SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XLI.—No. 5. [NEW SERIES.] NEW YORK, AUGUST 2, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

THE GRAND PRIZE DIPLOMA OF THE FRENCH EXHIBITION.

The accompanying excellent engraving represents a *fac-simile* 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.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included.................................. $3 20
One copy, six months, postage included 1 60

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

☞Single copies of any desired number of the SUPPLEMENT sent to one address on receipt of 10 cents.

Remit by postal order. Address

MUNN & CO., 37 Park Row New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

VOL. XLI., No. 5. [NEW SERIES.] *Thirty-fifth Year.*

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.

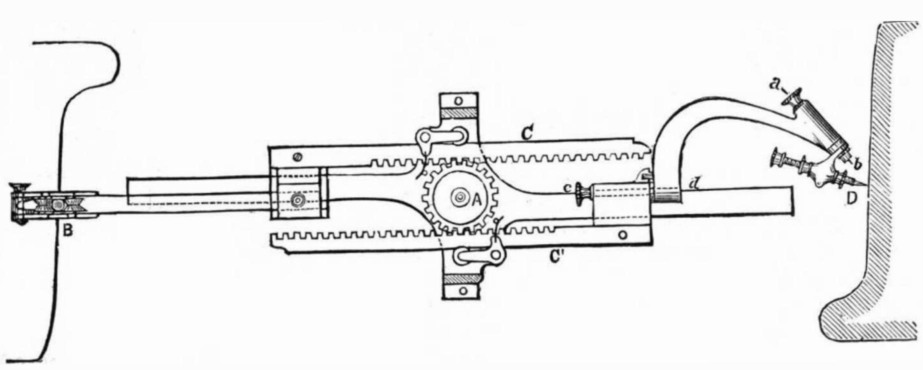
THE POLAR PANTOGRAPH.

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.

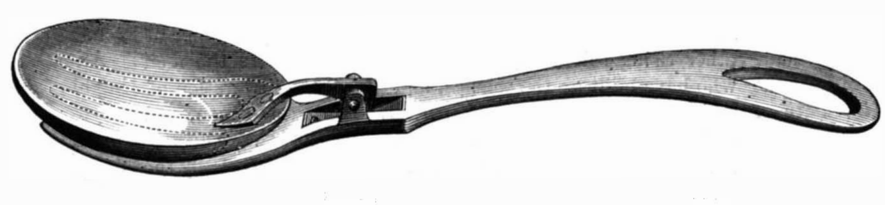
This instrument is the invention of Mr. Napoli, the chemist of the Eastern Railroad of France.—*Railroad Gazette.*



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.

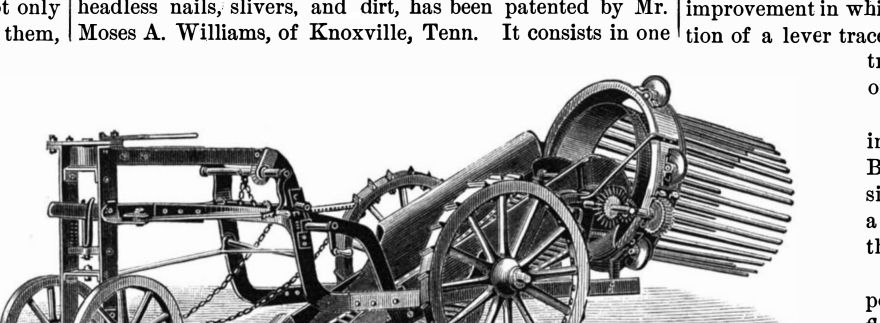
Telegraphic Ignition.

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 $\frac{2,323,200 \times 997\cdot137}{35,840}$, 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.

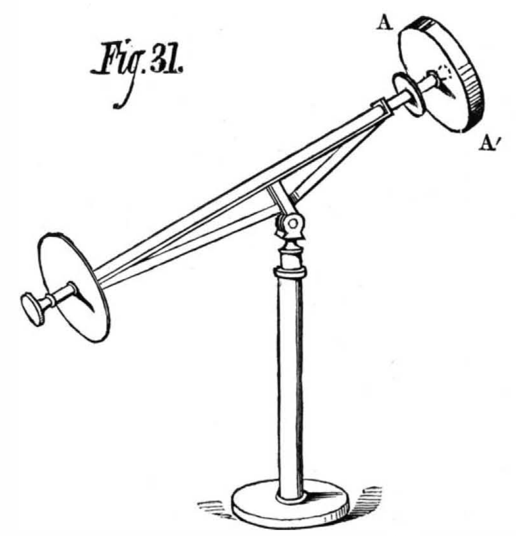
When we hold the right hand in warm water, the other in cold, for a few moments, and then plunge both in the same basin of tepid water, the two hands will give different reports; to the right the fluid is cold, to the left it will feel warm, though it is the same really to both, and we might vary the 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

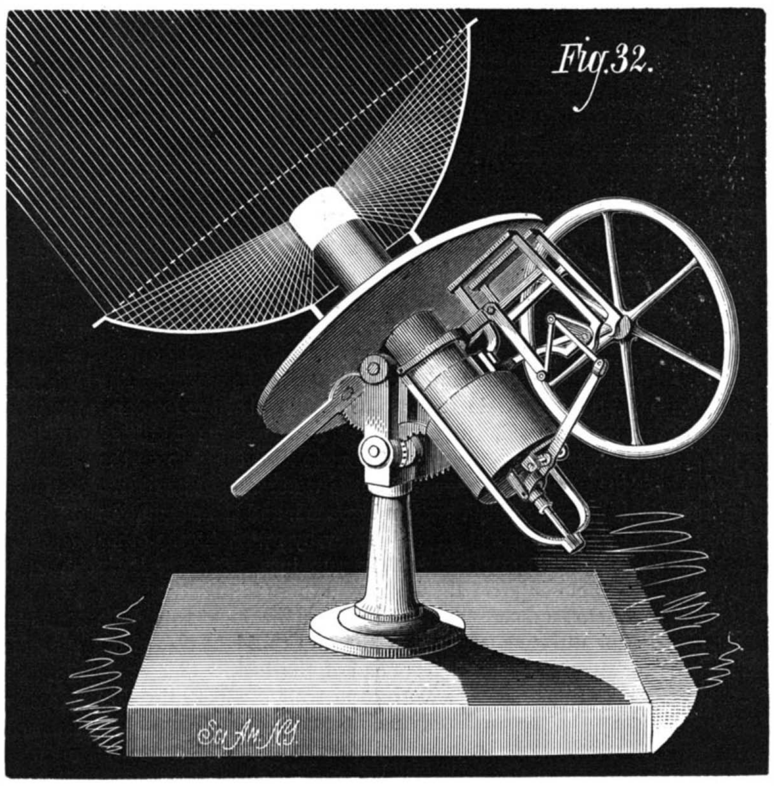
Fig. 31.



