WORKS RECENTLY PUBLISHED.

ARVINE'S CYCLOPÆDIA OF ANECDOTES OF LITERATURE AND THE FINE ARTS. Containing a copious and choice selection of Anecdotes of the various forms of Literature, of the Arts, of Architecture, Engravings, Music, Poetry, Painting and Sculpture, and of the most celebrated Literary Characters and Artists of different countries and ages, etc. Elegantly Illustrated.

This is a most amusing, instructive and entertaining work. The anecdotes are of a high order, and of such wonderful variety as to furnish something of interest for every class of readers, upon almost every possible topic.

The Christian Times says, "The work will be one of rare interest to the scholar and to the general reader. It is illustrated with engravings, and finely printed, the pages resembling in size and form the noble edition of 'Chamber's Cyclopædia,' by the same publishers."

The Carpet Bag says, "This is one of the best books of the season, and it presents, in a compact form, a thousand wise, witty and remarkable things, that might otherwise never have reached that inordinate public, which, like the daughter of the 'horse leech' we read of, is continually craving."

The work will first be published in eight numbers, at twenty-five cents each which together will make an elegant royal octavo volume of about 730 pages. The first number has just been issued, and the others will follow once in two weeks till completed.

A WREATH AROUND THE CROSS; or, Scripture Truth Illustrated. By Rev. A. Morton Brown. With an Introduction, by Rev. John Angell James. With an elegant Frontispiece. 16mo. cloth, 60 cents.

The Zion's Herald says, "In a richly evangelical style the author illustrates the essential truths of religion by their relation to the Cross. The plan of the work is happy, and its execution able."

The Albany Spectator says, "We have not seen a book for many a day with a more beautiful title than this. And the frontispiece is equally beautiful, presenting Christ as cheering the prospect. Leaving the field of mere controversy to others, the author at once approaches and leads all with him to the cross; exhibits it as the means of our justification, sanctification and eternal blessedness; aims to cultivate the heart rather than the intellect; takes the enquirer from the sign to the thing sanctified; and gives both edification and consolation to enquiring sinners."

GUYOT'S MURAL MAP OF THE WORLD, on a large scale, (5 by 7 feet,) for the Recitation Room. Printed in three colors. Price, mounted, $10,00

THE NATURAL HISTORY OF THE SPECIES; its typical forms and primeval distribution. With elegant illustrations. By Charles Hamilton Smith. With an Introduction, containing an abstract of the views of Blumenbach, Prichard, Bachman, Agassiz, and other writers of repute, by Samuel Kneeland, Jr., M. D. 12mo. cloth, $1,25

THE EXCELLENT WOMAN, as described in the Book of Proverbs. With splendid Illustrations, and an Introduction, by Rev. William B. Sprague, D. D. 12mo. cloth, extra, *in press*

☞ *An elegant Gift Book.*

NOVELTIES OF THE NEW WORLD, an Account of the Adventures and Discoveries of the First Explorers of North America. 12mo. cloth, *in press.* Being *second volume* of Banvard's Series of American Histories

YOUNG AMERICANS ABROAD: or Vacation in Europe; embodying the results of a tour through Great Britain, France, Holland, Belgium, Germany and Switzerland. with elegant Illustrations. 16mo. cloth, *in press*

DICTIONARY FOR THE PEOPLE.

WEBSTER'S
QUARTO DICTIONARY,
UNABRIDGED.

Containing three times the matter found in any other English Dictionary compiled in this country, or any Abridgment of this Work. A Geographical Table of 12,000 Names, Illustrative Quotations, and other peculiarities and advantages found in no other Work, yet is sold at a trifling advance above the price of other and limited Dictionaries.

The Legislature of New York have just passed an Act to furnish this work in the common schools of the State.

☞ *The following is an extract from the Report on the subject, by the " Committee on Literature."*

" Your committee regard it as superfluous labor to enlarge upon the *superiority* of this Dictionary; this is attested by the general circulation which this work has gained in this country, which is believed to be unprecedented for a work so expensive,

" That this work is peculiarly valuable for common schools, is, in the opinion of your committee, very evident. There is *no* branch of knowledge, in which it is *so* important, that the 750,000 children of this State who are taught in them should be perfected, *as* in the knowledge of their own language. There is no end so important to the education of the common mind as to use this our common language with correctness, ease and elegance, and to attain which we should make every possible facility readily accessible to all. And, in the opinion of your committee, there is no one book which furnishes so many facilities for this purpose as Webster's Unabridged Dictionary. The habit of referring to it will lead every scholar to a knowledge of this rich mine of *wealth intellectual;* and as he uncovers its treasures, his mind will be enlarged by the variety of knowledge which is condensed in the definitions of the familiar words he uses. The habit of reflection too, will be matured, by being employed on objects so entirely within his reach as the words which he spells, and reads and uses in speech. If he be once taught the habit of reflecting on words, he will soon learn to reflect on the thoughts which these words represent."

[*From Hon. J. C. Spencer,*]

ALBANY, June 18th, 1851.

More than twenty years ago I procured the Quarto edition, and have used it constantly ever since. My pursuits in life have rendered it necessary to consult it frequently, as well as other works of a kindred or similar character, particularly Dr. Johnson's Quarto, of the latest and best edition, Richardson's Dictionary, Crabbe's Synonyms, and Horne Took's Diversions of Purley. In professional, political, and literary discussions, the turning point of the argument has often been the exact meaning of words, as ascertained not only from their use, but from their derivation: while in many cases, perhaps in the majority of them, the works referred too have failed to give the desired information, that of Dr. Webster has always furnished precisely what has been desired, and I have long felt individually indebted to the illustrious author, for the labor and time he has saved me by his unweared patience, profound learning, and unsurpassed industry.

It is unquestionably the very best Dictionary of our language extant. It is a model of copiousness and precision, and its great accuracy in the definition and derivation of words, gives it an authority that no other work on the suject possesses. It is constantly cited and relied on in our Courts of Justice, in our Legislative bodies, and in public discussions, as entirely conclusive.

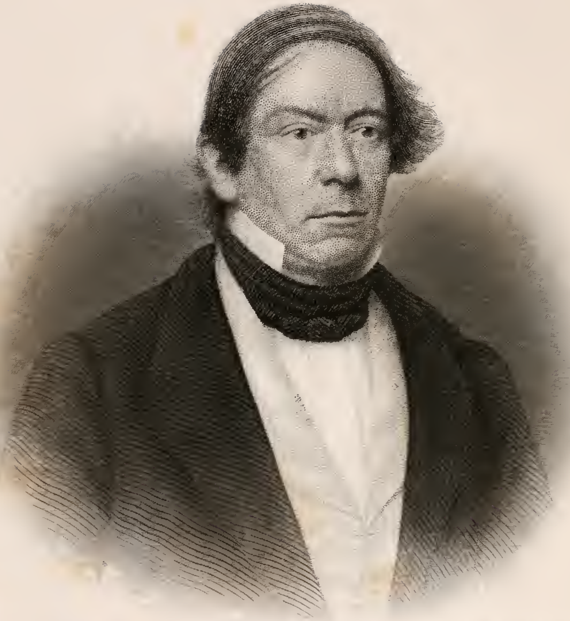
John C. Spencer.

" In revising and publishing an enlarged edition of this invaluable work at so cheap a rate as to bring it within the reach of almost every family, you have rendered AN ESSENTIAL SERVICE TO MANKIND."

Millard Fillmore

" A Dictionary is the last book which a scholar ever wants to have *abridged*, the process being sure to cut off THE VERY MATTER WHICH HE MOST VALUES,"—*Chronotype.*

Published by G. & C. MERRIAM, Springfield, Mass., and for sale by Booksellers generally.



A. D. Bache

ANNUAL

OF

SCIENTIFIC DISCOVERY:

YEAR-BOOK OF FACTS IN SCIENCE AND ART,

FOR 1853,

MOST IMPORTANT DISCOVERIES AND IMPROVEMENTS

DAVID A. WELLS, A. M.

BOSTON:
GOULD AND LINCOLN,
59 WASHINGTON STREET.
1853.

A. D. Bache

ANNUAL

OF

SCIENTIFIC DISCOVERY:

OR,

YEAR-BOOK OF FACTS IN SCIENCE AND ART,

FOR 1853.

EXHIBITING THE

MOST IMPORTANT DISCOVERIES AND IMPROVEMENTS

IN

MECHANICS, USEFUL ARTS, NATURAL PHILOSOPHY, CHEMISTRY, ASTRONOMY, METEOROLOGY, ZOOLOGY, BOTANY, MINERALOGY, GEOLOGY, GEOGRAPHY, ANTIQUITIES, &c.

TOGETHER WITH

A LIST OF RECENT SCIENTIFIC PUBLICATIONS; A CLASSIFIED LIST OF PATENTS; OBITUARIES OF EMINENT SCIENTIFIC MEN; NOTES ON THE PROGRESS OF SCIENCE DURING THE YEAR 1852, ETC. ETC.

EDITED BY

DAVID A. WELLS, A. M.

BOSTON:
GOULD AND LINCOLN,
59 WASHINGTON STREET.
1853.

G. C. Rand, Printer, 3 Cornhill, Boston.

PREFACE.

THE present number completes the fourth yearly volume of the Annual of Scientific Discovery. In its preparation, the Editor has followed the general plan indicated and developed in the former numbers of the work.

The mental activity at present displayed in developing new principles and modifying old ones, to meet the wants of practical industry, in cheapening and improving the production and preparation of all raw materials, and disseminating useful knowledge, is probably greater than at any former period of the world's history. Under these circumstances, the labor of preparing an annual retrospect has been greatly increased. The Editor has, however, endeavored to present as faithful an abstract of the progress of science and the useful arts during the year eighteen hundred and fifty-two, as the limits of the present volume would allow. The field for enlargement is ample, and would willingly be entered upon, were sufficient promise of encouragement afforded by the public.

The annual summary of "Notes by the Editor on the Progress of Science" has been considerably enlarged, and embraces several topics of interest, which could not conveniently be included in the body of the work.

We present our readers for 1853 with a portrait of Prof. Alexander Dallas Bache, President of the American Association for 1850–51, and Superintendent of the United States Coast Survey.

Boston, February, 1853.

NOTES BY THE EDITOR

ON THE

PROGRESS OF SCIENCE IN 1852.

In reviewing the progress of Science during the past year, 1852, it is especially to be remarked, that the annual record of discoveries in all the branches of science and the useful arts, is more characterized by its utility than by its brilliancy. The following remarks, appositely observed of the transactions of the British Association for 1842, apply equally well to the general scientific progress of the year 1852 : — " We have this year no great scientific novelty, theory, or discovery, brought upon the tapis, and claiming the attention of philosophers. There is no voyage to the South Pole to be promoted, — there is no hypothesis of glaciers to astonish the world, — there are no observations of the nature of storms to throw a light on those terrible visitations, — there is no doctrine and measurement of waves, or on the form of vessels, — there is no new feature in the grand research into the mysteries of magnetism, — in short, except the idea of following up the investigation of meteorological phenomena by means of balloons, we have heard of nothing very particular. Let it, however, be understood, that in all branches of science, steady progress has been made and recorded. Data of high consequence are collected, both to check future mistakes, and advance future information. Induction, the true basis of all truth, will flourish upon these ; and therefore, though there is nothing extraordinary in this stage of the onward journey, the distances and milestones are fairly marked so far, and the prospects in the distance are rendered much more clear and distinct. The way to the field is beaten, and its ample survey defined. There is nothing needed but to march on, take time, and labor to a useful end."

Europe, as if her energies were overtasked by the demands of the Great Exhibition year of 1851, has given us in 1852 nothing particularly new, striking, or wonderful; no new application of science to art, and no mechanical or chemical discovery of striking interest have been announced in the United States during the same period. Notwithstanding, many great plans are now in the process of development, many new ideas are germinating, and many old ones, which have long slumbered in the domains of theory are passing into real, substantial, practical facts. During the year 1852, more than one thousand patents for discoveries, inventions, and applications, "new and useful" were granted by the United States. More than three-fourths of these patents were granted to citizens of the five states of Massachusetts, Connecticut, New York, Pennsylvania, and Ohio. As many as three applications for patents from the same sources were probably rejected, where one was granted. The public journals are filled with accounts of the commercial prosperity induced by the gold discoveries of Australia and California; but the journalists and the public little know how many secret springs and incentives to invention and practical application, the same influx of gold, and the consequent revival of manufactures, has occasioned. There is an intensity of mental action and thought, devoted to the realization of the useful and the new, now pervading some portions of our country, especially in Massachusetts, the like of which the world has never before witnessed. The American operatives, mechanics and manufacturers, who have in vain sought protection from the National Government, are now creating protection for themselves; educated industry, and skill are rapidly forming a tariff, which in a few years will undoubtedly put foreign competition at defiance. Another curious fact in relation to this subject, is the intensity of competition which the mental activity referred to has engendered. An original thought, or a new idea, admitting the possibility of a practical application, when once promulgated becomes common property. A hundred minds at once seize upon it, elaborate it, perfect it. The engines of Ericsson had barely made a successful revolution before an improvement by another was announced in the New York Journals. The U. S. Court were recently occupied at Boston with a closely contested case respecting the validity of two patents for cotton-gins; the trial had not concluded before a new gin was put in operation which will undoubtedly render all others valueless. The discussions and experiments in England respecting the manufacture of flax by new processes, have awakened great interest in the subject in the United States, and more is probably known here at present in relation to this matter, than in Europe. We believe the day is not far distant, when the manufacture of flax will be conducted in the United States upon a most gigantic scale. We turn, however, from these generalizations to some of the more particular events of the past year.

The annual meeting of the American Association, for 1852, appointed to be held in Cleveland, in August, was postponed on account of the prevailing cholera in that region, and the great heat of the season. The place and time for the next regular meeting have not yet been determined by the Executive Committee.

The twenty-second annual meeting of the British Association, for the Advancement of Science, was held at Belfast, Ireland, September 1st; Col Sabine presiding. The attendance was somewhat less numerous than in 1851, and the papers read, had for the most part, a local rather than a general interest. Among the important measures taken by the Association, was a strong representation to the British Government, respecting the importance of sending out an expedition for the purpose of studying the phenomena of tides, especially those of the Atlantic Ocean. The President elected for 1853 is William Hopkins, President of the Geological Society, and of the Cambridge Philosophical Society.

