449
Gypsum, treating, C. T. Tomkins (r) ... 8,803
Harrow, J. Reese ... 217,638
Hat and cap sweat band, T. W. Bracher ... 217,576
Hay gatherer, H. Grebe ... 217,609
Hay rake, horse, A. Fager ... 217,455
Hay rake, horse, J. Hollingsworth ... 217,463
Hay rake, horse, J. E. Wisner (r) ... 8,805
Hay rake, revolving horse, L. S. Edleblute ... 217,595
Heater and cooker, A. V. M. Sprague ... 217,648
Hedge and pruning shears, Harrison & Lewis ... 217,531
Heel plate or guard, T. B. Lewis ... 217,624
Hoisting machine, J. Fensom ... 217,600
Hoof paring machine, horse, G. W. Schaefer ... 217,642
Horse toe weight, J. Everett ... 217,454
Horse stopper, runaway, A. Getzschmann ... 217,606
Horses, upper jaw check for, J. A. Sherman ... 217,555
Horseshoe calk, H. Dietrich ... 217,451
Horseshoe, detachable, C. A. J. Campbell ... 217,582
Horseshoe toe weight, Packard & Harris ... 217,547
Horseshoe machine, D. H. Hatlee ... 217,614
Hose coupling, J. L. Schmidt ... 217,643
Ice maker tanks, cell for, Siddeley & Mackay ... 217,647
Ironing board, D. T. Fuller ... 217,605
Jeweler's frosting tool, Fittz, Baxter, & Rowe ... 217,522
Journal cooler for railway cars, R. C. Norris ... 217,544
Knitting machine, H. Gunther ... 217,530
Knitting machine, straight, W. Aiken ... 217,569
Knitting machines, feeding attachment for circular, Byram & Fox ... 217,581
Ladder, step, J. A. Kellogg ... 217,539
Lamp, R. Abbatt, Jr. ... 217,502
Lantern, street, R. E. Dietz ... 217,517
Lap ring, M. R. McGregor ... 217,631
Lathes milling attachment for, W. Main ... 217,470
Lemon squeezer, J. Fanning ... 217,519
Letter box cabinet, J. D. Williams ... 217,566
Level, spirit, T. McWatters ... 217,633
Link motion, D. S. Stombs ... 217,650
Locomotive exhaust pipe, D. Harrigan ... 217,458
Locomotive exhaust pipes, tip for, D. Harrigan ... 217,459
Loom, Crompton & Wyman ... 217,589
Loom, P. W. Green ... 217,610
Loom shuttle, J. H. Coburn (r) ... 8,808, 8,809
Loom shuttle actuating mechanism, C. Fosdick ... 217,524
Loom shuttle operating device, E. H. Graham ... 217,529
Lumber, compound, D. M. Cummings (r) ... 8,807
Match box, A. B. Wood ... 217,664
Measuring can, liquid, F. J. Phillips ... 217,548
Meat tenderer, H. E. Clement ... 217,586
Metal bending machine, A. Vivarttas ... 217,560
Milk jar, G. M. Richardson ... 217,551
Mucilage holder, W. J. Schilling ... 217,490
Music leaf turner, W. T. Moore ... 217,473
Nursery chair, G. W. Swain ... 217,652
Nut lock, M. H. Grubb ... 217,612
Oatmeal machine, J. F. Byers (r) ... 8,806
Odometer, J. D. Richardson ... 217,550
Oil can, T. J. M., & T. E. Scantlin ... 217,489
Organ melody chest, E. White ... 217,660
Oyster float, L. J. Stewart ... 217,568
Pail lid or barrel cover, J. C. Moore ... 217,634
Paper bag machine, C. M. Richardson *et al* ... 217,639
Paper box, F. Imhof ... 217,619
Paper cutting machine, gauge for, J. C. Marshall ... 217,629
Paper pulp, apparatus for forming and cutting sheets of, F. Wurtzbach ... 217,666
Paper pulp machinery, wood, S. H. Burhans ... 217,509
Parer and corer, fruit, R. Bennett ... 217,507
Pen, stylographic fountain, D. Mackinnon (r) ... 8,802
Pencil sharpener, eraser, and tablet, H. Clayton ... 217,446
Pitman joint, J. F. Smith ... 217,493
Planter, corn, E. D. Macfee ... 217,627
Plated ware, covered articles of, Wilcox & Jepson ... 217,662
Plow, L. S. Edlebluto ... 217,594
Plow standards, manufacture of, T. C. Pinckard ... 217,481
Potato digger, B. B. Lang ... 217,622
Printing machine, Hoe & Tucker (r) ... 8,801
Pump automatic, W. Lyman ... 217,636
Pumping engine, H. F. Gaskill ... 217,526
Pyrotechnic signal, J. J. Detwiller ... 217,591
Quicksilver furnace, J. W. Epley ... 217,518
Railway, C. F. Dodge ... 217,452
Railway crossing gate, M. S. Drake ... 217,592
Railway, elevated, O. W. Barnes ... 217,441
Railway frog, C. H. Jackson ... 217,536
Railway signal, T. A. B. Putnam ... 217,482
Refrigerating house, D. C. Sanford ... 217,552
Refrigerator, W. T. Alley ... 217,504
Register and indicator, Windmuller & Ahrens ... 217,663
Rocking chair, W. Liesenbein ... 217,625
Rocking chair, folding, G. C. Paine ... 217,475, 217,476
Rolling mill, D. N. Jones ... 217,537
Rolling mill, metal, J. H. Swett ... 217,653
Saw mill, band, Crawford & Jackson ... 217,514
Sawing machine, circular, R. D. Pike ... 217,480
Scoop, E. Gourley ... 217,528
Sewing machine hemmer, J. P. Muller ... 217,545
Sheet metal can, J. Henderson ... 217,532
Shelf bracket, adjustable, A. P. Massey ... 217,471
Shoe, C. M. Lee ... 217,467
Snap hook, M. Ross ... 217,487
Spark arrester, Burgess & Russell ... 217,579
Spark arrester, C. F. Lochner ... 217,542
Spinning machine fliers, E. A. Cowper ... 217,587
Spinning rings, mechanism for supporting and adjusting, J. W. Wattles (r) ... 8,811
Spool and bobbin, O. E. Wait ... 217,655
Stamp, perforating, Roberts & Hathaway ... 217,640
Stamp, hand, J. Murdock, Jr. ... 217,546
Steam engine, H. A. Walker ... 217,656
Steam heater, Birchall & Parton ... 217,574
Steel, manufacture of Bessemer, S. G. Thomas ... 217,495
Stove, cooking, J. M. Read (r) ... 8,810
Stove, hay, J. A. Stocum ... 217,651
Stove oven, C. Caldwell ... 217,511
Stove, reservoir cooking, G. W. Walker ... 217,497
Stud for boots and shoes, lacing, C. Storer ... 217,494
Sugar solutions, filtration of, G. C. W. Belcher ... 217,442
Swing, W. R. Lashorne ... 217,465
Teaching penmanship, device for, C. R. Wells ... 217,499
Telegraph, autographic, E. A. Cowper ... 217,588
Telegraph line, underground, J. S. Pierson ... 217,479
Telephone, speaking, T. A. Watson ... 217,561
Thill coupling, P. A. Owen ... 217,636
Tilting chair, F. Chichester ... 217,584
Time detecter, watchman's, F. Imhaeuser ... 217,620
Tin box, J. E. Burns ... 217,445
Tire setter and fastener, D. Fairbanks ... 217,599
Tongs, pipe, J. D. Davis ... 217,450
Tool combination, C. W. Cannon ... 217,583
Traction engine and steam plow, B. S. Benson ... 217,506
Trunks, C. Gunsel ... 217,613
Type, printing, P. Gfroerer ... 217,607
Type writing machine, C. T. Brown ... 217,444
Umbrella frame, W. Hoyland ... 217,533
Valve, globe, J. C. & J. Lorenz ... 217,468
Valve spindles steam-tight, rendering, A. Kerr ... 217,540
Vapor engine, W. P. & W. T. Wood ... 217,665
Vehicle spring, A. Gummer ... 217,457
Velocipede, R. R. Ingersoll ... 217,535
Wagon, dumping, H. Bailey (r) ... 8,804
Wagon, road, C. W. Saladee ... 217,641
Wagon running gear, J. C. Fowler ... 217,601
Wardrobe, S. B. Sherer ... 217,646
Washer cutter, R. J. Bartley ... 217,505
Washing machine, W. Price ... 217,549
Washing machine, C. F. Sheppard ... 217,554
Waterproof fabric, C. S. Francis ... 217,604
Weather strip, J. V. Beavers ... 217,573
Weigher, automatic liquid, L. N. Watts ... 217,657
Window guard, S. Weinhandler ... 217,659
Window ventilator, F. Maull ... 217,630
Wringing machine clamp, I. Copeland ... 217,447
Yeast, preparing, H. Z. Felde ... 217,521