THE PYRHELIOMETER.

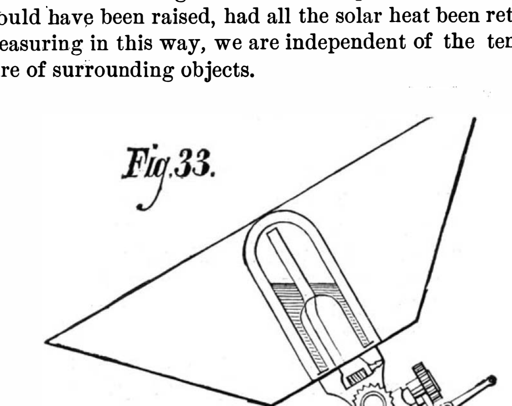
like, if we could, to keep all this heat in it to measure. As we cannot, we reach the same result by finding how much is lost, and allowing for it. Thus, the observer first leaves the apparatus in the shade (for instance) five minutes, and notices whether it loses or gains from its own radiation to surrounding 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 $\frac{5\cdot6 \times 772}{33000} =$ 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 yards the 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.

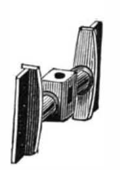
The California Codfish Trade.

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.

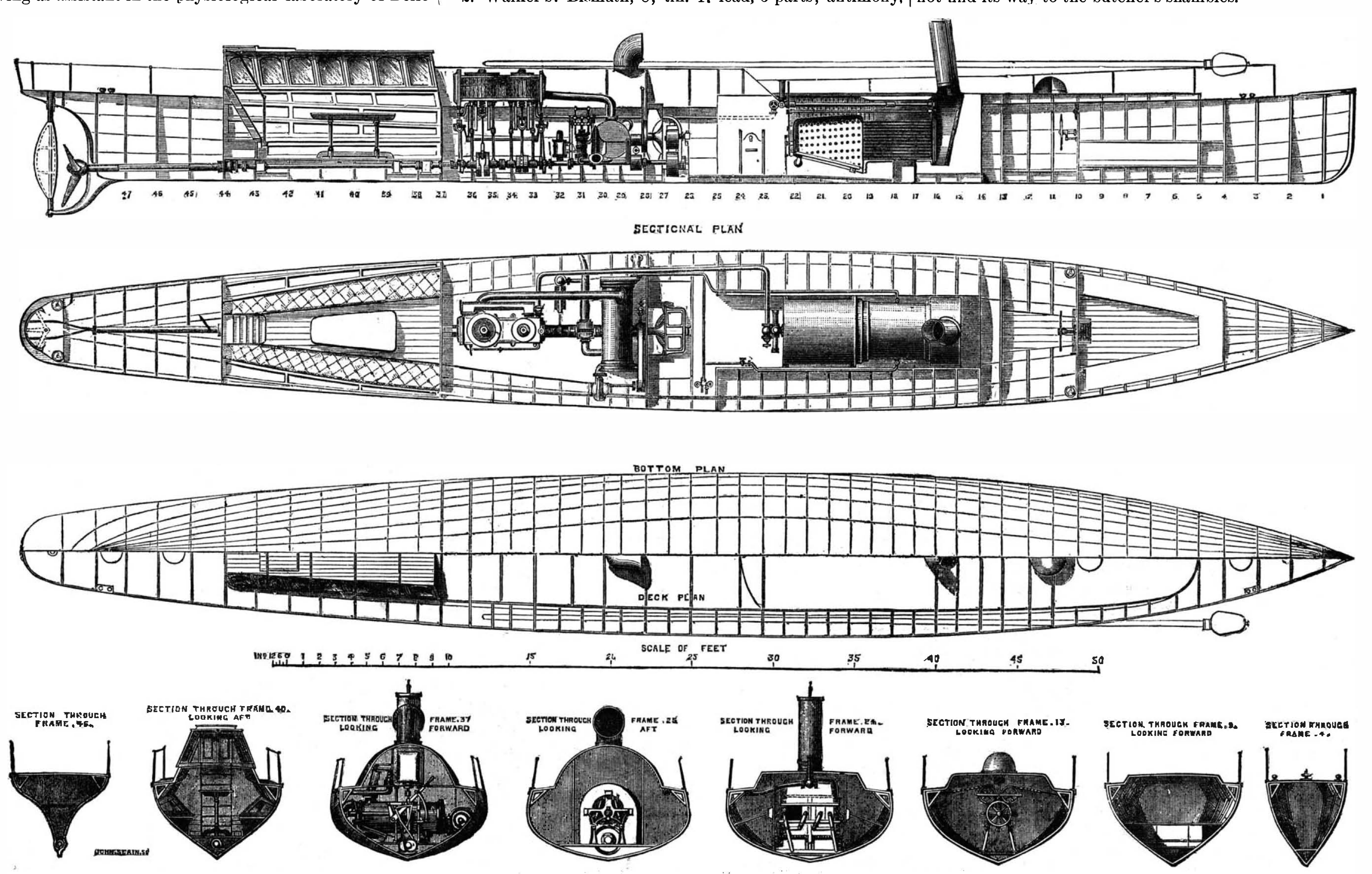
(3) It relieves thirst, which soft water does not.

(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.