From the annual address of the President we copy the following passages:—"Hitherto the researches of Sidereal Astronomy, even in their widest extension, had manifested the existence of those forces only with which we are familiar in our own solar system. The refinements of modern observation and the perfection of theoretical representation had assured us that the orbits in which the double stars, immeasurably distant from us, revolve around each other, are governed by the same laws of molecular attraction which determine the orbits of the planetary bodies of our own system. But the Nebulæ have revealed to us the probable existence in the yet more distant universe, of forces with which we were previously unacquainted. The highest authorities in this most advanced of all the sciences acknowledge themselves unable even to conjecture the nature of the forces which have produced and maintain the diverse, yet obviously systematic, arrangement of the hosts of stars, which constitute those few of the Spiral Nebulæ which have been hitherto examined. Hence the importance of increasing our knowledge of the variety of forms in which the phenomena present themselves, by a similar examination of the Southern Heavens to that which Lord Rosse is accomplishing in the Northern Heavens. In addition we can scarcely forbear to covet at least an occasional glance at bodies which from their greater proximity have more intimate relations with ourselves, and which, when viewed with so vast an increase of optical power, may afford instruction of the highest value in many branches of physical science. In our own satellite, for example, we have the opportunity of studying the physical conformation and superficial phenomena of a body composed, as we believe mainly at least, of the same materials as those of our own globe, but possessing neither atmosphere nor sea. When we reflect how much of the surface of the earth consists of sedimentary deposites, and consequently how large a portion of the whole field of geological research is occupied with strata which owe their principal characteristics to the ocean in which they were deposited, we cannot but anticipate many instructive lessons which may be furnished by the points of contrast, as well as of resemblance, which the surface of the moon, viewed through Lord Rosse's telescope, may present to the best judgment we are able to form of what the appearance of the earth would be if similarly viewed, or — with what may be more difficult perhaps to imagine — what we may suppose the earth would appear if it could be stript of its sedimentary strata, which conceal from us for the most part the traces of that internal action which has played so large a part in moulding the great outlines of the present configuration of its surface. It is understood that Lord Rosse himself participates in the wish that such an examination of the surface of the moon should be made, and, should the desire of the Association be expressed to that effect, is willing to undertake it in conjunction with one or two other gentlemen possessing the necessary physical and geological knowledge. It will be for the Association to determine the form in which a report on the "Physical Features of the Moon, compared with those of the Earth," may most appropriately be requested.

The German Association for the advancement of Science held its 29th annual meeting at Wiesbaden, commencing September 18th. The attendance was very numerous, nearly 800 members being present. Dr. Fresenius was President of the Association, and Prof. Sandberger, Secretary. A public address was delivered by Prof. Nees von Esenbeck, of Breslau.

To be a privileged member of this Association, with the right of speaking and voting in the meetings, it is necessary to have written some work bearing on natural history, physics, or medicine; but to become a temporary associate, with the right of being present as a listener merely at all the scientific meetings, as well as of taking part in all the festive social *reunions*, is free to every one on the very moderate payment of two Prussian dollars. The next meeting of the Association was appointed to be held at Tubingen.

A "Hygienic Congress," consisting of gentlemen of different countries, who take an interest in promoting the health of towns and the welfare of the working classes, was held in Brussels, in September About 200 gentlemen, Belgians and foreigners, were present, — nearly all the Scientific Societies of Europe being represented. The work was done in four different sections: — one, charged to occupy itself with workmen's houses, baths, wash houses, and hospitals; another, with sewers, &c., the distribution of water, and ventilation; the third, with the organization of public health, the maintaining of children, interments, and cemeteries; and the fourth, with the adulteration of food, the labor of children in work shops, and prostitution.

The Scientific Congress of France, held its annual session at Toulouse, commencing on the 13th of September. Count de Peyronnet, of the Academy of Bordeaux, was elected President of the meeting.

A new Geological Institute has been formed during the past year at Vienna, the principal object of which will be, the production of a series of geological maps of the Austrian dominions:— the whole of which gigantic undertaking may be completed, it is to be hoped, within thirty years,— beginning with Austria proper, and proceeding gradually to the Italian, Hungarian, and Bohemian dominions. The institution is under the direction of Prof. Haidinger.

A circular has been issued by several of the prominent geologists of our country, proposing the organization of an Association of American geologists, somewhat on the plan of the Geological Societies of England and France. It is not intended, that the members of the society should sever their connection with the American Association, but it is thought, that by means of meetings or sittings of the Society, or of its Committees, to be held at regular and irregular intervals, to be fixed by the Association, and at places where interesting and disputed questions arise, or even of ambulatory character, in the field, quicker and surer results would be arrived at; and the conclusions would be more satisfactory at home, as well as more respected abroad.

A National Agricultural Society composed of delegates from the different States and Territories, has been formed at Washington, during the past year. Marshall P. Wilder, of Massachusetts, has been elected President, with a Vice President from each State.

The French Government have recently instituted a General Horticultural Society for all France, which is to consist of titular and honorary members, and of an unlimited number of foreign correspondents. It is to occupy itself with all matters connected with horticultural science; to publish a monthly volume of "annals" thereon; to give prizes for elementary works; and to grant certificates of horticultural merit.

A most noble and princely donation to the cause of science and art has been made by Mr. Peter Cooper, of New York. The plan proposed is essentially educational in its features, and has in view the moral and intellectual elevation of the youth of the city of New York. A large building is now erecting in New York as the nucleus of the institution, the cost of which, together with the land will amount to $300,000; the building is to contain a "sculpture and picture gallery, exhibition hall, library, lecture-room and observatory. Books, apparatus, instructors, &c., are to be provided, and it is intended that the institution shall enjoy an annual income of $25,000."

Among the other donations made in behalf of Science in the United States during the past year, we would mention the following:— George

Peabody, Esq., the eminent London banker, has given to the town of Danvers, Mass., which is his native place, the sum of twenty thousand dollars for the establishment of a lyceum and library and the erection of the necessary buildings.

The sum of $50,000 has also been given by Joshua Bates Esq., of London, to the city of Boston, to aid in the establishment of a free public library.

Dr. George C. Shattuck, of Boston, has presented Dartmouth College with $7,000, to be used in the erection of an observatory, on condition that the trustees of the college will raise the further sum of $8,000 for the purchase of instruments.

The sum of $1,000 has been given by Hon. Jonathan Phillips, of Boston, to the American Academy, for the purpose of defraying the expense of its publications.

The expenses of a new Expedition in search of Sir John Franklin and for Arctic exploration, are to be defrayed by Henry Grinnell, of New York, and George Peabody, of London.

Five hundred dollars have been voted by the Board of Underwriters to the Geographical Society, at its solicitation, to be devoted to a series of magnetic observations to be made under the direction of Dr. Kane, the Arctic Explorer on his next expedition.

Within a few years, a number of projects have been set on foot in New York, for the establishment of an astronomical observatory in that city or vicinity, but they have all failed, mainly from want of means and encouragement. A new enterprise has recently been started, with a fair prospect of success. The "American Observatory Association," issue a prospectus for the establishment of an Observatory on the Palisades, above Fort Lee, on the basis of a joint-stock association, self-governed. Four hundred shares are to be offered at twenty-five dollars each, and the names of many prominent citizens of New York are pledged to the work. The originator of the plan is Mr. Leon Lewenberg, of New York, who proposes to endow the Observatory with a sufficient tract of land, one mile distant from Fort Lee. He also offers a Telescope of his own manufacture, as an additional donation. The building to be erected will be 150 feet in height; giving the Telescope, with the elevation of the ground — 320 feet above the River — an altitude of 500 feet. This height will be sufficient to relieve the instrument from the influence of a smoky or impure atmosphere, and will insure a wide range of vision.

In relation to the progress of astronomy in England, Prof. Piazzi Smyth, observes, that if it were not for private enthusiasm, England would be left quite behind in some branches of astronomy; for while the Russians, Germans, and Americans, are continually ordering for their observatories the largest telescopes that can be made, the English Government will not supply any such to those of Britain. The recommendation of the Britsh Association, and of the Royal Society to the Government, to send a superior telescope to the clear climate of Australia, has been refused; the East India Company have also shown themselves unwilling to do anything towards aiding the establishment of an observatory on the Nilgheny Hills, India, 6000 feet above the level of the sea. The great purity of the atmosphere which prevails in these regions, would undoubtedly lead to many important and signal discoveries. What the East India Company have refused to do, Capt. Jacobs is endeavoring to do on his private responsibility.

At the session of the French Academy on the 22d of March, the prize in Astronomy for 1851, was divided between Mr. Hind, and M. Gasparis, the former for the discovery of the new planet Irene, and the latter for that of Eunomia. The Cuvierian prize, (a triennial prize, and never before awarded,) was given to Prof. Agassiz, for his researches on fossil fishes.

Among the prizes offered by the Academy is one for 1854 in the department of Mathematics, as follows: — To determine the equations of the general movements of the earth's atmosphere, having in view the rotation of the earth, the calorific action of the sun, and the attraction of the sun and moon. The authors are desired to exhibit the concordance of their theory with the best observations on the atmospheric movements. Even if the whole question is not resolved, but some important steps are made towards its solution, the prize will be awarded by the Academy. The prize is a medal of 3,000 francs. There is also an extraordinary prize for 1853, on the application of steam to navigation. It is offered "for the best work or memoir on the most advantageous employment of steam for steamships, and upon the best system of mechanism, stowage and armament for such vessels." The prize is 6,000 francs.

The French Government, through the *Moniteur*, have officially offered a prize of 50,000 francs for the discovery that shall render the voltaic pile applicable, with economy, to industry, as a source of heat — to lighting, chemistry, mechanics, or medical practice. All nations are admitted to compete during five years.

The Germanic Diet at Frankfort, have voted a sum of £3,500 to M Schonbein, and others, the inventors of gun-cotton, as a reward for the discovery.

An Exhibition of the Industry of all nations will be opened in the city of New York, in May of the present year. The plan of the Exhibition, as well as the building erected for the purpose, is essentially that of the Great Exhibition of 1851. The enterprise has been entered into with great spirit, and the display of the products of American science and art, together with the agricultural and mineral productions, of the United States will be probably unequalled. The productions of foreign countries will be also well represented.

The scientific expeditions, surveys and explorations prosecuted, or projected during the year 1852, have been numerous, and attended with valuable results.

The survey of the coast of the United States, under the superintendence of Prof. A. D. Bache, has been prosecuted with great energy. With only one link of twenty-six miles south of the Chesapeake to be filled up, an unbroken triangulation now extends from the mouth of the Kennebec river, in Maine, to the harbor of Beaufort, in North Carolina. The topography and hydrography have made corresponding progress. In a few years an unbroken series, with points well determined by astronomical aud other observations, will cover the coast from the Penobscot river in Maine, to the St. Mary's in Florida. The progress of the survey on the Florida reef and the shores of the Peninsula is entirely satisfactory, in view of the limited appropriations, compared with the vast extent and variety of the whole work. The entire reef and western shore has been examined in a preliminary way, and nearly one-half of the survey of the reef has been made. A reconnoissance has been made of about one-half of the distance between St. Mark's and Mobile bay, and the triangulation and topography now extend from Mobile bay to Lake Ponchartrain, and nearly all the hydrography has been completed, and an examination made of the delta of the Mississippi. Galveston bay has been surveyed excepting a small portion of the hydrography, and the triangulation now extends to the vicinity of Matagorda bay. On the western Coast, in consequence of the extraordinary difficulties in securing hands and means owing to the discoveries of gold, the survey did not fairly get under way till about three years since. A very good preliminary reconnoissance has been made of the whole coast, from San Diego to the Straits of San Juan del Fuca, and of nearly every important harbor. In connection with this rapid progress of the survey on this coast, observations have been made for latitude and longitude, and the magnetic variation. The geographical position of the coast, from the Straits of San Juan del Fuca to San Diego, has been established ; the latitude and longitude of the most important headlands having been determined by sufficiently numerous and reliable preliminary observations.

The exploration of the Gulf Stream has been continued. Great progress has been made in publishing the results of the survey. Forty-two charts, elaborate and highly finished, and forty-two preliminary charts have already been published, and twenty-seven sheets are in various stages of engraving. The geographical positions determined by the survey from its commencement to July, 1851, have been published. The latitude and longitude of over 3,200 points have thus been given to the public, furnishing information of great value for general and local purposes.

Under the direction of the U. S. Government a strong naval expedition has sailed for the purpose of endeavoring to establish relations of amity and commerce with the Empire of Japan. Looking to the magnitude of the undertaking, and the great expectations which have been raised both in this country and in Europe, in reference to its results, this expedition is full of interest, and will undoubtedly be productive of many valuable results, scientific, as well as commercial and moral. The expedition has on board a variety of articles as presents to the Emperor of Japan, to conciliate him and prepare the way for the desired negotiation. A locomotive and a quantity of railroad iron have been taken with which to show the operations of a railroad; telegraph apparatus with which to demonstrate how the lightnings have been converted to the use of civilization. An apparatus for taking daguerreotypes will also be used and explained for the information of His Majesty. A beautiful barge is on board to be presented to him. Also, boxes of domestic goods, comprising a great variety of manufactured articles, which are to give the Emperor an idea of the industrial pursuits of this country, and perhaps awaken a desire on his part for an exchange of commodities between Japan and the United States.

Somewhat allied in character and importance to these projected operations of the Japan squadron, is the expedition now prepared for the exploration and survey of the China seas, the Northern Pacific, and Bhering's Straits. This expedition, in aid of which $125,000 has been appropriated by Congress, is provided with a corps of scientific men, an astronomer, hydrographer, botanist and naturalist.

