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.