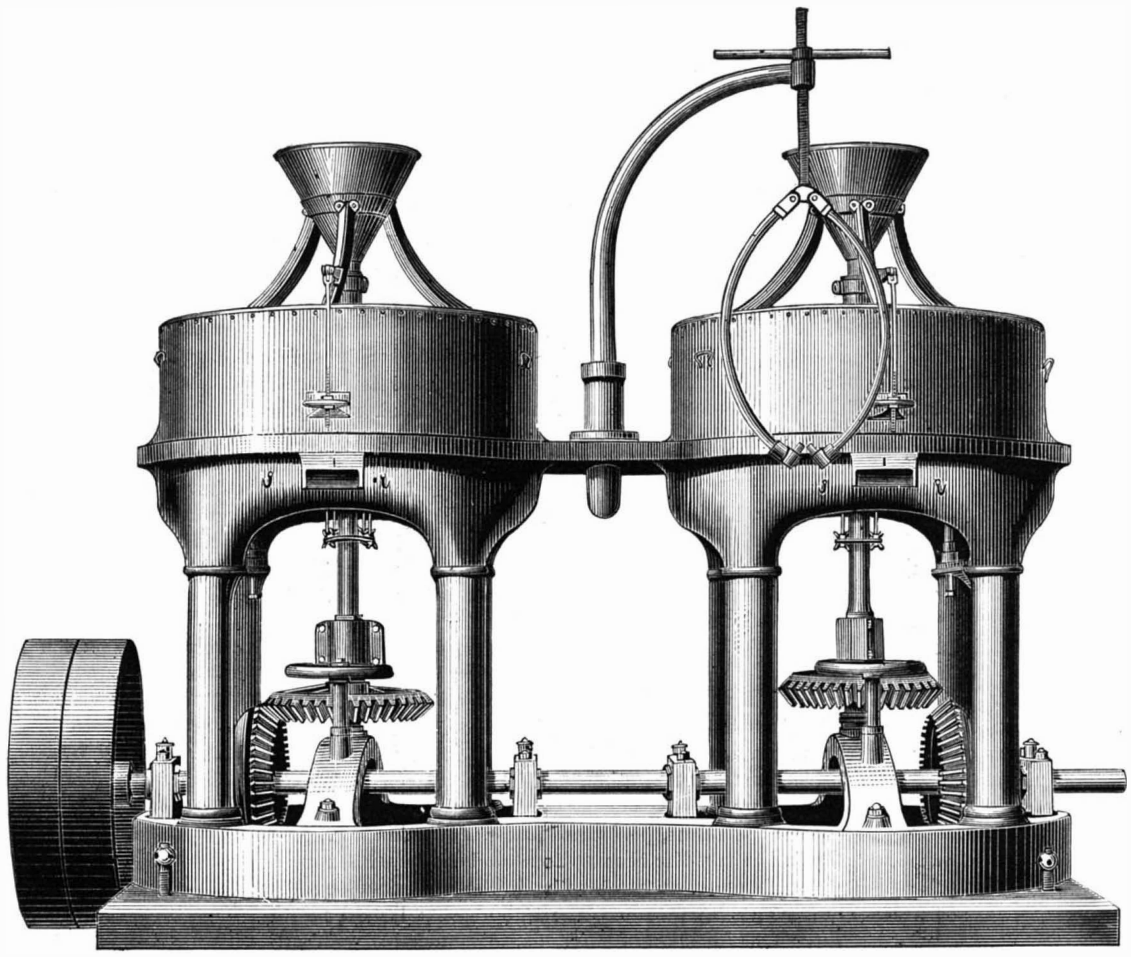
THE SPAR TORPEDO VESSEL ACHERON.

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.



CLAYTON & SHUTTLEWORTH'S PORTABLE MILL.

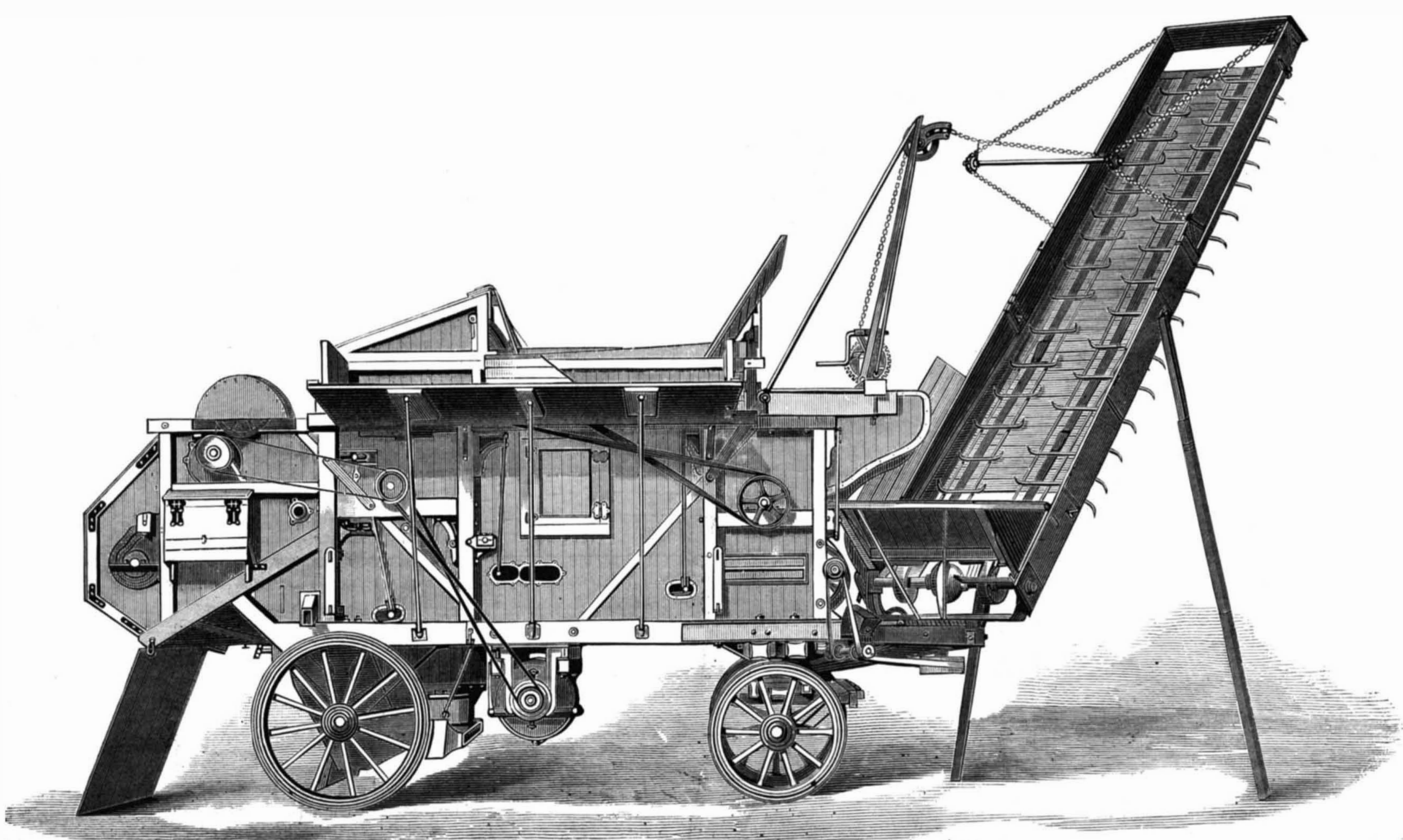
NEW THRASHING MACHINE.

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. 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.