Under the direction of the Navy department, Lt. Lynch, well-known from his connection with the Dead Sea Expedition, has been detailed on a tour of African exploration, especially of that portion of the Continent lying east of the settlements of Liberia. It is supposed that an exploration of this region would lead to the discovery of a broad tract of fertile and healthy country, well adapted to the extension of that system of colonization, which for some years past has greatly interested public attention in the United States. Lt. Lynch will land at Liberia, Cape Palmas, and other points, and will pursue his inquiries as far as the river Gaboon, with a view to the ascertainment of such localities on the margin of the African continent as may present the greatest facilities, whether by the river courses or by inland routes, for penetrating with the least hazard into the interior. He will collect information touching the geographical character of the country; its means of affording the necessary supplies of men and provisions; the temper of the inhabitants, whether hostile or friendly; the proper precautions to be observed to secure the health of a party employed, and all other items of knowledge upon which it may be proper hereafter, to prepare and combine the forces essential to the success of a complete and thorough exploration of the interior.

A fourth expedition under the direction of the United States Government, commanded by Capt. Page, has sailed to explore the long-sealed and excluded countries lying on the tributaries of the river La Plata, South Americaa. By a decree of the Argentine Government, there has recently been opened to the access of all nations, a vast territory of boundless resource, proverbial for its treasures of vegetable and mineral wealth, extending, like the Mississippi from south to north, and reaching through twenty-four parallels of latitude, with every climate between the temperate and torrid zones, and with every variety of product which may be gathered from the alluvial plains of the ocean border to the height of the Andes.

An expedition under the charge of Lt.'s Herndon and Gibbon, U. S. N., charged with the exploration of the Amazon and its tributaries, has in part returned. These officers were directed to cross the Cordileras in Peru and Bolivia, and by a selection of the most judicious routes of travel, with a small company of men, to explore the valley of the Amazon, and to descend that river to the sea. More than a year has has been spent in the active prosecution of this duty. Lieut. Herndon reached the United States in July last, bringing with him a large amount of interesting and useful facts, industriously collected by him in the course of his long and hazardous journey, embracing many valuable statistics of the country, and adding most important contributions to the hitherto unknown geographical character of this region. He is now engaged in preparing a full report of the incidents and discoveries of his travels.

Another expedition to the Arctic Sea under the charge of Dr. Kane, in search of Sir John Franklin, and for scientific exploration, is now fitting out under the auspices of our countrymen, Mr. Henry Grinnell, and Mr. George Peabody, of London. Their endeavor will be directed to an exploration of the upper coasts of Greenland, by land as well as sea, and will furnish occasion for valuable scientific observation tending to the ascertainment of the magnetic poles and the intensity and dip of the needle; and interesting also, as regards geological questions connected with the supposed existence of an open polar sea, and other subjects of much importance in the natural history of our globe.

The course adopted by the British Government in relation to the discoveries made by the last American Expedition under Lieut. De Haven, is in the highest degree discreditable and dishonorable. In the Charts published by the authority and under the direction of the Admiralty, the localities discovered up Wellington Channel, by the Americans in Sept., 1850, are for the most part ignored, or altered. The "Grinnell Land" first seen by De Haven in 1850, and subsequently by Capt. Penny in 1851, has had its original name, given in honor of a noble American merchant, changed to that of "Prince Albert's Land." Courtesy, if no other motive, should have prevented a change.

Lieut. Gillis, who, for more than three years past, has been employed, in pursuance of the directions of Congress, in conducting in Chili the observations recommended to be made by the American Philosophical Society and the Academy of Arts and Sciences, has recently returned to the United States, bringing with him a rich contribution to science, in a series of observations, amounting to nearly forty thousand, and embracing a most extensive catalogue of stars.

Under the auspices of the American Antiquarian Society, Worcester, Mass., Mr. Lapham has recently made series of complete surveys of numerous ancient mounds now existing in the State of Wisconsin. Mr. Lapham's report will be shortly published by the Smithsonian Institution.

An expedition under the charge of M. Deville, is about to be sent out by the French Government, for the purpose of exploring some parts of Brazil, Paraguay and the provinces of Para, Pernambuco, and Bahia.

A mission is about to start, under the auspices of the Geographical Society of St. Petersburgh, for Kamschatka, the Kurile Islands and Russian America. The objects are — to study the ethnography of these districts, to collect specimens of their Flora and Fauna, to report on their physical characteristics, and to make maps and plans of their roads, coasts, and other topographical features.

An English exploring expedition, consisting of two vessels under the charge of Capt. Denham, R. N., sailed for the South Pacific in June last. The object of the expedition is to survey and explore all the islands between Australia and Valparaiso, and particularly the Fejee Islands. Mr. McGillivray, the well known naturalist, was appointed to take charge of the department of Natural History, and Mr. S. G. Wilson was appointed artist, to make drawings of any objects in these islands likely to prove interesting, and for which purpose he has been supplied with a photographic apparatus.

Some months ago a Scientific Expedition was sent out from Copenhagen to explore the hills of Greenland and report on their mineral resources. This expedition has recently returned to Denmark, with a cargo of minerals as the fruits of their industry. The explorers have failed to find any of the more precious metals ; but they have brought back iron, lead, nickel, tin, and copper mixed with a little silver : — the whole valued at nearly two thousand pounds. The society appears to be encouraged by these first-fruits of its enterprise to renewed exertions ; but the rigors of the climate of Greenland deter even the Norwegian miners from embarking in the adventure.

The exploration of different portions of Africa have been continued with such success, that even in the brief space of a year the vast blank on all former maps has been materially reduced. Mr. Oswell, and the missionary Livingston, his companion, to both of whom we are indebted for our acquaintance with the Ngami Lake, have pushed their researches northwards to 17 deg. 25 min. S. latitude, and between 24 deg. 30 min., and 26 deg. 50 min. E. longitude, and have traversed a considerable track, watered by deep and constantly flowing streams, which they believe to be feeders of the river Zambesi. We learn from them, that the Zonga, which was to the east from Lake Ngami, is dissipated and absorbed in sands and salt-pans, and the travellers passed over a large salt incrustation of about 100 miles in length and 15 miles in width, and saw many others lying to the north of the spot where the Zonga loses itself. Considerably to the north of these great natural salt pans, a population was met with, more advanced in intelligence than most of the tribes of South Africa. They also relate as a striking incident, that shortly before their arrival, the slave-dealers had, *for the first time*, penetrated from the west coast, and through the temptation of gaudy European goods had purchased many children.

Researches made in Africa by Mr. Galton, an English traveller, between latitude, 17 deg. 58 min. S., and longitude, 21 deg. E., taken also in connection with the explorations of Messrs. Oswell and Livingston, show, that the central region of Southern Africa, instead of being mountainous, is a watershed of no great elevation, and that the most central portion of it is occupied by a succession of lakes, of which Ngami is the southernmost.

Under the direction of the Swedish Government, a topographical survey extending over 8700 geographical miles is now in progress. Levellings and trigonometrical surveys from Torneo to Alten, in the North Sea, will, when finished, give not only the relative heights of the Gulf of Bothnia, and the North Ocean, but will also serve as fixed data from whence to calculate the greater or less irregularity of the rise, or depression of the Scandinavian lands.

The most perfect topographical and geographical maps which perhaps have ever been produced, are those of the cantons of Appenzel and St. Gallen, in Switzerland, brought out during the past year, by M. Ziegler. These maps, the part only of a large survey, are on a scale of 2 1-2 inches to amile, or 1-25,000. The lights are all thrown in perpendicularly, and the altitudes of each terrace, valley, or mountain-top is inserted in numbers on a most exquisitely finished lithographic relief.

The great military map of France is also in active progress ; and 149 sheets out of 258 have been already published. As an illustration of the gigantic nature of this work, it may be stated, that since this survey was commenced in 1818, 2250 officers have been employed on it — i. e., in the geodesic and topograpical operations alone. The annual expense is about $150,000 per year.

Mr Bartlett, Commissioner for running the boundary between the United States and Mexico, has devoted much attention to the Indian vocabularies of the districts visited during the progress of the survey. His researches have corresponded exactly with those submitted to philological inquiry by the lamented Albert Gallatin, with the addition of forty words discovered by Mr. Bartlett during the progress of this Commission. The number of words now ascertained is two hundred. Mr. B. will return accounts of the Vocabularies of nineteen languages west of the Rio Grande. These results will prove highly important and useful.

Considerable interest has been of late excited in Russia among the scientific men in regard to the prosecution of meteorological investigations, and at their request observations are now being constantly taken in England, France, Prussia, and other parts of Europe. The Russian Government has liberally encouraged the desire of its savants to investigate thoroughly this important branch of science, which has hitherto not received so much attention as others. It has established for them not fewer than ten magnetic and meteorological observatories ; viz., one at St. Petersburgh, another at Catharineburg in the Ural Mountains, two at Barnoual and Nertschinsk on the Chinese frontier, one at Sitka in North America, one at Tiflis, another at Pekin, two others at Bogoslowsk and Zlatouste on the western side of the Oural mountains, and one at Lougan in the steppes of the Don. In addition there are also a considerable number of stations in different parts of the Empire. At all these establishments observations are taken at every hour of the day and night.

An important step in relation to the system of weights and measures, was recently taken by the Bank of England. The only weights to be hereafter used in the Bullion Office of that establishment will be "the Troy ounce and its decimal parts," — superceding by that change the present system of pounds, ounces, pennyweights and grains. Practically the change will be one of great convenience.

Among the scientific publications of 1852, issued by the United States Government are the following : Report on the Iron Region and the Lake Superior Mining District, by Messrs. Foster and Whitey, U. S. Geologists; Part second, with volume of maps ; Patent Office Report for 1851, 2 vols. Mechanical and Agricultural, by Thomas Ewbank ; Expedition to the Great Salt Lake, by Capt. Howard Stansbury, U. S. N ; Maury's Winds, Currents, and Sailing directions — new and enlarged edition ; Scientific Report of the Dead Sea Expedition, Lieut, Lynch, U. S. N.; U. S. Exploring Expedition, Conchology, Dr. A. A. Gould ; Chart of the Arctic Regions, with the explorations and track of the Grinnell Expedition ; American Nautical Almanac, Lieut. Davis; Annual Report of the Smithsonian Institution; Report on the Geology of Wisconsin, Iowa and Minnesota, by Dr. D. D. Owen, U. S. Geologist.

The Mechanical volume of the Report of the Patent Office contains a Report on the Great Exhibition, by Edward Riddle, U. S. Commissioner, and is by far the best publication, both as regards contents and typography that has been issued by the Patent Office. The agricultural volume is also superior to any that has preceeded it, and contains valuable papers on wool and sheep-breeding by P. A. Browne, Esq., and on the American Ruminants, by Prof. S. F. Baird; the remainder of the volume consist of odds and ends, of little or no value, apparently made up by supplying sufficient paste to agglutinate scraps of paper taken from all sources, to a substratum of stout grocer's paper. The letter-press of the Conchology of the U. S. Exploring Expedition, by Dr. A. A. Gould, has been published during the past year; the accompanying volume of plates, is also in a state of forwardness. Of the published results of this expedition, twelve volumes quarto and four volumes of plates, have already been issued, leaving fifteen yet in the course of preparation. The series already published embraces the Narrative, 5 vols. and atlas ; Zoophites, 1 vol. and atlas; Philology; Races of Men ; Mammals and Birds ; Geology and Mineralogy, 1 vol. with atlas ; Meteorology ; Charts ; Conchology. Those yet to appear will embrace the following subjects ; Herpetology, Ichthyology, Crustacea, Medusæ, Echinoderms, Annelids, Insects, Ferns, Fungi, Algæ, Botany, (Phanerogams,) Mosses, Geographical Distribution of Species, Hydrography, Astronomy and Magnetism, Charts. Naturalists, generally, who have been watching the progress of this great national work, will learn with deep regret that all the undistributed copies of the first seven volumes already published were destroyed in the same fire which consumed the library of Congress in December, 1851. This is the more melancholy, since but seventy copies were distributed.

The first volume of the American Nautical Almanac, for 1855, published by authority, has been issued. It has been prepared under the supervision of Lt. C. H. Davis, and is a material improvement on the British Nautical Almanac ; it having more correct lunar tables, which give more accurate predictions, as tested in the case of the solar eclipse of July, 1851. At Washington, the British Almanac was in error for the beginning of the eclipse, 78 seconds, and for the end, 62 seconds. The American Almanac was in error for the beginning only 13 seconds, and for the end only one second and a half. The errors exposed in this eclipse may give rise to an error of from 15 to 20 miles in the determination of the longitude at sea by means of lunar distances, and to an uncertainty of twice that amount. The possibility of such an error, arising from this source, is removed in the American ephemeris. There are other points of superiority ; one of the principle being " a more complete, full and accurate table of latitudes and longitudes, particularly of American latitudes and longitudes, than is now anywhere to be found," and the other relates to the tide tables and other practical information concerning the tides.

Under resolutions of the two Houses of Congress, the valuable report of Dr. D. D. Owen on the geography of Wisconsin, Iowa, and Minnesota, (and incidentally of the " Mauvaises Terres " in Nebraska,) has been published. Its preparation reflects the highest credit upon the author, while the mechanical execution of the work is excellent, and forms a striking contrast with the usual style adopted for Government publications. The report is voluminous and constitutes a quarto of about 650 pages, with a volume of maps. A report has also been submitted to Congress by Dr. Owen, recommending a geological survey of Oregon and a special reconnoissance of that singular region of Nebraska, known as the " *Mauviases Terres.*" The interest awakened throughout the Scientific world by what has been already made known respecting the latter district is very great. It is a tertiary deposite, abounding to a most extraordinary extent with the fossil remains of extinct animals, some of which combine the distinctive characteristics of several existing and distinct races. The discovery of an entirely new family of mammalia, embracing eight new genera, is one result of the examinations already made by Dr. Leidy. In reference to this region, Dr. Owen states that " it is not too much to assert that since the disclosures by the opening of the gypsum quarries of Montmatre, in France, that made us first acquainted with those singular extinct fossil races entombed in the Paris basin, no discovery in geology has divulged such extraordinary and interesting results in palæontology.

The Legislature of Massachusetts have published during the past year a new and enlarged edition of Dr. Harris' valuable work on " Insects Injurious to Vegetation," and the Legislature of New York, " A Report on the Great Exhibition of 1851," by B. P. Johnson, Esq.