TRADE MARKS.

Axle grease, Hucks, Lambert & Greene ... 7,512
Chewing and smoking tobacco, Fite & Moore ... 7,509
Chiccory and other substitutes for coffee, H. F. Sohne ... 7,514
Cigarettes, P. H. Ertheller ... 7,503
Cigars, cigarettes, and smoking and chewing tobacco, Heyman Bros. & Lowenstein ... 7,502
Cigars, cigarettes, and smoking tobacco, Straiton & Storm ... 7,504
Cigars, Gordon & Campbell ... 7,505
Cigars, cigarettes, and smoking and chewing tobacco, C. G. Emery ... 7,520
Compound for tempering and refining steel, R. A. Goodchild ... 7,510
Composition used in the manufacture of paints, varnishes, calcimine, and enamels, American Crystalene Company ... 7,507
Cotton goods, Forbes Lithograph M'f'g Company ... 7,518
Cough sirup, J. Adams ... 7,501
Dress shirts, H. Wallach's Sons ... 7,519
Food for children, A. Weissbein ... 7,516
Hoes, Moritz & Keidel ... 7,513
Illuminating oils, J. R. Kelly & Co. ... 7,506
Plug chewing tobacco, O. P. Gregory & Co. ... 7,511
Washing powder, J. Dawson & Son ... 7,508
Whisky, F. G. Tullidge ... 7,515
Volatile ink, A. A. Wright ... 7,517

DESIGNS.

Card basket, T. J. Linnekin ... 11,296
Carpet pattern, A. Heald ... 11,294, 11,298
Lock face plate, G. S. Barkentin ... 11,297
Ornamental chain, D. A. Beam ... 11,295

English Patents Issued to Americans.

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Boot nailing machine, W. G. Budlong, Providence, R.I.
Exercising apparatus, W. I. O. Bryan, Jr., N. Y. city.
Gearing conversion, I. M. Avery, New York city.
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Regulator for steam engines, R. K. Huntoon, —, Mass.
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Wrench, A. Jackson *et al.*, San Francisco, Cal.

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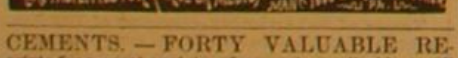

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