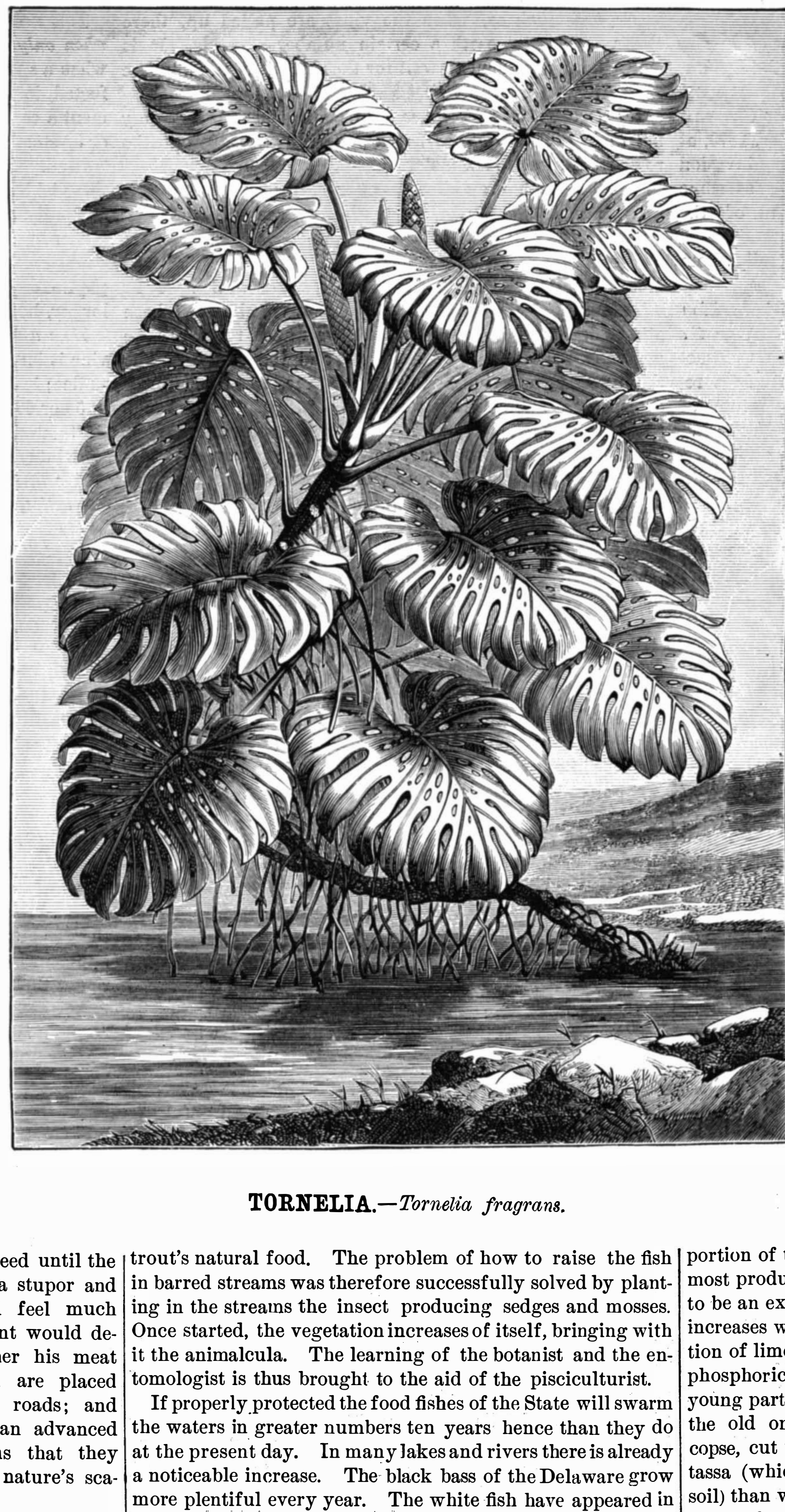
The taking to pieces of the elevator for packing up is a very simple process. The trough is lowered nearly to the ground, when the rake belts are taken off, rolled up, and put under the hopper of the elevator, as also the top roller and winch board. The two tightening chains under the floor are now unfastened, 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.

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.



TORNELIA.—*Tornelia fragrans.*

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 watercourses 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.

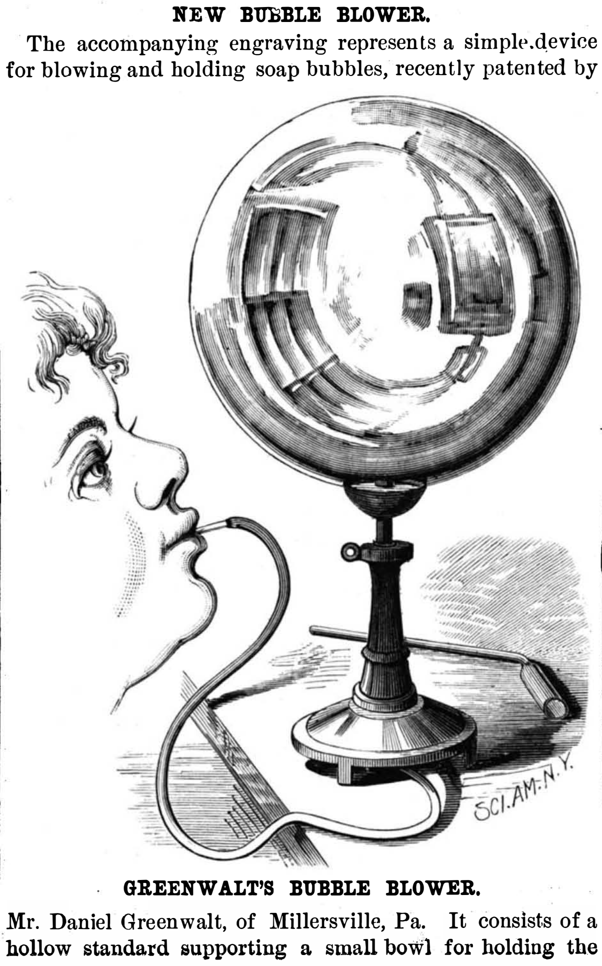
Is there not some danger that French stocks grafted upon American ones will yield an inferior quality of wine? Experience has already pronounced in favor of French fruit trees and vines; and the wines coming from French stocks grafted upon American ones are absolutely the same as if they had not been 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." "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 $\frac{54}{10000}$. 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 (Ca2HO), 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 an 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 5/16 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 5/16 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 5/16 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)83129·95200(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 ⅛ of an inch up to 1 inch, varying 1/16 in size, and from 1 inch up to 3 inches, varying ⅛ 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	3¼	3	3	2⅞	2¾	2⅝	2½
Diameter in in..	5¼	5½	5¾	6						
Threads per in..	2½	2⅜	2⅜	2¼						

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.]