We would also in this connection call attention to the following scientific works of great interest, issued during the past year in this country, by private individuals. " Mastodon Giganteus," a description of the skeleton of the Mastodon Giganteus of North America, with plates. This elegant and costly work, the fruit of many years' investigation, has been brought out by Dr. J. C. Warren of Boston, and is intended for private distribution. Several valuable geological and zoological memoirs have been publishd by Isaac Lea, Esq., of Philadelphia, and a valuable " Catalogue of shells collected at Panama with notes on their synonomy, station and geographical distribution," has been issued by the late Prof. C. B. Adams. The number of specimens of Mollusks collected by Prof. Adams, while at Panama, amounted to 41,830, embracing 516 species, of which 160 were new and undescribed. The department of mechanics and civil engineering has been enriched by the publication of a work entitled "The naval Dry Docks of the United States," by Charles B. Stuart, Engineer in Chief of the U. S. Navy.

Two new scientific periodical publications have been started during the past year ; "The Annals of Science, being a record of the inventions and improvements in applied science," conducted by Hamilton L. Smith, Cleveland, Ohio ; and the "American Polytechnic Journal," conducted by Messrs. Page, Greenough & Co., Washington, D. C. Within the same period, the Journal known as the New York Farmer and Mechanic has been discontinued.

A descriptive catalogue of the plants indiginous to is Ohio in the course of preparation by James W. Ward, Esq., of Cincinnati.

Chemists and others interested in the progress of science will regret to learn that the reprinting and translating into English of Liebig and Kopp's "Annual Report of the Progress of Chemistry" has failed, after a trial of three volumes, for want of sufficient encouragement.

Under the auspices of the French Government, a Chinese work on the production of silk has been translated by M. Julien, an eminent scholar of Paris ; in consequence of which the Chinese method has been introduced with great benefit into some of the silk-growing districts of France. M. Julien has also translated a Chinese manual on the fabrication of porcelain, which, it is anticipated, will be equally beneficial to that branch of industry.

The Smithsonian Institution, at Washington, has continued silently, but effectually, to enlarge the sphere of its influence and usefulness, and to elicit from every part of the civilized world commendations, not only of the plan of organization it has adopted, but also of the results it has produced. By a judicious management on the part of the Regents, the funds of the Institution have been increased by the interest on the original bequest, until they now amount to a little more than 750,000. A portion of the original bequest is also yet remaining in England, as the principle of an annuity settled upon the mother of the nephew of Smithson. The Institution is also by the recent decease of a citizen of New York made contingent legatee of an estate of considerable magnitude, depending on the demise without issue of a single individual.

Since the adoption of the plan of organization, nearly fifty original memoirs, purporting to be additions to the sum of human knowledge, have been presented to the Institution for publication. Though a number of these have been returned to their authors, principally on account of not falling within the restricted class of communications accepted for publication, yet they have generally been productions of much merit, and have evinced a surprising activity of mind, and manifest a growing attention in this country to original research. The probable success of this part of the plan of organization was not overrated ; for, were the whole income of the institution devoted alone to publishing the results of the labors of men of literature and of science, which otherwise would never see the light, it could be profitably expended. In this respect, the Smithsonian bequest supplies the wants which in Europe are met by richly endowed academies and national societies.

Each memoir is printed separately, and with a separate title and paging, so that it can be distributed to persons most interested in its perusal as soon as it comes from the press, without waiting for the completion of the volume to which it belongs. In this way, the author is enabled to present a full account of his discoveries to the world with the least possible delay, while, by the rules of the Institution, he is allowed to publish an abstract of his paper in the proceedings of the American Association for the advancement of science, or in those of any other properly organized society. The number of copies of the Smithsonian Contributions distributed, is greater than that of the transactions of any scientific or literary society, and therefore, the Institution offers the best medium to be found for diffusing a knowledge of scientific discoveries. Every memoir published by the Institution is issued with a stamp of approval of a commission of competent judges, and in order to secure a cautious and candid opinion, the name of the author, and those of the examiners, are not made known to each other unless a favorable report is given; and, in this case, the names of the commission are printed, as vouchers for the character of the memoir, on the reverse of the title-page.

This plan secures an untrammelled expression of opinion, while it induces caution on account of the responsibility which it involves.

That the encouragement of the discovery of new truths, the publication of original memoirs, and the establishment of new researches, are in conformity with the design of Smithson, is not only manifest from the terms of his will, but also from the fact, which has lately come to our knowledge, that he at first left his property to the Royal Society of London, for the very object embraced in this part of the plan. And what prouder monument could any man desire than the perpetual association of his name with a series of new truths! This building and all its contents may be destroyed, but the volumes of the Smithsonian Contributions, distributed as they are among a thousand libraries, are as wide-spread and lasting as civilization itself.

The following memoirs have been recently published by the Smithsonian

Institution, or are now in the course of preparation. On the "Dip, Intensity, and Inclination of the Magnetic Force in several parts of the United States," by Dr. John Locke of Cincinnati. "On the Winds of the Southern Hemisphere," by Prof. James Coffin. The data used in the preparation of this memoir have been collected with great labor, and consist of observations made at no less than five hundred and seventy-six different stations on land, and a large number taken during numerous voyages at sea. The field of observation includes a zone which extends from the equator to nearly the parallel of 85 deg. north latitude, and occupies a period, taken in the aggregate, of 2,800 years.

A memoir is also in the course of preparation on the extinct family of crinoids found in the vicinity of Nashville, Tenn., founded on drawings, collections, and descriptions left by the late Dr. Troost of Nashville. The labor of preparing this work has been gratuitously undertaken by Prof.'s Agassiz & Hall. A memoir by Dr. Leidy, "The Flora and Fauna of Animals." This is an elaborate history of a most remarkable series of plants, in many cases accompanied by parasitic animals, found growing, as an ordinary or natural condition, within the interior of the bodies of living animals. In some of the latter, it is stated, growing plants are never absent; and in a species of insects, viz: *Papulus Cornutus*, a forest of vegetation is always found covering the inner surface of the *ventriculus* or second stomach, The plants of course are Cryptogamic, and are algoid in their character. Some are as long as half an inch, but usually they are very much smaller. They grow attached to the mucous membrane of the cavities in which they are found, and occasionally from the exterior covering of worms infesting the same cavities. The researches are prefaced by some observations on the laws of parasitic life in general, which are presented in a highly philosophical manner, and entirely free from hypothesis — the whole forming one of the most remarkable papers on physiology, which has ever been produced by our countrymen. "On the Dynamic Effect of the Tides," by Lieut. Chas. H. Davis.

A volume of tables of use in Meteorolgy and other branches of scientific observations, has been prepared, under the direction of the Institution, by Prof. Guyot. The following are the contents of this volume, viz: 1. Thermometrical tables for the conversion of the scales of different thermometers into each other. 2. Hygrometrical tables, giving the elastic force of vapor, the relative humidity, &c. 3. Barometrical tables for the comparisons of different scales, reduction of observations to the freezing point, and correction for capillary action. 4. Hypsometrical tables for calculating altitudes by the barometer, and by the difference of the boiling point. 5. Tables of the corrections to be applied to the monthly means to obtain the true mean. 6. A set of miscellaneous tables frequently required in physical investigations. These tables supply a desideratum in the English language, and will doubtless be highly prized by all engaged in physical research. It is proposed to extend their number so as to include a wider range of objects, and to publish them in parts to suit different purposes.

"Researches on Electrical Rheometry," by Prof. Secchi; "Description of Ancient Works in Ohio," by Charles Whittlesy; "On the Ancient Works at Prescott, Canada West," by William E. Guest. The great size of the remains of trees which occupy the ground, evince the long time which must have elapsed since these works were constructed, and the entire absence of stone pipes and arrow heads has induced the belief that they are of a higher antiquity than those in the Ohio valley.

List of occultations and tables of reductions have been published from 1848 to 1852, inclusive. The primary object of these tables is, to facilitate the accurate determination of the longitude of places within the territory of the United States; and in this respect they have done good service, especially in the hands of the officers of the coast survey, and the explorers and surveyors of our new possessions on the coast of the Pacific. Their extension will render them useful to geographers in every part of the world.

It will be recollected that Mr. Sears C. Walker, astronomical assistant of the United States coast survey, prepared for the Smithsonian Transactions a memoir containing a determination of the true orbit of the planet Neptune, and that from this orbit, and the mathematical investigations of Professor Pierce, an ephemeris of Neptune was compiled. The ephemeris has been generally adopted by the principal astronomers of the world; and Professor Airy, the astronomer royal of Great Britian, has undertaken the labor, in his last volume of Greenwich Observations, of critically comparing his observations on the planet in the heavens with the predictions of the Smithsonian ephemeris. From these comparisons it is found that the ephemeris gives the position of the planet with a degree of precision not inferior to that with which the planets longest known are calculated. The labors, therefore, of Mr. Walker on the elements, and Professor Pierce on the theory of the planet Neptune, have been crowned with complete success. It is proposed hereafter to collect all the observations which may have been made on the planet, and compare them with the ephemeris, in order, if necessary, still further to correct the orbit.

The general system of meteorology now in operation in this country under the auspices of the Smithsonian Institution, is continually enlarging and extending. The Institution has at the present time a corps of trained, intelligent men, between two and three hundred in number, extended over the entire continent, and making frequent observations, many with standard instruments. All the observations at the military ports and naval stations, as well as the vessels of the mercantile and goverment marine (through the National Observatory,) are freely at its command, and are used. The returns for each month fill a large folio volume. Nor does this matter accumulate unused. A competent gentleman has been long engaged in noting down the observations for particular days of interest, upon a large physical map of North America and the Atlantic Ocean, developeing laws of great importance. No institution or government in the world is now doing anything like as much for Meteorology as the Smithsonian Institution. The results already obtained give promise of interesting and valuable additions to our knowledge of the nature of the storms, which traverse this continent during the winter seasons, and will probably serve to settle definitely several theoretical questions of much interest to the meteorologist.

Considerable progress has been made in the formation of the library and museum of the Smithsonian Institution. The whole number of books, pamphlets, engravings, &c., at present collected is nearly twelve thousand; of these 4,608 were obtained by purchase; 3,218, by donations; 3,196 by copyright law; and 873 by deposite. The number of books received by exchange is large; an unique feature in this system of exchange consists in the number of academical publications received from almost all the Universities of Europe. The series from many are very full, particularly for later years; and very few are to be found in any other American library. These works are generally of great value to the student.

The museum of natural history, besides plants and minerals, numbers eighteen hundred and fifty jars, containing specimens in spirits, of mammalia, reptiles, fishes, articulata, mollusca, and radiata, amounting in all to twenty-five hundred species. Besides these, there are about nine hundred specimens of skulls and skeletons, and three thousand skins of European and American birds.

A magnificent collection of Scandinavian mammalia has been presented by the Swedish Academy, at Stockholm. Some very valuable European mammalia have also been received from Mr. Steenberg, of Elsinore, including skins of wolves, seals, arctic foxes, &c., and several skulls of the reindeer of Greenland.

The following statistics, obtained from official documents, afford some idea of the present resources, wealth, and commerce of the thirty-one United States at the present time;

The annual value of the agricultural, mineral and manufacturing productions of the country is supposed to at least equal three thousand millions of dollars, (3,000,000,000.) A large portion of these productions are transported by river, canal, or coasting vessels, or on railroads, and which in the course of trade changes hands several times before reaching the domestic consumer; making, in the aggregate, an amount of traffic counting by thousands of millions; whilst the whole amount shipped to foreign countries is but $140,000,000, being only one-thirtieth part of the entire production of the country, which thus finds an outlet in foreign markets.

The single article of coal annually transported coastwise, and in canal boats, or on railroads, is of sufficient bulk to furnish full cargoes for four times the quantity of all the American tonnage employed in foreign commerce, and probably affords the means of livelihood to a greater number of persons than the latter.

The coastwise trade to and from the American ports in the Gulf of Mexco is of itself, probably, nearly equal, in point of value, to the entire export of American productions to foreign nations.

The statistics of exports during the year 1847, when famine prevailed so extensively in Europe, furnish some curious illustrations respecting the home markets and the foreign ones. There was some difficulty, at that time, in procuring sufficient shipping, including both American and foreign, to convey our breadstuffs to the famishing nations of Europe, and yet our entire exports during that year of the two principal articles of food—Indian corn (maize) and flour—were only about three per cent. of the former, and about ten per cent. of the latter, estimated on the whole crop produced in the United States; leaving ninety-seven per cent. of the Indian corn, and ninety per cent of the wheat crop, for the supply of the home market, where it was actually consumed. Our exports of breadstuffs at present are only about one-third of what they were during the above year of unusual demand; exhibiting, in a still more striking contrast, the immense difference between the home and foreign markets in favor of the former.

The mere tolls collected by the canals and railroads on the transportation of merchandise for the internal trade of the country, exceeds in amount the total value of all the breadstuffs purchased from us by foreign nations.

The annual value of the crop of Indian corn, of wheat, and of hay, each respectively, is fully equal to the entire value of our productions exported to foreign countries. The annual amount of the manufactures in the States of New York or Pennsylvania, in either of those States, greatly exceeds the value of such exports; and even those of the comparatively small State of Massachusetts are fully equal to all the productions of the country consumed by foreign nations. The latter State probably consumes breadstuffs that are produced in the middle and western States to a greater amount than is shipped to all Europe.

The manufacture of beet-root sugar is at present receiving great attention in some parts of Europe, and in consequence of some valuable improvements in evaporation and purification recently effected, its manufacture has greatly extended, accompanied with a reduction of prices. In France, especially, this branch of industry is increasing beyond precedent. The following statistics were recently published officially in the *Moniteur*. The factories at work in France on the 1st of December in 1851, were 254, and on the 1st of December of 1852, they numbered 335, an increase of 81. The quantity of sugar made in 1851 was 10 millions of pounds, while that of 1852 will not be far from 37 millions of pounds. The best quality retails at 16 cents a pound.

Beet-root sugar has also made its appearance for the first time during the past year in American ports, as an article of traffic.

The scarcity and high price of all kinds of animal oils, have within a few years past called into requisition and use the various kinds of vegetable oils, especially those derived from rosin. The uses to which this oil is already applied are innumerable, and a great number of patents for improvments in its manufacture and purification have been granted. A process has been recently brought out, first in France, lately in the United States, by which the rosin is made to yield a substance resembling tallow in many respects, which can be advantageously and cheaply applied for the lubrication of heavy gearing, and other coarse machinery. This process has not yet been made public.