Cane shaving machine, G. S. Colburn ... 216,723
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 ... 216,766
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 ... 216,807
Coat and vest hanger, F. H. Zahn ... 216,928
Cock, steam gauge, T. Shaw (r) ... 8,772, 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 ... 216,825
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
Disks, adjusting cutting, G. S. Colburn ... 216,724
Doubling and twisting machines, stop motion for, J. H. Knowles ... 216,867
Dredging appratus, J. Grant ... 216,847
Electric light, J. H. Rogers ... 216,760
Eyeglasses, M. Thum ... 216,812
Fence hook, J. & W. M. Brinkerhoff ... 216,778
Fence, portable, J. Landis ... 216,742
Fence, portable, W. G. Poston, *et al* ... 216,757
Fence post for wire fences, iron, J. W. Jackman ... 216,855
Fence twister, metallic, J. & W. M. Brinkerhoff ... 216,779
Firearm, magazine, S. T. Harrison ... 216,848
Fire extinguishing apparatus, C. Barnes ... 216,821
Fog signal, W. B. Barker ... 216,820
Fruit can, W. Collings ... 216,831
Furnaces, dumping dead plate for, N. W. Pratt ... 216,888
Galvanic battery, W. S. Wilson ... 216,774
Gate, T. D. Crumpton ... 216,726
Gate, J. S. Noyes ... 216,883
Glue stock, treating bones for, W. Adamson ... 216,816
Governor, dynamometrical, E. A. Bourry ... 216,826
Governor, engine, S. Whinery ... 216,922
Grain separator, J. N. Clees (r) ... 8,775
Grain separators, blast regulator for, C. H. Faling ... 216,732
Grate, fire, R. McKellar ... 216,872
Grate, fire place, J. B. Tarver ... 216,769
Grinding mill, Stevenson & Wylde ... 216,906
Harness mountings, constructing, S. S. Sargeant ... 216,764
Harness strap, T. G. Glennon ... 216,845
Harrow, smoothing, C. A. Meeker ... 216,878
Harrow, wheel, J. S. Corbin (r) ... 8,765
Harvester, J. P. Manny ... 216,744 to 216,746
Harvester guard finger, J. P. Manny ... 216,748
Harvester mitt, A. Gillinn ... 216,788
Hay press, E. E. Fuller ... 216,785
Hay rake, horse, S. H. Bushnell ... 216,829
Hedge trimmer, Rogers & Freeman ... 216,894
Hedge trimmer, H. Unkrich ... 216,915
Hinge, spring, W. G. Barry ... 216,777
Hoe, T. B. Lockwood (r) ... 8,777
Hoisting device, D. Abrey ... 216,815
Holdback, vehicle, T. W. & H. K. Porter ... 216,756
Horse and mule shoes, machine for making, J. A. Burden ... 216,828
Horses to vehicles, apparatus for attaching, J. Knights ... 216,741
Hose coupling, O. B. Hall, 2d ... 216,736
Hose coupling, W. F. Hofmann ... 216,851
Hydrocarbon burner, S. C. Salisbury ... 216,898
Hydrocarbon burning apparatus, R. F. Humiston ... 216,853
Ink powders, capsuled, G. J. Collins ... 216,832
Iron, dephosphorizing, S. G. Thomas ... 216,910
Jail, prison, and grating bar, Kinsey & McDonald ... 216,865
Lamp shade holder, H. D. Stanley ... 216,905
Lamps, manufacturing glasses for street and other, W. P. Butler ... 216,830
Lasting machine, Shaller & Ethridge ... 216,765
Latch, C. H. Smith ... 216,904
Locomotive boiler cleaner, W. Titcomb ... 216,911
Lounge, folding, J. E. Binder ... 216,718
Metal tubes, machine for reducing the diameter of, S. P. M. Tasker (r) ... 8,774
Milker, mechanical cow, A. A. Durand ... 216,838
Millstone driver, W. J. Blackwell ... 216,824
Mortising machine, E. H. N. Clarkson ... 216,722
Motion by impact, combined lever rotary, H. B. Keiper ... 216,794
Mower, W. R. Otis ... 216,754
Nailing machine, L. Goddu ... 216,790
Night chair, C. Kienzle ... 216,863
Nut lock, C. G. Lea ... 216,870
Oil can shipping case, E. Morgan, Jr ... 216,751
Ore separator, H. W. King ... 216,740
Organ, reed, G. W. Scribner (r) ... 8,771
Oscillating chair, A. H. Ordway ... 216,753
Oven, portable, W. F. Rossman ... 216,896
Paint or covering, roofing, J. R. Hazelet ... 216,850
Paper bag, C. Newman ... 216,881
Paper clips, machine for setting eyelet, W. A. Rollins ... 216,895
Paper machines, dandy roller for, W. S. Tyler ... 216,914
Paper, package of prepared, C. C. White ... 216,923
Pegging machine, gang, Woodward & Brock ... 216,926
Piston meter, steam, J. A. Cook ... 216,833
Pitman connection, J. P. Manny ... 216,747
Plant sprinkler, A. Schrader ... 216,808
Planter, check row corn, J. H. Allyn ... 216,775
Planter, combined, R. I. Cowden ... 216,781
Planter, corn, J. A. Patterson ... 216,755
Plastering walls, machine for, G. Stevens ... 216,907
Plow, E. Wiard ... 216,772, 216,773
Polishing machine, L. A. Sandford ... 216,763
Potato digger, C. F. Benz ... 216,822
Printing machine, oscillating, G. W. Prouty ... 216,890
Propeller, chain, T. L. Lee ... 216,871
Propeller, enameled screw ... 216,880
Pump, G. W. McKenzie ... 216,877
Pump for testing machines, hydraulic, T. Olsen ... 216,752
Rail tie and joint, L. A. Gouch ... 216,846
Railway gate, Pope & Tincher ... 216,886
Railway rails, piling old, Griffen & Weeks (r) ... 8,770
Railway switch, D. Tracy ... 216,913
Refrigerating air for cooling beer and other liquids, apparatus for, F. Pallausch ... 216,884
Refrigerating chambers, condenser for, F. Roloson ... 216,761
Rivet, M. Bray ... 216,719
Rolling mill, A. Mechwart ... 216,750
Rowlock, G. W. McKenzie ... 216,876
Safe doors, device for opening, C. F. Gessert ... 216,843
Sash and bead fastener, Window, L. Fisher ... 216,784
Sash cord guide, Sloan & Clarkson ... 216,767
Sash fastener, G. F. Knight ... 216,866
Saw handle, adjustable, W. McNiece ... 216,800
Sawmill dog, C. H. Roberts ... 216,893
Screw cutting tap, B. Stott ... 216,909
Sectional boiler, N. W. Platt ... 216,887
Seeding machine, J. P. Fulgham ... 216,735
Settee, folding, F. F. Morse ... 216,803
Sewing machine, C. O. Parmenter (r) ... 8,767
Sewing machine, button hole, F. Simmons ... 216,903
Sewing machine feeding device, W. O. Grover ... 216,791
Sewing machine needle bar, N. Hayden ... 216,849
Sewing machines, hand lever for operating, T. Shanks ... 216,901
Shafting flexible, H. D. Justi ... 216,858
Shoe fastening and lacing, S. Jones ... 216,857
Shoe tack wire, machine for making, L. Goddu ... 216,789
Sifter, coal, W. W. Whitaker ... 216,813
Sign, F. Tuchfarber ... 216,771
Skelp bending and scarfing machine, B. & B. C. Lauth ... 216,869
Smoke and spark arrester, De Turk & Olds ... 216,783
Spinning and twister rings, tool for manufacturing, G. D. Edmands ... 216,729
Spinning ring, G. D. Edmands ... 216,728, 216,731
Spinning ring traveler, H. L. Peirce ... 216,806
Spinning rings, tool for making, G. D. Edmands ... 216,730
Stall and stable door releasing device, animal, J. W. Bartleson ... 216,819
Stamp, hand, G. K. Cooke ... 216,835
Stationary and portable fountain tip, A. Weber ... 216,920
Stave chamfering and crozing machine, Gardener & Stephenson ... 216,786
Steam and air brake, Smith & Frink (r) ... 8,778
Steam engine, balance, J. O. Baird ... 216,818
Steam generator, J. T. Kelly ... 216,859
Steamer, food, S. H. Baker ... 216,717
Steering apparatus, S. G. Martin ... 216,873, 216,874
Stopping and reversing machinery, apparatus for, G. C. Gill ... 216,787
Stove, reservoir cook, T. H. Roberts ... 216,892
Stove pipe coupling and brace, W. E. Hofman ... 216,852
Surveying instrument, T. F. Randolph ... 216,759
Suspenders, J. A. Adamson ... 216,715
Table knife, A. W. Cox ... 216,725
Tag, P. F. King ... 216,796
Tag fastener, T. P. Marston ... 216,798
Telegraph, railway car, E. J. J. DeBaillehache ... 216,716
Telephone, electric, J. H. Irwin ... 216,793
Telephone, mechanical, E. D. Finch ... 216,840
Time lock, P. F. King ... 216,795
Time locks, automatic winding mechanism for, S. M. Lillie ... 216,797
Top spinning, A. J. Davis (r) ... 8,768
Toy locomotive, C. C. Shepherd ... 216,809
Toy, optical, D. Buckler ... 216,721
Toy whirl, A. Kiesele ... 216,864
Train indicator, Keys & Smith ... 216,862
Trap valve, R. G. Miller ... 216,801
Truck, car, G. Hambruch ... 216,792
Truck, hand, G. M. Titus ... 216,770
Tweezers, W. A. Wales ... 216,918
Valve, L. Brandeis ... 216,720
Valve, steam, J. A. Cook ... 216,034
Valve, stop, A. Weber ... 216,921
Vehicle wheel, F. H. Rossman ... 216,762
Ventilating buildings, vessels, etc., F. L. Norton ... 216,804
Vessels, construction of hulls of, H. T. Morse ... 216,802
Wagon and car brake, Franklin & Landrum ... 216,842
Wagon brake, automatic, L. L. & W. E. Johnson ... 216,856
Wagon brake, automatic, J. J. Rose ... 216,897
Wagon running gear, L. D. Hurd ... 216,854
Wagon scoop board, Maguire & Ditto ... 216,875
Washing machine, B. J. Williams ... 216,925
Watch and clock dials, blank for, W. A. Wales ... 216,917
Watch winding device, B. Wormelle ... 216,814
Water purifier and elevator, T. T. Bishop ... 216,823
Water wheel, turbine, F. M. Kent ... 216,860
Whiffletree hook, W. L. B. & J. J. Cushing ... 216,727
Wire, spool for winding, E. M. Crandal ... 216,836