Napthaline, formerly a chemical product of great rarity, is now extracted in considerable quantities, from the refuse coal tar of gas works. This substance in external appearance greatly resembles purified stearine, and the use to which it is applied is somewhat curious. Put up in cakes, and enclosed in waxed cloths to prevent evaporation, it is sent to California and other distant regions, where dissolved in weak alcohol it furnishes the best of burning fluids,—a great saving being thus effected in freights, risks, &c.

American Madder, grown in the valley of the Connecticut, has been introduced to some extent during the past year into the Merrimac Print Works, and found to be superior in some respects to the best foreign article. The introduction of madder as a staple production of the United States, is greatly to be desired, and that it can be raised profitably and successfully by the agriculturalist, is beyond a doubt.

The preparation and manufacture of flax-cotton, introduced in 1851 by Chevalier Claussen, and from which so much was anticipated, is generally regarded as a failure. The most serious objections to the plan proposed seem to be these: it has for its object the conversion of a superior article into an inferior one, or in other words, the changing of the long and strong fibre of flax into a short and weak fibre, inferior to cotton ; the product so prepared is wanting in any regularity of staple, or length of fibre ; the fibres of the flax are not split longitudinally as has been represented, by the expansive action of a gas generated within them, but they are merely separated from one another, and broken irregularly. If it is desired to reduce the flax fibre to a condition resembling the short fibre of cotton, it can be accomplished more expeditiously, cheaply and securely, by mechanical, rather than by chemical agents. With a view of examining into the plans and projects proposed by Claussen and others for the improved manufacture of flax, agents have been sent to Europe from time to time by several of the large manufacturing corporations of New England, but their report has been uniformly unfavorable as regards the success of the undertaking. The introduction and discussion of the subject of the manufacture of flax in Europe, has excited much interest in the United States, and a variety of new machines and processes for preparing and dressing flax have been invented during the past year, most of which have not yet been made public.

Some new improvements in the manufacture of paper have been brought out, or attempted during the past year. The consumption of this article in the United States at the present time is immense, and is continually on the increase. It is already a matter of some difficulty to obtain stock in sufficient quantities to supply the various mills now in operation; a large proportion of the rags used in this country are derived from the rag-producing countries of the South of Europe, the home supply not being at all commeasurate with the consumption of paper. Vast quantities of fibrous materials imported from the East Indies, such as refuse gunny, manilla, jute, coir, &c., are also worked into the poorer qualities of paper. There is, however, in all these substances, an inherent difficulty which prevents their being made available for the manufacture of white paper; they all contain a natural fixed color, which, hitherto, it has not been found possible to eradicate, except by the use of expensive chemical agents, as chlorate of potash, oxalic acid, and the like.

The number of patents issued by the Patent Office in 1852, was upwards of one thonsand, a number exceeding that of any former year. The number of Patents issued in 1851, was eight hundred and sixty-five ; the number of applications for patents during the same period was two thousand, two-hundred and fifty-eight. An important measure has been recommended to Congress, both by the Secretary of the Interior, and the Commissioner of Patents, viz : the preparation of an analytical and descriptive index of all inventions for which patents have been issued by the United States. In regard to this index, the late Commissioner says : " its importance, utility and necessity are becoming more and more apparent. No State paper, and no mere human volume can ever surpass it in immediate and enduring value. A greater boon to science, to inventors, and to the world at large, could hardly be named. It would be consulted as long as the arts are cherished, and would rather increase than diminish in interest as time rolls on.''

Among the inventions for which patents have been applied for during the past year, are two of more than ordinary interest:—The first for an improved grain reaping machine. This machine not only cuts regularly and completely the grain, but also collects it, bundles it in nearly equal quantities, binds and delivers. The other is for a wool-combing machine, which entirely supersedes the old method of hand-combing. This machine accomplishes the labor of from six to eight men, separating the long from the short fibres in the most perfect and thorough manner.

Among the various important contributions made to Science during 1852, other than mechanical, we would call attention to the following: the researches of M. Melsens, of Brussels, on the production and formation of artificial cellular tissue; the researches of Arago, on the physical constitution of the sun, one of the most brilliant and interesting of the publications of this eminent astronomer; the researches and discoveries of Prof. Stokes, on the "epipolic dispersion of light," and of M. Niepce, of France, on the production and fixation of colored photographs. Some interesting researches have been also published by Renault, the Director of the Veterinary School of Alfort, France, "On the Effects of Swallowing virulent matters in the digestive organs of man and animals." This author shows that the baking and roasting of meats, and the boiling of liquids arising from animals affected with contagious diseases, have the effect of completely annihilating the virulent properties of these substances The practical value of this fact will be appreciated by many of the inhabitants of large cities, who are obliged to use milk and some other articles of food, which are not of the best quality.

The year 1852, will also be memorable for the discovery of eight new asteroidal planets, making the whole number of planets now known to exist between Mars and Jupiter twenty-three.

The following geological surveys have been authorized or continued during the past year:

The legislature of Massachusetts have authorized a re-survey of some portions of the State under the direction of its geologist, Pres. Hitchcock. Steps have also been taken for the completion of the survey of Vermont, commenced by the late Professor C. B. Adams. The State of Mississippi has also authorized a survey under the direction of Messrs. Wailes and Millington, and has appropriated $6,000 per annum, for the maintainance of the same. The survey of Illinois has been commenced under the direction of Dr. Norwood. Surveys are also continuing at present in North Carolina under Dr. E. Emmons ; in Alabama, under Prof. M. Tuomey; in Canada under Mr. Logan; and in Pennsylvania, under Prof. H. D. Rogers. The report of this last elaborate survey will appear in two quarto volumes, with a large map, and among other points of special interest, will contain a monograph of the coal plants of the United States by Mr. Lesquereaux. The States of Missouri and Florida, are now the only ones which have not yet authorized surveys.

A geological reconnoissance of the Territory of Oregon, is now being made under the direction of the General Land Office, by Dr. Evans.

The obituary register for 1852, both in the United States and in Europe, contains the names of many who have been distinguished in the annals of science, and have been useful to their fellow-men. The American list includes the names of Norton, Downing, James Rogers, Johnson, Overman Woods Baker, Drake, Lassel, and others. We have also to record since the commencement of 1853, the death of Prof. C. B. Adams, and the distinguished American astronomer and mathematician, Sears C. Walker.

Satisfactory information has also been obtained during the past year respecting the fate of Jaques Compagnon, the long lost African traveller, and of Dr. Ludwig Leichardt, the missing explorer of Central Australia. The first named died in captivity in the interior of Africa, among the tribe of Kommenis. He departed from Senegal in 1758 and was last heard from in 1760. Dr. Leichardt left Sidney a few years since for the purpose of exploring the interior of Australia, the extent of Sturt's desert, and the character of the western and north-western coast, and to observe the gradual change in vegetation and animal life, from one side of the continent to the other. This expedition was expected to occupy two and half years in reaching Swan River. One letter only was received from him by a friend in Sidney, when he was eleven days out, closing with these words : "Seeing how much I have been favored in my present progress, I am full of hope, that our Almighty Protector will allow me to bring my darling scheme to a successful termination." Since then his fate has remained a mystery, until within a recent period it has been definitely ascertained that he was killed by the natives, after having penetrated 1200 miles into the interior of Australia.

THE

ANNUAL OF SCIENTIFIC DISCOVERY.

MECHANICS AND USEFUL ARTS.

DRAINAGE OF THE GREAT LAKE OF HAARLEM.

The drainage of the great lake of Haarlem by the Dutch Government, a work which stands unrivalled in the history of hydraulic engineering, and which has been prosecuted with energy since 1848, has been nearly completed within the past year. The origin and history of this great enterprise is as follows:—

In the year 1539, the North Sea, long restrained by artificial dams and dikes, as well as by some natural ridges of sand, suddenly burst its barriers, and brought horror and desolation into the fertile flats of North Holland. Twenty-six thousand acres of rich pasture land, with meadows, cattle and gardens, were covered by the waves, and the village of Nieuweinkirk was submerged and all its inhabitants lost in the tremendous calamity. The inundation resulted at first in the formation of four lakes, but the barriers of soft alluvial soil which separated them were gradually destroyed, and the four lakes became merged into one. The degradation of the shores also continued, until, at the commencement of the 18th century, the waters covered an area of 45,000 acres, with an average depth of 13 feet below low water in the Zuyder Zee. This lake constituted what has since been known as the Haarlem Meer, or Sea. The people of Holland saw with much alarm, the rapid extension of its boundaries, and, at an expense of about £33,000, succeeded in partially arresting its progress; an expense of about £4,000 per year was moreover entailed, for the preservation and repair of the works of defence. More than two centuries elapsed from the time of the first inundation before any one began to dream of recovering this vast tract of country, and then, for a long period, all plans proposed were deemed impracticable. At length, on the 9th of November, 1836, a furious hurricane from the west drove the waters of the Lake upon the city of Amsterdam, and drowned upwards of 10,000 acres of low land in the neighborhood. On the 25th of December following, another hurricane from the east drove the waters in an opposite direction upon the city of Leyden, the lower parts of which were submerged forty-eight hours, and 19,000 acres of land were inundated. The enormous loss occasioned by these two storms induced the government to determine on the drainage of the Lake, and a credit of 8,000,000 florins was voted by the States General. In May, 1840, a commission was appointed to superintend the work.

The first operation was to cut a canal round the Lake, to isolate it from the neighboring waters, and to afford the means of navigation to the enormous traffic which previously passed over the Lake, amounting to 700,000 tons per annum. This canal was 37 miles long, 130 feet wide on the west side, and 115 feet on the east side of the Lake, with a depth of 9 feet water. On the side next to the Lake, the mouths of all water-courses entering it, were closed by earthen dams, having an aggregate length of 3,000 yards, made in 10 feet depth of water. Other great works were executed by enlarging the sluices at various points, and in erecting powerful steam engines to assist in discharging the water from the canal during the time of high water. The water of the Lake has no natural outfall, being below the lowest practicable point of sluicage. The area of water enclosed by the canal was rather more than 70 square miles, and the quantity to be lifted by mechanical means, including rain water and springs, leakage, &c., during the time of drainage, was estimated at 1,000,000,000 tons. In determining the motive power to be employed, two points were to be kept in view; first, the cost of draining the Lake; second, the cost of annual drainage; for, when once the work was accomplished, the site of the Lake could only be kept dry by mechanical power. With the exception of a few steam engines, the wind had hitherto been the motive power employed to work the hydraulic machines used in the Netherlands to keep the country dry. And the power of 12,000 wind-mills, having an average aggregate power of 60,000 horses, is required to prevent two-thirds of the kingdom from returning to the state of morass and lake, from which the indomitable energy and perseverance of the Dutch people have rescued what is now the most fertile country in Europe.

The Haarlem Meer Commissioners were convinced that the old means must be laid aside, and new ones adopted to suit the magnitude and peculiarities of their work. They accordingly determined to erect three gigantic steam engines of a peculiar construction, which was accordingly done, and the whole put in operation in 1848. These engines consume but two and a half pounds of coal per hour, for each horse power, and are capable of raising 112 tons of water 10 feet high at each stroke, or of discharging 1,000,000 tons in 25½ hours.

A short description of one of these engines may prove interesting. It has two steam cylinders, one of 84 inches diameter, placed within another of 144 inches diameter; both are fitted with pistons; the outer piston is of course annular, and the two pistons are united to a great cross-head, or cap, which is furnished with a guide-rod, or spindle; both pistons and cross-head are fitted with iron plates, and together, with parts of the engine attached, have an effective weight of nearly 90 tons. The Engine House is a circular tower, on the walls of which are arranged 11 large cast-iron balance-beams, which radiate from the centre of the engine. Their inner ends, furnished with rollers, are brought under the circular body of the great cap, and their outer ends are connected to the pistons of 11 pumps of 63 inches diameter each; the stroke of both ends is 10 feet; and the discharge from the pumps 66 cubic metres, or tons, of water per stroke.

The action of the engine is very simple; it is on the high-pressure-expansive-condensing principle. The steam is admitted first beneath the small piston; and the dead weight of 90 tons is lifted, carrying with it the inner end of the pump balances, and of course allowing the pistons to descend in the pumps.

The equilibrium valve then opens, and the steam in the cylinders passes round to the upper surface of the small and annular pistons; puts the former in a state of equilibrium, and presses with two-thirds of its force upon the annular piston, beneath which a vacuum is always maintained: thus, the down stroke of the engine, and the elevation of the pump pistons and water, is produced by the joint action of the descending dead weight in the cap and pistons, and the pressure of steam on the annular piston. The engine has two air pumps, of 40 inches diameter, and 5 feet stroke each. The water is lifted by the pumps into the canal, from which it passes off towards the sea sluices.

The total weight of iron employed for the engine, pumps, &c., is 640 tons. The cost of the machinery and buildings, £36,000.

The pumping was actively commenced in May, 1848, and has been continuously carried on up to the present time. The Lake is now nearly dry; much of the bottom is exposed, only large pools of water being left. The remains of the unhappy village of Nieuweinkirk have been found, with a mass of human bones, on the very spot where the old charts of the province fixed its site. From May, 1848, up to April, 1851, the Lake was lowered 7 feet 3 inches. The level reached at the end of October of the same year was 9 feet 7 inches below the original surface, or at an average rate of 4.79 inches per month. In November, 1851, a great quantity of snow and rain fell, raising the level of the Lake about four inches, and in December the weather was still unfavorable, so that at the end of that month, the level stood at 9 feet 5.38 inches below the original surface, showing a total gain since April of 2 feet 5.58 inches, or 3.32 inches per month. This progress may appear to some inconsiderable; but when it is recollected that the lowering of the Lake one inch involved the raising of upwards of 4,000,000 of tons of water, and allowing for rain and snow falling during these eight months, there could not have been less than 186,000,000 tons of water pumped up during that period, the performance will appear great indeed. To give a better idea of this, it is stated that 186,000,000 tons of water are equal to a mass of solid rock, one mile square, and 100 feet high, allowing 15 cubic feet to a ton.