TRADE MARKS.

Cigars, G. A. Kent & Co ... 7,443
Fertilizers, A. J. Wedderburn ... 7,439
Friction matches, J. Eaton & Son ... 7,429
Lamp oil, J. W. Cammett ... 7,435
Laundry blue, Meyer, Bain & Co ... 7,428
Liquid pearl, a preparation for the human complexion, Champlin & Co ... 7,441
Medical compounds, H. A. Tilden ... 7,431
Ranges, Stuart, Peterson & Co ... 7,438
Roasted coffee and roasted and ground coffee, E. Guittard & Co ... 7,432
Rye whisky, C. Gallagher ... 7,442
Sewing thread, Marshall & Co ... 7,433
Smoking and chewing tobacco and cigarettes, J. W. Martin ... 7,430
Smoking tobacco, Allen & Ellis ... 7,440
Soap, C. Lipps ... 7,437
Twines and cordage, Hooven & Allison ... 7,436
White and fancy shirts, Buchman Brothers & Co ... 7,434

DESIGNS.

Apron, C. Y. Wemple ... 11,265
Bar of soap, H. J. Ecker, *et al* ... 11,261
Carpet, F. Oertly ... 11,263
Handles for fire irons, R. Christesen ... 11,257
Handles for spoons, Gill & Brittin ... 11,268
Hinges, G. S. Barkentin ... 11,267
Lock cases, G. S. Barkentin ... 11,266
Overshoes, G. Watkinson ... 11,260
Padlock, C. L. Bellamy ... 11,256
Padlocks, J. Gerard ... 11,259
Pen racks, H. K. Ely ... 11,258
Photograph stand, J. T. Reed ... 11,264
Stocking, S. Hodgson ... 11,262

English Patents Issued to Americans.

From June 27 to July 1, inclusive.

Aero steam engines, J. M. Whitney, Providence, R. I.
Berth, D. Huston, Boston, Mass.
Casters, J. H. Schlott, Freeport, Ill.
Cream, manufacture of, W. Cooley, Waterburg, Vt.
Cresylic acid, volatilizing, J. H. Valentine, Providence, R. I.
Elevators, S. A. Bates *et al*, Pittsburg, Pa.
Fence, metallic, apparatus for erecting, Washburn Moen Mfg. Co., Worcester, Mass.
Fire Extinguishing apparatus, H. S. Parmelee, New Haven, Conn.
Fuel, artificial, C. E. Lester, New York city.
Hose coupling, W. J. Stevens *et al*, New York city.
Locks, time, E. Holmes, Brooklyn, N. Y
Marine signal, W. B. Barker, Hoboken, N. J
Paving block, A. H. Elliott, New York city.
Photography, Carvalho & Marks, New York city
Pumps, steam, G. W. Dixon, Spring Lake, Mich
Railway brakes, S. P. Tallman, Dunellen, N. J
Spinning machinery, T. Mayor, Providence, R. I.
Spinning rings, G. D. Edmands, Milford, Mass.
Targets, C. W. Boughton, Titusville, Pa
Telephones, H. M. McIntire, Easton, Pa.