The average progress has been less during the last year than during the preceding ones, but this is readily accounted for, by the increased lift of the pumps, and by the difficulty of forming the channels which lead the water to them.

The annual drainage hereafter, is estimated at 54,000,000 tons of water, which must be lifted on an average 16 feet; it may occur, however, that as much as 35,000,000 of this amount must be discharged in one month, in order to preserve and render the space formerly occupied by this Lake habitable.

CRYSTAL PALACE IN NEW YORK.

It having been determined to open an Exhibition of the Industry of all Nations in the city of New York, during the summer of 1853, the following plan of an edifice suitable for the purpose has been adopted; the plan being furnished by Messrs. Carstensen & Gildemiester, of New York. The general idea of the edifice is a Greek cross, surmounted by a dome at the intersection. Each diameter of the cross will be 365 feet 5 inches long. There will be three similar entrances—one on the Sixth Avenue, one on Fortieth, and one on Forty-second Street. Each entrance will be 47 feet wide, and that on the Sixth Avenue will be approached by a flight of eight steps. Each arm of the cross is on the ground-plan 149 feet broad. This is divided into a central nave and two aisles, one on each side; the nave 41 feet wide; each aisle 54 feet wide. On each front is a large semi-circular fanlight, 41 feet broad and 21 feet high, answering to the arch of the nave. The central portion, or nave, is carried up to the height of 67 feet, and the semi-circular arch by which it is spanned is 41 feet broad. There are thus, in effect, two arched naves, crossing each other at right angles 41 feet broad, 67 feet high, to the crown of the arch, and 365 feet long; and on each side of these naves is an aisle, 54 feet broad and 45 feet high. The exterior of the ridgeway of the nave is 71 feet The central dome is 100 feet in diameter—68 feet inside from floor to spring of arch, and 118 feet to the crown; and on the outside, with the lantern, 149 feet. The exterior angles of the building are filled up with a sort of lean-to, 24 feet high, which gives the ground-plan an octagonal shape, each side or face being 149 feet wide. At each angle is an octagonal tower, 8 feet in diameter, and 75 feet high. Each aisle is covered by a gallery of its own width, and 24 feet from the floor. The building contains, on its ground floor, 111,000 square feet of space, and in its galleries, which are 54 feet wide, 62,000 square feet more, making a total area of 173,000 square feet for the purposes of exhibition. There are thus in the ground floor two acres and a half, or exactly two acres and 52.100; in the galleries, one acre and 44.100; total, within an inconsiderable fraction of four acres. There are on the ground floor 190 columns, 21 feet above the floor, 8 inches diameter, cast hollow, of different thicknesses, from half an inch to one inch thick; on the gallery floor there are 122 columns.

NAVAL DRY DOCK AND RAILWAY AT PHILADELPHIA.

The Journal of the Franklin Institute gives the following description of the U. S. Dry Dock and Railway, recently completed at Philadelphia; the dock and its appendages being the largest in the world.

The lifting power consists of nine sections, six of which are 105 feet long inside, and 148 feet over all, by 32 feet wide, and 11½ feet deep; three of them are of the same length and depth as the others, but two feet less in width; the gross displacement of the nine sections is 10,037 tons, gross weight 4,145 tons, leaving a lifting power of 5,892 tons, which far exceeds the weight of any vessel yet contemplated. The machinery for pumping out the sections consists of two engines of 20, and two of 12 horse power. In connection with the sections (which form the lifting power of the dock,) is a large stone basin, 350 feet long, 226 feet wide, and 12 feet 9 inches deep, with a depth of water of 10 feet 9 inches at mean high tide. At the head of this basin are two sets of ways, each being 350 feet long, and 26 feet wide. These ways are level, and consist of the bed pieces, which are three in number, and firmly secured to a stone foundation; the central way supports the keel, while the side ways receive the weight of the bilge; these ways are of oak, and are finished off to a smooth surface. On the top of the bed pieces or fixed ways, comes the sliding ways or cradle, which are also 350 feet long and 26 feet wide, so constructed as to admit of being adjusted to the length of any vessel. The operation of the dock is as follows:—The sections are sunk so as to allow the vessel to be floated in; as soon as she is secured in the proper position, the pumps are put in operation, when the sections begin to rise, and as soon as they come to a bearing on the keel, the bilge blocks are run in until they fit the ship. When all is secure, the sections are pumped out until the keel is some two or three feet above the water. If repairs that will only require a short time are contemplated, the vessel is kept on the sections, and no other portions of the dock used. When this is accomplished, the sections are filled with water, and rest on the bottom of the basin, which is of stone. Bed ways are now laid on the sections in line with those before mentioned. When they are secured they are greased, and the cradle is now slid under the ship, and she is blocked up on the cradle, and the blocks on the sections are removed. At this point of the operation a new instrument of power is brought forward for the purpose of hauling the ship from the sections to the bed ways in the Navy Yard. It consists of a large hydraulic cylinder, having a ram of 15 inches diameter and 8 feet stroke, and a power of 800 tons. On the top of this cylinder, and attached to it, are two vertical direct acting engines, with cylinders 16 inches in diameter and 16 inches stroke, connected at right angles to one shaft, on which are four eccentrics for working four hydraulic pumps of 1½ inches bore, and 6 inches stroke; the tank which carries the water for the press is also on the top of the cylinder, and forms the bed on which the pumps are secured. The boiler which supplies these engines with steam, is on a sliding cast iron bed way, some 12 or 15 feet ahead of the hydraulic cylinder, and connected to it by two cast iron rods. This boiler is of the usual locomotive form, and has 85 tubes of 2 inches diameter, and 9 feet long. To get ready for operation, the hydraulic cylinder is slid down to the edge of the basin, its ram is run in, and a connection made by means of two side rods of wrought iron from the cross head of the ram to the sliding cradle which carries the ship. The central bed way has key holes mortised through it horizontally, every 8 feet, and there are projections from the hydraulic cylinder, which have corresponding key holes in them. Two cast iron keys, 24 inches wide, and 6 inches thick, are slid through the key holes on small wheels; these keys secure the cylinder to the central bed way; the engines and pumps being now put in operation, a pressure is brought on the 15 inch ram, and as soon as the pressure overcomes the resistance, the vessel must move. As soon as the vessel has been moved 8 feet, the keys which hold the cylinder to the central way are withdrawn, and by means of a screw which is attached to the head block of the ram, and driven from the engine, the cylinder and boiler are in their turn rapidly slid ahead, (the water in the cylinder being allowed to escape into the tank,) when the cast iron keys are again slid in place, and the vessel moved another 8 feet. To push the vessel off, the cylinder and appendages are moved to the head of the ways, put on a turn-table and reversed, when it is again brought down to the cradle, and the cylinder being secured as before, the head of the ram is applied directly to the cradle, and the vessel shoved back on to the sections, which requires the same time and power as to haul them off. The capacity of this dock exceeds that of the stone docks at New York, Boston, and Norfolk, combined, for united they can take but three vessels, while here, two of our longest war steamers may be hauled out on the ways, and two frigates lifted on the sections. The advantages that must result from the facilities of repairing a vessel elevated into light and air over one sunk in a stone dock, are very great, and have only to be seen to be appreciated.

BEACON ON ROMER SHOALS.

A NEW beacon, having some peculiarities of structure, has recently been erected on the Romer Shoals, at the entrance of New York Harbor, under the direction of Mr. J. W. Lewis, C. E. The Beacon is built on the southeast crest of the Romer Shoal, about two miles from Sandy Hook Light, in 13 feet water, and is in plan an octagon 20 feet in diameter and 50 feet in height. The principle of its construction consists in screwing into the sand of the shoal, at each angle of the octagon, and in the centre, one of Mitchell's screw piles; the blade of each screw being 2 feet in diameter, and entering the sand to a depth of 10 feet; attached to the screw are nine wrought-iron shafts or piles, each 6 inches in diameter and 32½ feet in length, extending to a height of 8½ feet above high water mark; on the top of these piles, heavy cast iron sockets are keyed, to which are attached also by keys the cast iron shafts, which rising form the pile heads, and uniting in a centre frame at the tops, form the supporting braces for the basket frame, or distinctive mark of the Beacon, which is secured to a prolongation of the centre pile at a height from the level of the sand of 63 feet. The whole of the piles and shafts are securely braced and counter-braced by wrought iron tie-rods, keyed to the sockets, rings or pile heads, forming altogether one of the most efficient systems of frame work ever erected for such a purpose. The whole weight of the structure is but 75 tons, and it cost the Government but $10,000, whereas a stone structure would not cost less than $35,000, that being the cost of a stone beacon on the same shoal, and but 40 feet in height.

GREAT TUNNEL IN HUNGARY.

One of the longest, if not *the* longest tunnel in the world, is now in a forward state of completion. It is situated in Hungary, and leads from the shores of the river Gran, not far from Zarnowitz, to the mines in the Schemnitzer hills; it is two geographical, or about ten English miles, long; it is intended to answer the double purpose of a channel to drain off the water accumulating in the works, and of a railway to transport the ore from the mines to the river.

MODERN CYCLOPEAN WALL.

A recent number of the Allgemeine Zeitung contains an interesting account of a visit which the writer had made to inspect the progress of building a wall in the manner called Cyclopean, near Kiel, in Schleswig-Holstein. He considers the effect of the work and the style of execution far superior to any of the numerous remains called by the same name which he had seen in Italy, and goes so far as to give it the preference over any other kind of wall, so far as the plain, vertical surface of the material, apart from ornamental accessories, is concerned. He thinks that the polygonal stones, exerting their pressure in all directions, must insure stronger work than squared stones, however closely jointed, which only act in the direction of gravity. Indeed, the innumerable many-sided and multangular stones of all sizes seem run together into one compact mass, of which neither time nor age will get the better. Neither mortar nor any other means of binding the stones together is employed; but the greatest care is taken in fitting the granite blocks one into the other, the vacant spaces in the wall as it is carried up being accurately taken off with a lead tape forced with a hammer into all the angles of the openings, and then applied to the flat hewn face of the block best suited, and next to be brought to its proper shape by the workman. From the workmen he learned that the directions given them by the architect were, "Five-sided and six-sided blocks, seldom four-sided; straight lines, obtuse angles, joint upon angle and angle upon joint; all according to the lead tape, and only inclined junctions." In fact, all the junctions between the blocks were found to be in every gradation between the perpendicular and the horizontal, without coinciding with either of them. In this obliquity of the joints the author detected the arch principle of construction as applied to the work, and the workmen pointed out to him, that each stone either pressed or supported, with every one of its sides, however numerous. Generally, the writer holds this polygonal or Cyclopean kind of building to be especially applicable in, first, hydraulic works, as it offers nowhere a continuous joint to the water; second, in fortifications; third, for railways in substruction and steep coverings, and in the cellar story and even in the next story of large buildings and palaces. In these mortar would be used, not as a means of connecting the stone, but only as pointing to the joints, so that the immediate contact of the stone should not be interrupted. In conclusion, the writer recommends the adoption of this method of building according to determined and clearly defined principles and rules, as altogether practical, wherever the material for polygonal blocks is found,—a method which is at least to us a new one, and not simply a more careful execution of the long-used rock walls, or an ornamental imitation of an old style.—*London Builder.*

WHITE'S WOODEN SUSPENSION BRIDGE.

By this invention the Patentees claim to have solved the problem of spanning broad and rapid rivers with a structure which requires no piers, yet is suitable for railroad purposes, and can be built at a reasonable and practical cost. The principal feature of the invention is the substitution of wooden stringers constructed of boards cemented, dowelled and bolted, for iron chains or wire cables. There is no question as to the strength which may thus be attained; a reference to any tables of the strength of materials will show that the tensile strength of hard wood is much greater in proportion to its weight than bar iron. Any number of these stringers considered necessary for a given structure may be placed one above another and each be firmly anchored beyond the points of support, by back stays fastened into the abutment; the only question seems to be, whether the stringers can be locked to the back stays with a sufficient degree of firmness. The principal advantage which is claimed for this invention is that it can be entirely freed from that tendency to vibration, which is fatal to the use of the iron suspension bridge upon railroads. The means used to effect this are very simple, and certainly seem to be effectual. Perpendicular oscillation is partly overcome by springing a direct arch from one abutment to another which in the centre rises nearly to the road bed, and which is firmly connected with the stringers above by the suspension rods which sustain the floor; and lateral oscillation is overcome partly by making the bridge diminish in width from the extremities to the centre; while all possibility of vibrations would seem to be avoided by the mode of covering. This is done as follows: the entire structure is covered with a double diagonal boarding, and the planks of the road bed are also laid double, crossing the floor joists also diagonally.

The weight of the structure decreases in a geometrical ratio as the distance from the towers increases, so that at the centre, though the full strength of the stringers and the direct arch below them is retained, the weight of the structure is diminished to an exceedingly low point. As to economy of construction this bridge can be surpassed by none, especially where a great span is required. There is no heavy timber, the entire structure being built of plank and boards. No piers are necessary, the only stone work being the laying the abutments, etc.

The manner of constructing the stringers speaks well also for their durability, being put together with oil cement between each board which will render decay next to impossible; it is very well known that wood prepared in this way has been excavated from the ruins of old cities, after being buried more than three thousand years, in a state of perfect preservation.—*Railroad Journal.*

FLYING RAILROAD BRIDGE.

The Scientific American states that C. B. Hutchinson, of Waterloo, N. Y., has invented and taken measures to secure a patent for a valuable improvement on Railroad Bridges for navigable waters. The object of the invention is to have a bridge perfectly open and free at all times for vessels to pass, except the few minutes required for a train to pass over, and to carry over trains expeditiously and safely. A certain number of piers or abutments are built in the river, with space between them for the passage of vessels. Instead of having a stationary platform to the roadway extending across on the piers, he employs a flying or running platform, which carries the train spanning and springing over the successive spaces between the piers from the one side to the other. There are tracks or rails on all the piers, and on the flying platform there are wheels that run on the tracks, like a long railroad car. The length of the flying platform is in proportion to the width of space between the abutments, so that it will be impossible to overbalance it while springing from one pier to the other like a sliding drawer. The flying train is stationary at one side or the other, when the train is not passing. It is to be propelled across by having stationary power on itself, or to have it so constructed that the locomotive of a train may propel it across. It may be called "a flying railroad bridge."

THE GENESEE HIGH BRIDGE.

The bridge by which the Buffalo and New York Railroad crosses the Genesee river, near Portageville, is one of the most gigantic structures in this country, being eight hundred feet in length, and two hundred and thirty-four feet above the stream. About one hundred feet below the bridge is a perpendicular fall in the river of sixty-six feet; hence, from the top of the bridge to the bed of the river below the fall, it is three hundred feet. The Genesee High Bridge towers above all similar structures in America; even the suspension bridge at Niagara is only two hundred and thirty feet high, and no longer than this. Some more definite idea of this immense structure may be gathered from the following statistics; — rising from the bed of the river are eight stone abutments, each thirty feet high. On these rest the truss work of wood, extending one hundred and ninety feet above the abutments. On the top of this structure stands the bridge itself, which is fourteen feet high. The base of the truss work is seventy-five feet in width, and the top of the bridge, twenty-five feet. To furnish the timber for it, over two hundred and fifty acres of land have been required. More than a million and a half feet of timber, board measure, have been used in the construction, together with sixty tons of iron in bolts. The work was completed in eighteen months at a cost of about $140,000. The bridge was designed by Mr. H. C. Seymour, and so perfect is the model, that from the supporting truss-work any piece of timber can be removed, in case it becomes defective, and a new one placed in its stead, without affecting the strength of the work, or displacing any other timber. The truss-work is composed chiefly of timbers placed on their ends in an upright position, and so braced, and counter-braced, and the whole structure made so firm, that it is estimated it will sustain with safety twenty times the weight of any train that can pass over it.

NOVELTIES IN SHIP BUILDING.

There is now building at the Clyde, at Carts' Dyke, an immense iron steamship, to be called the Atrato, of much greater capacity and considerable larger, than that leviathan steamer, the Great Britain; indeed so large is the Atrato to be, that the Cunard steamship Arabia, of 2,400 tons, might be put inside the new steamer, with a good deal of room to spare.

The origin of the Atrato is somewhat singular. Her builders, having constructed the engines (of 850 horse power) for the Demerara, which got jammed across the Severn, and had to be broken up in strains she received, got an order from the West India Mail Steamship Company, to whom the Demerara belonged, to build a vessel of iron instead of wood, to which the new engines might be adapted. They were permitted to modify the design of the hull so far as the length was concerned, although the retention of the original paddle-shafts compelled an adherence to the same breadth of beam at that line as the original vessel. The result has been that the engineers submitted plans which were approved of, and are now being carried out in the building of the largest vessel ever afloat. The entire length of the keel is laid resting on blocks. The enormous bar is in nine pieces, joined by scarf-joints, and firmly riveted together. The stern post is in one piece, and so is the stem, which runs for about ten feet into the horizontal keel. The stem alone weighs 65 cwt. Only one-half of the ribs or frames are as yet in place, and even with the long length of bare keel terminated by the stem standing up some forty feet or more, the enormous dimensions of the vessel can hardly be appreciated, but they will be understood from the principal measurements of the Atrato, and those of the largest ship-of-war in the British service, the Windsor Castle, now on the stocks at Pembroke Dock Yard, which is stated to be "the largest vessel in the world." Their principal measurements are:

THE ATRATO.	Feet.	WINDSOR CASTLE.	Feet.
Length of keel,	310	Length extreme,	278
Do. of keel and forerake,	340	Do. of keel and forerake,	240½
Breadth of beam,	52	Breadth,	25
Depth of hold,	34	Depth of hold,	24

It would thus appear that the Atrato will be about 60 feet longer than the "largest vessel in the world," and about 10 feet deeper in the hold; the only dimension by which she is exceeded by the Windsor Castle being in the breadth of beam, and in that particular the builders were bound down by the existing machinery, which as above stated, was made for the Demerara, a much shorter vessel. The floor of the new steamer will have a rise of four feet at the flattest part, so that the easy curves afforded by such a sweep of midship section, combined with the enormous length, can only be appreciated by those conversant with ship-building. There are to be four decks; the upper or spar deck being flush from stem to stern, and presenting a promenade of about 330 feet in length, by about 38 in breadth. The hull is to be divided into seven compartments by six iron water-tight bulk heads, extending from the keel to the main deck. This will give rigidity to the hull, and afford security against sinking.

A new and beautiful steamer, called the "Light of Heaven," has been recently launched at Glascow, for the Pacha of Egypt. Her engines are of 300 horse power, and of the most beautiful make and finish. The fittings of the interior are gorgeous beyond comparison, consisting of papier-mache ornaments and rich brocaded silks, which will alone cost $125,000. The ceiling of the saloon will be divided into a number of panels of rich white silk, having upon the centre the device of the crescent and the star, encircled with most elaborate and richly colored wreaths of Eastern flowers of silk. The borders of the panels are to be richly ornamented Raffaelesque decorations. Other portions of the ceiling between the beams, are to be covered with a silk of a white ground and groups of flowers of gold thread. The panels on the sides are of papier-mache. The ottomans in the saloon are covered with cloth of gold, formed with a warp of gold and a weft of glass thread. The awning of the deck is to be formed of entirely brocaded silk, the fringe being of gold and costing twenty guineas per yard. The cost of the silk for the awning alone will not be less than $10,000.

A new steamer has recently been built in England, with the following remarkable proportions. Her length exceeds 200 feet; while her breadth is little more than 13 feet. She is fitted with engines of 80 horse power. Her wheels, which are on the feathering principle, are remarkably small, and, to a casual observer, appear totally inadequate to the propulsion of a boat of such great length; this, however, we are assured is not the case.

STEAMBOAT PROPELLERS.

There have been brought to light, recently, two new inventions: the one adapted to give increased speed to screw, the other to paddle navigation. Mr. G. Bovill's screw propeller, described in the Mining Journal, is an entirely novel affair. Its central portion is fitted up with a hollow sphere, occupying one-third of the entire diameter of the propeller, and the blades are made narrower at the outer extremity than at the base. The blades are also made to revolve, so as to admit of the pitch being altered to meet the various circumstances of speed and power. From a table of the comparative result of trials on three different boats, it appeared that important advantages have been obtained from the new propeller.

The paddle invention is that of a Liverpool shipwright named Hampson. A piece of wood, perhaps about a foot square, and connected to a movable framework, so as to be capable of being moved to and fro, was fixed to the stern of the boat; the paddle, so to speak, being covered by the water, and assuming a slightly diagonal position. By moving two handles rapidly with his hands in the direction of his body from the stern, Mr. H. brought the paddle in rapid motion, the action resembling that of the fin of a fish, the result being to propel the boat with great speed through the water. Mr. Hampson contends, that by this simple appliance alone he can propel row-boats at much more than their ordinary speed, and with infinitely less manual labor; but his grand object is to apply it to sea-going vessels by means of steam and machinery.

The Sidney papers contain accounts of a new propeller invented by Sir Thomas Mitchell, the Surveyor-General of New South Wales, a trial of which in a small steamer at that port had excited great interest. It is called the Bomerang propeller, and is constructed on the principle of the weapon of that name used by the natives to kill game. Although the experiment was only on a small and imperfect scale, a speed of 12 knots an hour against a head-wind is stated to have been obtained. The instrument is described to combine great strength and simplicity, while it has also the advantage that its motion in the water causes but a comparatively slight agitation, so that it is capable of being adapted to canal boats as well as to other vessels. At the conclusion of the trial Sir Thomas Mitchell expressed his conviction "that the weapon of the earliest inhabitants of Australia has now led to the determination, mathematically, of the true form, by which alone, on the screw principle, high speed on water can be obtained."

NEW BOAT LOWERING APPARATUS.

The want of a ready means of lowering boats from vessels in distressed circumstances, has been of late years exemplified in numerous cases of the most tragical character. Mr. W. S. Lacon of the East India Company's Service, has recently invented a plan for making the boats attached to a ship quickly available, which seems likely to be entirely successful. Mr. Lacon takes as his principle the well-known axiom in mechanics, that what is gained in power is lost in time; and although he approves of the method at present in use, as being the best for hoisting up boats; he (seeing that the hoisting need never be a hurried operation) substitutes two single ropes or chains, which being secured to two broad slings passing round the body of the boat, are then brought inboard on davits, and carried to two concave barrels connected together by means of a shaft. The ends of the ropes or chains are secured to the barrels in such a manner that they will support any amount of weight until such time as the boat has reached the water, when they will disconnect and fall away from their attachment by their own weight, by which means he prevents the possibility of a ship, in its onward progress through a rough sea, dragging forward a lowered boat sideways, and capsizing or swamping it. By means, then, of a friction strap and pulley round the shaft, one man is enabled to regulate the descent of the boat, which will go down by its own weight; and by means of the parallel action of the two barrels, he lowers both ends uniformly, and insures the boat falling in a proper position on the water.

Two several trials made at Folkestone on this method of lowering boats, gave great satisfaction to a committee of nautical men. In the first trial, a boat was lowered from the steamer by one man, with several persons on board, and alighted on the water, abaft of the larboard paddle-box, with the utmost safety and apparent comfort, the tackle being released momentarily by the weight of the boat's descent, the vessel at the time steaming at the rate of 12½ knots per hour. It was afterwards hoisted up again by two men. At the second trial, the boat was lowered and cleared from the ship by one man, with Mr. Lacon and three men on board, the vessel at the time maintaining full speed.

PATENT SELF-ACTING SAFETY-PLUG FOR BOATS.

The self-acting safety-plug for ships' boats, river barges, lighters, &c., invented by Mr. Lisabe, consists of a hollow brass box, with perforations at the top and bottom, let into one of the lower planks of a boat or barge. In the interior is a loose ball, with sufficient room for play, so that when the boat is immersed the pressure of the external water urges and retains the ball lightly against an India Rubber seating at the top, thereby effectually closing the upper perforations against the admission of water; while, on the boat being suspended, the ball, by its own gravity, rests upon the bottom of the chamber, and allows any rain or other water which may accumulate in the boat while in suspension to drain out through the upper perforations. Provision is also made for the retention of water in boats when in the davits, as often such is rendered necessary, by the addition of a "turn-table" at the top, which, being turned round, closes the upper perforations, and retains the water in the boat. The object of this simple but important invention is to guard against the frequent casualties which occur when, in cases of shipwreck, or vessels striking on rocks, the ships' boats are suddenly lowered into the water to afford means of escape to the passengers and crew; but in too many instances the boats become immediately filled, and swamp, owing to the neglect or forgetfulness of stopping the plug-holes which all boats have in their bottoms for their drainage, while suspended along the ship's side. The patent accomplishes this important result with unerring certainty, and by its self-acting principle requires no attention; and, while it answers the object of drainage of the old method of plug-holes while in suspension, the act of immersion instantaneously closes the orifice by the pressure of the external water against the ball.

ERICSSON'S CALORIC ENGINE.

We copy the following popular description of this much talked-of engine, from Hunt's Merchants' Magazine.

This invention, by Capt. John Ericsson, was first brought before the public in 1833, at London, where he made an engine of five horse power, and exhibited it in operation to several scientific gentlemen. It was timidly, but generally, approved, by intelligent men; but Brunel (the engineer of the Thames tunnel) and Prof. Faraday, decided against the feasibility of the machine, and by means of the powerful indirect influence of that decision, the English Government — which had at first seemed inclined to give the matter their attention — let it drop, and it was soon forgotten by the public. Latterly Mr. E. has revived the Caloric Engine in this country, and built two or three, which have been in successful operation.

It is stated in the journal above referred to, that his Caloric Engines are at work in the foundry of Messrs Hogg and Delamater, in New York; the one of five, and the other of sixty horse power. The latter has four cylinders. Two, of seventy-two inches in diameter, stand side by side. Over each of these is placed one much smaller. Within these, are pistons, exactly fitting their respective cylinders, and so connected that those within the lower and upper cylinders move together. Under the bottom of each of the lower cylinders a fire is applied. No other furnaces are employed. Neither boilers nor water are used. The lower is called the working cylinder; the upper, the supply cylinder. As the piston in the supply cylinder moves down, valves placed in its top open, and it becomes filled with cold air. As the piston rises within it, these valves close, and the air within, unable to escape as it came, passes through another set of valves, into a receiver, from whence it has to pass into the working cylinder, to force up the working piston within it. As it leaves the receiver to perform this duty, it passes through what is called the regenerator, which we shall soon explain, where it becomes heated to about four hundred and fifty degrees, and upon entering the working cylinder, it is further heated by the fire underneath. We have said the working cylinder is much larger in diameter than the supply cylinder. Let us, for the sake of illustration merely, suppose it to contain double the area. The cold air which entered the upper cylinder will, therefore, but half fill the lower one. In the course of its passage to the latter, however, we have said that it passes through a regenerator, and let us suppose, that as it enters the working cylinder, it has become heated to about four hundred and eighty degrees. At this temperature, atmospheric air expands to double its volume. The atmospheric air, therefore, which was contained within the supply cylinder, is now capable of filling one of twice its size. With this enlarged capacity it enters the working cylinder. We will further suppose the area of the piston within this cylinder to contain a thousand square inches, and the area of the piston in the supply cylinder above, to contain but five hundred. The air presses upon this with a mean force, we will suppose, of about eleven pounds to each square inch; or in other words, with a weight of 5,500 pounds. Upon the surface of the lower piston, the heated air is, however, pressing upward with a like force upon each of its one thousand square inches; or, in other words, with a force which, after overcoming the weight above, leaves a surplus of 5,500 pounds, if we make no allowance for friction. This surplus furnishes the working power of the engine. It will be readily seen that, after one stroke of its pistons is made, it will continue to work with this force, so long as sufficient heat is supplied to expand the air in the working cylinder to the extent stated; for, so long as the area of the lower piston is greater than that of the upper, and a like pressure is upon every square inch of each, so long will the greater piston push forward the smaller, as a two pound weight upon one end of a balance will be quite sure to bear down one pound placed upon the other. We need hardly say, that after the air in the working cylinder has forced up the piston within it, a valve opens, and as it passes out, the pistons, by force of gravity, descend, and cold air again rushes into, and fills the supply cylinder, as we have before described. In this manner the two cylinders are alternately supplied and discharged, causing the pistons in each to play up and down, substantially as they do in the steam engine.