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - - $1.00 a line.
(About eight words to a line.)
Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ **Special attention is called to the following interesting and highly valuable testimonial to**

THE HANCOCK INSPIRATOR.

CEREDO, W. VA., July 11, 1879.

Messrs. FAIRBANKS, MORSE & Co., Cincinnati, Ohio:

GENTLEMEN: I got one of your No. 25 Hancock Inspirators, and it is a good boiler feeder. Before I put it on it took one man to run the pump, one the engine, and a small boy to help fire. Now I have only the engineer, and he needs his pants half-soled. In fact he has not much work to do but entertain the friends when they come around. He wants to know what I am going to do with the surplus fuel that is piling up on him. I have plenty of steam all the time, with one-half less labor and fuel than with my pump. I have a pump for sale, to feed three cylinder boilers, thirty inches in diameter and thirty feet long. I think old Mr. Hancock did a big thing when he signed the Declaration of Independence, and invented the Inspirator.

Yours truly,
G. W. PARSONS, Ceredo, W. Va.

☞ Illustrated and descriptive circulars sent on application to

Hancock Inspirator Co.,
52 CENTRAL WHARF,
BOSTON, MASS.

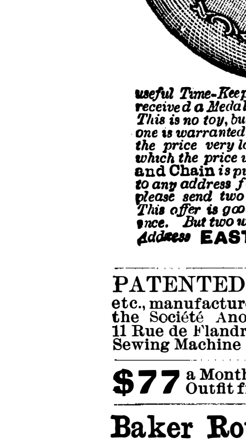
OUR SPECIALTY STEAM PUMPS AND BOILER FEEDERS. SEND FOR ILLUSTRATED CATALOGUE. COPE & MAXWELL MFG. CO. HAMILTON, OHIO.

THE GREAT NAME AT LAST FOUND. The Infallible Catarrh Remedy. In fear of counterfeiting all medicines will be given by himself
DR. M. TREMBLAY, 38 Main St., Holyoke, Mass.

SPATTERGRAPH. SOMETHING NEW, FOR MAKING MOTTOES, &c. 50c. POSTPAID. MODEL NOVELTY CO., Boonton, N. J.

VALVE REFITTING MACHINES. ALL USERS OF GLOBE VALVES SHOULD HAVE ONE. GRISCOM & CO., POTTSVILLE, PENN.

THE SOLARGRAPH WATCH ONLY $1.



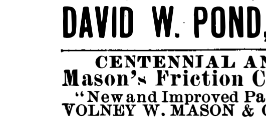
A perfect Time-keeper, Hunting-Case, and Heavy Plated Chain, latest style. We warrant it for five years to denote time as correctly as a $100 Chronometer Watch, and will give the exact time in any part of the world. It also contains a **First-Class Compass,** *worth alone the price we charge for the Time-Keeper. For Men, Boys, Mechanics, School Teachers, Travellers and Farmers, it is indispensable. They are as good as a high-priced watch, and in many cases more reliable. Boys, think of it! A Hunting-Case Watch and Chain for $1.00. The* Solargraph Watch *is used by the* **Principal of the Charlestown High School,** *and is being fast introduced into all the schools throughout the United States, and is destined to become the most useful Time-Keeper ever invented. The* Solargraph Watch *received a Medal at the Mechanics' Fair, at Boston, in 1878. This is no toy, but is made on scientific principles, and every one is warranted to be accurate and reliable. We have made the price very low simply to introduce them at once, after which the price will be raised. The* Solargraph Watch *and Chain is put up in a neat outside case, and sent by mail to any address for $1.00. We have made the price so low, please send two stamps, if convenient, to help pay postage. This offer is good for sixty days only, and will appear but once. But two watches sent to one person. Name this paper.* Address **EASTERN MANUFACTURING CO.** Rockland, Mass.

PATENTED ARTICLES, MACHINES, etc., manufactured in France according to the Laws by the Société Anonyme pour l'Exploitation de Brevets, 11 Rue de Flandre, Paris, France. References: Mackay Sewing Machine Association, Boston, Mass.

$77 a Month and expenses guaranteed to Agents. Outfit free. SHAW & CO., AUGUSTA, MAINE.

Baker Rotary Pressure Blower.

(FORCED BLAST.)



Warranted superior to any other.
WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA

FOR SALE. Tin, Lamp, Glass, and Oil Store; also, Factory for tin ware and sheet iron work. Established thirteen years. Inquire WM. S. SULGER, No. 109 Hanover St., Trenton, New Jersey. Reason, Hemorrhage of Bowels.

Pond's Tools,

Engine Lathes, Planers, Drills, &c.

DAVID W. POND, Worcester, Mass.

CENTENNIAL AND PARIS MEDALS. Mason's Friction Clutches and Elevators. "New and Improved Patterns." 20 per cent. off list. VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

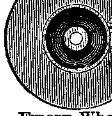
SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO., 331, 333, 335, & 337 West Front Street, Cincinnati, Ohio.

STEAM ENGINES AND BOILERS,
Wood and Iron Working Machinery.
(Send for circulars.)
GEO. M. CLAPP, Manager. BELCHER & BAGNALL, Warerooms: 40 Cortland Street, N. Y.

NEW YORK BELTING AND PACKING COMP'Y.

The Oldest and Largest Manufacturers of the Original



Emery Wheel.

SOLID VULCANITE EMERY WHEELS.

All other kinds Imitations and Inferior. Our name is stamped in full upon all our standard BELTING, PACKING, and HOSE.
Address NEW YORK BELTING AND PACKING CO., JOHN H. CHEEVER, Treas. NEW YORK.

THE BEST STEAM PUMP in AMERICA
More than 4500 in use. **THE DEANE** Made by HOLYOKE MACHINE CO. Send for reduced Price List. Deane Steam Pump Works 92 & 94 LIBERTY ST., NEW YORK.

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving *insurance* and avoiding all risk of *interruption to business* in consequence of fire. Book of detailed information furnished on application.

STEAM PUMPS Wright's Pat. Bucket Plungers are the best. VALLEY MACHINE CO. Easthampton, Mass.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.

THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

Cigar Box Lumber,

MANUFACTURED by our NEW PATENT PROCESS.
The Best in the World.
SPANISH CEDAR, MAHOGANY, POPLAR.

Also thin lumber of all other kinds, 1/8 to 1/2 in., at corresponding prices. All qualities. Equal in all respects to any made, and at prices much under any to be obtained outside of our establishment. Send for price list.
GEO. W. READ & CO., 186 to 200 Lewis Street, N. Y.

$100 INVESTED, EARNED **$1,358**

profit in 13 days, on a recent turn of the market, by the new system of protective time options for operating stocks in Wall St. Larger or smaller investments pay proportionately as well or better, by the positive rules for "safety and success," on which this system is based. It is worthy the closest investigation of all who desire to make money more rapidly and securely than by any method of stock operations hitherto known. Full explanation and much valuable financial information on application to Messrs. ITHAMAR DIBBELL & CO., Bankers and Brokers, 19 Broad St., N. Y. City.

Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S
WOOD WORKING MACHINERY

was awarded at the Paris Exposition over all competitors **THE GOLD MEDAL OF HONOR.** Also highest award at Phila., Santiago, Australia, and Vienna. It is **Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and Increases products of the highest standard of Excellence.**

Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for Circulars.
J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29. ST. NEW YORK CITY.

PATENTS at AUCTION.

Regular Monthly Sales. For terms, address N. Y. PATENT EXCHANGE, 67 Liberty Street, New York.

EXETER MACHINE WORKS, Manufacturers of Steam Engines, Blowers, and Steam Heating Apparatus. 50 Federal St., Boston, Mass.

NEW METHOD OF ENGRAVING
Moss' Process.
Photo Engraving Co.
67 Park Place, New York.

L. SMITH HOBART, President. JOHN C. MOSS, Superintendent.

TYPE-METAL RELIEF PLATES
A SUPERIOR SUBSTITUTE FOR WOOD-CUTS
AT MUCH LOWER PRICES.

Persons desiring illustrations for Books, Newspapers, Catalogues, Advertisements, or for any other purposes, can have their work done by us promptly and in the best style.

Our Relief Plates are engraved by photo-chemical means; are mounted on blocks type-high ready for use on any ordinary press, and will wear longer than the common stereotype plates.

They have a perfectly smooth printing surface, and the lines are *as deep, as even,* and *as sharp* as they could possibly be cut by hand.

Electrotypes may be made from them in the same manner as from wood-cuts.

Copy. The engraving is done either from prints or pen-drawings. Almost all kinds of prints can be re-engraved directly from the copy, provided they be in *clear, black lines* or stipple, and on *white* or only slightly tinted paper.

Pen drawings, suitable for engraving by us, must be made with *thoroughly* BLACK ink, on *smooth, white* paper. They should usually be made twice the length and twice the width of the plates desired.

When such drawings cannot be furnished us, we can produce them from photographs, pencil sketches, or designs of any kind accompanied with proper instructions. Photographs taken in the usual way, and of any convenient size, we can use.

Change of Size.—Wood-cut prints of the coarser kind may often be reduced to half their lineal dimensions, while others will admit of very little reduction, and some of none at all.

Most lithographic and steel-plate prints will admit of no reduction.

Very fine prints of any kind may be *enlarged* moderately without detriment.

Any prints which cannot be satisfactorily reduced or enlarged may be *redrawn* and thus brought to any desired size.

In all cases of reduction and enlargement, the relative proportions remain unchanged.

Proofs.—Whenever desired, we will furnish tintype proofs of the drawings made by us, for approval or correction, before engraving. A printed proof is furnished with each plate.

Time.—We cannot usually engage to fill an order for a single plate in less than from three to six days; larger orders will require longer time.

Estimates will be promptly furnished when desired. That these may be definite and correct, the copy to be used—whether print, photograph, sketch, or drawing—should always be submitted for our examination, together with a distinct statement of the size of plate wanted, and of any other details to be observed.

Terms.—To insure attention, all orders must be accompanied by an advance of half the price charged, the balance to be paid on delivery.

Electrotyping and Printing.—We have recently added to our establishment excellent facilities for making electrotypes, and also five power presses specially fitted for printing plates of all sizes in the finest manner.

Artificial Light.—We have just introduced this most important facility, which enables us to prosecute our work *in cloudy weather,* and to push forward hurried orders *in the night.*

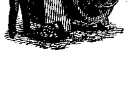
References.—Our plates are now used by the principal publishers in this city, and by most of the leading houses in every State in the Union.

Our General Circular contains a few specimens of the various kinds of our work, and will be sent on receipt of stamp. We have just prepared five special circulars, as follows:

No. 1. Portraits and Figures.
" 2. Buildings and Landscapes.
" 3. Machinery and Apparatus.
" 4. Maps, Autographs, and Ornamental Lettering.
" 5. Reproductions from Wood-Cuts, Steel-Plate Prints, and Lithographs.

These will be furnished at *ten cents* each.

BLAKE'S STONE AND ORE BREAKER AND CRUSHER.



For breaking hard and brittle substances to any size. Endorsed by the leading **Mining, Manufacturing, and Railroad** corporations in the **United States and Foreign Countries. First Premium** wherever exhibited, and hundreds of testimonials of the *highest character.*
Indispensable for making best McAdam Roads, Ballasting of Railroads, Crushing the hardest Ores, Stone for Concrete, etc., etc. *Prices greatly reduced.*
Address **BLAKE CRUSHER CO., New Haven, Conn.**

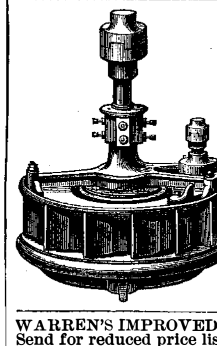
STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.

THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.

Price list issued Jan. 1, 1879, with a reduction exceeding 30 per cent.

WATER METERS. OIL METERS.



THE
Bellefonte Water Wheel
is the best, cheapest, most powerful, and durable in the market.
Send for circular.
W. P. Duncan & Co.,
Bellefonte, Pa.

WARREN'S IMPROVED TURBINE WATER-WHEEL. Send for reduced price list. 29 Exchange St., Boston, Mass.

BIG PAY to sell our Rubber Printing Stamps. Samples free. Taylor Bros. & Co., Cleveland, O.

Important to Manufacturers.

The City of ST. CATHARINES, Ontario, Canada, offers **UNRIVALED ADVANTAGES** and **SPECIAL INDUCEMENTS** to Manufacturers. Population of City and surrounding Municipalities, 20,000. **Waterworks by Gravitation.** Center of extensive Manufacturing District.

Unlimited Water-Power.

Connects with four leading lines of **RAILWAYS,** and on direct line of **Inland and Ocean Navigation.**
CORRESPONDENCE INVITED. Prompt replies.
Address **City Clerk, St. Catharines, Ont.**

PROSPECTUS
OF THE
Scientific American
FOR 1879.

The Most Popular Scientific Paper in the World.

VOLUME XL.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Fourth day of January, 1879, a new volume will be commenced. It will continue to be the aim of the publishers to render the contents of the new volume as, or more, attractive and useful than any of its predecessors.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.