The most striking feature of the Caloric Engine consists in what is called the regenerator. Before describing this, we will present the idea upon which it is based. First, let it be remembered that the power of the steam engine depends upon the heat employed to produce steam within its boilers. It will be seen that from the very nature of steam, the heat required to produce it, amounting to about 1,200°, is entirely lost by condensation the moment it has once exerted its force upon the piston. If, instead of being so lost, all the heat used in creating the steam employed could, at the moment of condensation, be reconveyed to the furnace, there again to aid in producing steam in the boilers, but a very little fuel would be necessary; none, in fact, just enough to supply the heat lost by radiation. The reason is obvious. Let us suppose the steam has passed from the boiler, has entered the cylinder, has driven the piston forward, and is about to pass into the condenser, there to change its form, and to be again converted into water. This steam, yet in the cylinder, and uncondensed, possesses all the heat it contained before passing out of the boiler. It has driven the piston forward, but in that effort it has lost no heat. That source of power it still contains. Let it be supposed that the heat contained in the steam could, at the moment it is converted into water within the condenser, be saved, and by some device be again used to create steam from water within the boiler, with what exceeding cheapness could the power of the steam engine be employed. But it is quite impossible thus to re-employ the heat of steam; it cannot thus be saved: and hence every effort to economize in this manner would be unavailing.

Let us now attempt to describe the regenerator, to which we have referred. Without this, the machine we examined would possess, in point of economy, no advantage over the best constructed steam engine. With it, the advantage is incalculable.

We have before stated that atmospheric air is first drawn into the supply cylinder, whence it is forced into a receiver, and that from this it proceeds toward the working cylinder, before reaching which, it passes through the regenerator. This structure is composed of wire net, somewhat like that used in the manufacture of sieves, placed side by side, until the series attain a thickness, say of twelve inches. Through the almost innumerable cells, formed by the intersection of these wires, the air must pass, on its way to the working cylinder. In passing through these, it is so minutely subdivided that the particles composing it are brought into close contact with the metal which forms the wires. Now, let us suppose, what actually takes place, that the side of the regenerator nearest the working cylinder is heated to a high temperature. Through this heated substance the air must pass before entering the cylinder, and in effecting this passage, it takes up, as is demonstrated by the thermometer, about 450° of the 480° of heat required, as we before stated, to double its volume. The additional 30° are communicated by the fire beneath the cylinder. The air has thus become expanded; it forces the piston upward; it has done its work — valves open — and the imprisoned air, heated to 480°, passes from the cylinder, and again enters the regenerator, through which it must pass before leaving the machine. We have said that the side of this instrument nearest the working cylinder is hot, and it should be here stated that the other side is kept cool, by the action upon it of the air entering in the opposite direction at each up-stroke of the pistons. Consequently, as the air from the working cylinder passes out, the wires absorb the heat so effectually that, when it leaves the regenerator, it has been robbed of it all, except about

30°. In other words, as the air passes into the working cylinder, it gradually receives from the regenerator about 450° of heat; and as it passes out, this is returned to the wires, and is thus used over and over, the only purpose of the fires beneath the cylinders being to supply the 30° of heat we have mentioned, and that which is lost by radiation and expansion. Extraordinary as this statement may seem, it is nevertheless incontrovertibly proved by the thermometer, to be quite true.

The regenerator contained in the sixty-horse engine we have examined, measures twenty-six inches in height and width internally. Each disc of wire composing it contains 676 superficial inches, and the net has ten meshes to the inch. Each superficial inch, therefore, contains 100 meshes, which multiplied by 676, gives 67,600 meshes, in each disc, and as 200 discs are employed, it follows that the regenerator contains 13,520,000 meshes, and consequently, as there are as many small spaces between the discs as there are meshes, we find that the air within it is distributed in about 27,000,000 minute cells. Hence, it is evident, that nearly every particle of the whole volume of air, in passing through the regenerator, is brought into very close contact with a surface of metal, which heats and cools alternately. The extent of this surface, when accurately estimated, almost surpasses belief. The wire contained in each disc is 1,140 feet long, and that contained in the regenerator is consequently 228,000 feet, or 41½ miles in length, the superficial measurement of which is equal to the entire surface of four steam-boilers, each forty feet long, and four feet in diameter; and yet the regenerator, presenting this great amount of heating surface, is only about two feet cube — less than 1-1920 of the bulk of these four boilers.

Involved in this process, of the transfer and retransfer of heat, is a discovery which justly ranks as one of the most remarkable ever made in physical science. Its author, Captain Ericsson, long since ascertained, and upon this based the sublimest feature of his caloric engine, that atmospheric air and other permanent gases, in passing through a distance of only six inches, in the fiftieth part of a second of time, are capable of acquiring or parting with, upward of four hundred degrees of heat. He has been first to discover this marvellous property of caloric, without which, atmospheric air could not be effectively employed as a motive power. The reason is obvious. Until expanded by heat, it can exert no force upon the piston. If much time were required to effect this, the movement of the piston would be so slow as to render the machine inefficient. Captain Ericsson has demonstrated, however, that heat may be communicated to, and expansion effected in, atmospheric air, with almost electric speed; and that it is, therefore, eminently adapted to give the greatest desirable rapidity of motion to all kinds of machinery.

In order to afford a practical trial of the caloric engine upon a large scale, a gigantic vessel has been built, and fitted with engines constructed on the principles described. This vessel is said to be the finest specimen of naval architecture, (especially in point of strength ever created in this country. The engines being placed in the centre of the vessel, admit of a better form of midship section than in steamships. Of this the builders have availed themselves, by giving such a rise to the floor, that strength and easy lines for passing through the water, are appropriately combined. The floor of the vessel is built entirely solid from stem to stern, and in order to give additional strength to the ample timbers, the entire frame is banded by a double series of diagonal braces, of flat bars of iron, let into the timbers at intervals of about three feet, each series being riveted together at all the points of intersection. In addition to the ordinary central keelsons, there are six engine keelsons, bolted on the top of the floor timbers, for three-fourths of the length of the ship. On these keelsons the bed-plates of the engines are secured by bolts passing through the floor timbers. These bed-plates extend over the entire area occupied by the engines, and present a continuation of iron flooring, not witnessed in any steamship. The security thus attained is further enhanced by dispensing entirely with the numerous holes through the bottom of the vessel, which in steamers are necessary, and have often brought that class of vessels to a sinking condition. The engines being arranged in the centre of the vessel, the decks are not cut off as in steamers; and as the whole of the machinery is confined within a vertical trunk 76 feet long and 18 feet wide, ample space is left on each side of the ship for state-rooms along its entire length, with unbroken passages, fore and aft, on either side. The freight deck also presents an unbroken area fore and aft, diminished only in width in the central part of the vessel. The coal being carried in the bottom, at each side of the engines, the fore and aft hold are clear for freight. The central arrangement of the engines involves, of necessity, a *central* crank, and thus the spar-deck presents an uninterrupted area, on both sides, the ordinary objectionable crank hatches being dispensed with. The slow combustion peculiar to the caloric engines renders the huge smoke funnel unnecessary. A short pipe to carry off the gases produced by the combustion in the furnaces takes its place in the caloric ship. The absence of steam in every form is sufficiently important in producing a more pleasant atmosphere than in steamers, but far more remarkable is the fact that the quantity of air which will be drawn out of the ship by the action of the supply cylinders of the engines, will exceed *sixty tons in weight* every hour! Each supply piston presents an area of 102 superficial feet, with a stroke of six feet. 612 cubic feet of atmospheric air will therefore be drawn into the engine at each stroke; and when the engine makes fourteen strokes per minute, 8,568 cubic feet. But as there are four supply cylinders, they will in this space of time draw in 34,272 cubic feet. The weight of atmospheric air is nearly $13\frac{1}{2}$ cubic feet to the pound; and thus it will be seen that 68 tons of air are drawn from the interior of the ship, through the engines, and passed off into the atmosphere, every hour. The effect of such an extraordinary system of ventilation, in purifying the atmosphere of the ship, is self-evident.

The simple construction of the caloric engine, and the small quantity of coal to be handled, will reduce the number of engineers and firemen, in the aggregate, to less than one-fourth the compliment required for steamers. This great reduction in the number of men, whose duties are incompatible with strict cleanliness, will still further promote a purer state of atmosphere in caloric ships than in steamers. Again, as no smoke whatever is produced, when anthracite coal is employed, the masts and rigging of the caloric ship will be as clean as in sailing vessels.

The following are some of the dimensions and statistics of this ship: Length, 250 feet; beam, 40; hold, 27; tonnage, 2,000 to 2,200; diameter of wheels, 32 feet; face of wheel, 11½ feet; power of engines, 600 horse; consumption of coal per day, (24 hours,) 8 tons; number of men in engine department, 10; number of sailing crew, 20; passenger accommodation for 200, with room for enlargement to double the capacity; room for 1,500 tons freight; cost, in the neighborhood of $300,000.

The scientific and commercial world will watch with deep anxiety the result of this grand experiment with the caloric engine. Should it fail, a contingency, by the way, which its friends deem most improbable, the world will lose nothing, and the experimenters comparatively little, since the strong and beautiful ship may be put to other uses in ordinary steam navigation. Should it succeed, the days of steam are numbered.

ON CERTAIN POINTS IN THE CONSTRUCTION OF MARINE BOILERS.

Mr. J. Scot Russell, the celebrated ship architect of England, having arrived at certain theoretical results relative to the construction of marine boilers, put them into practice, about ten years back, in designing the boilers for the Royal Mail Steam Packets Clyde, Tay, Tweed, and Teviot; and as they have been in constant work ever since, running from 42,000 miles to 48,000 miles per annum, without material repairs, he believes their durability, combined with effective combustion, and economy of fuel, to have been fully established. The principles upon which these boilers are constructed, differ from those generally recognized. In the first place, it was considered that a judicious distribution of the most intensely heated surfaces would be conducive to durability; and for this purpose, instead of returning the flues over the furnaces, the top of the furnaces and the hottest flues were brought to the surface of the water, and the cooler, or return flues, were taken to the bottom of the water. The water was admitted at the bottom, and was gradually warmed as it rose, the greatest heat being imparted at the last moment, by which means the bubbles of steam were prevented from accumulating in contact with intensely heated metal. In the next place, the capacity of the furnaces, or fireboxes, was unusually large, and their height above the incandescent fuel much greater than usual. The evaporating surface in these boilers was also much more than customary, there being no less than three feet of evaporating surface for every foot of furnace bars. The process of blowing off was provided for by arranging, under the flues and furnaces, large water spaces, as reservoirs for the collection and blowing off of brine, and other deposit.—*Proc. Inst. Civ. Eng.*

DIAPHRAGM STEAM GENERATOR.

The principle upon which this steam generator, invented by M. Boutigny, is based, is that "bodies evaporate only from their surfaces." This being received as an axiom, it must necessarily follow, that in the construction of steam boilers, either the evaporating surface of metal should be extended to its utmost limit, or the water should be so divided, and its evaporating surfaces be so multiplied, as to arrive at the same end, of obtaining the greatest amount of steam, by the expenditure of the least amount of fuel. The steam generator is described as consisting of a vertical cylinder of wrought iron, 25 inches high, by 12⅝ inches diameter; the base terminating in a hemispherical end, and the upper part closed by a curved lid, upon which was attached the usual steam and safety valves, feed, steam, and other pipes, &c. The interior contains a series of diaphragms of wrought iron, pierced with a number of fine holes and having alternately convex and concave surfaces. They were suspended by three iron rods, at given distances apart, in such a manner as not to be in contact with the heated exterior, or shell of the boiler. When any water was admitted through the feed-pipe, it fell upon the upper (convex) disc, which had a tendency to spread it to the periphery, the largest quantity falling through the perforations in the shape of globules; the second diaphragm, being concave, tended to direct the fluid from the circumference to the centre, and so on, until, if any fluid reached the bottom of the cylinder, it mingled with a thin film of water, in a high state of ebullition, that being the hottest part of the boiler. It appeared, however, that in its transit through these diaphragms, the water was so divided, that, exposing a very large surface to the caloric, it was transformed into steam with great rapidity, and with great economy of fuel. The boiler described has been worked for a long time at Paris with great success, giving motion to a steam engine of two horse-power. The consumption of coal is stated to be very small; 789 pounds of water having been converted into steam by 182 pounds of coal in nine hours, under a pressure of ten atmospheres. The chemical part of the question has been carefully examined, and it has been shown that at that temperature the iron was exactly in the best condition to bear strain. M. Boutigny has only proposed this system for small boilers, and under circumstances of wanting to obtain a motive power in situations of restricted space, and where first cost was a great object.— *Civil Engineer's and Architect's Journal.*

NEW TUBULAR BOILER.

Mr. Fairbairn, at the last meeting of the British Association, described a new tubular boiler, which consists of two furnaces, the same as the double-flue boiler, but with this difference, that the cylindrical flues which contain the grate bars are united at a distance of eight feet from the front of the boiler into a circular flue which forms the mixing chamber, and which terminates in a disc plate, which contains a series of three-inch tubes, eight feet long, and similar to the locomotive boiler. These tubes in a boiler seven feet diameter are 104 to 110 in number, and, from the thinness of the metal, become the absorbents of the surplus heat escaping from the mixing chamber and the furnace. On this principle of rapid conduction, the whole of the heat, excepting only what is necessary to maintain the draught, is transmitted into the boiler, and hence follows the economy of entirely dispensing with brickwork and flues, — an important desideratum in those constructions.

CORNISH ENGINES.

The following statistics of the famous Cornish engines of England, for the months September, October, and November, 1851, are given in Lean's Engine Reporter. These engines, it is well known, are among the most perfect and powerful ever constructed, and the result of their working strikingly illustrates the wonderful precision and magnitude of the steam power. They are employed in raising water from the deep mines of Cornwall. The number of pumping engines employed in September was 21; consumption of coal, 1,512 tons; water raised, 13,000,000 tons, ten fathoms high. Average duty of the whole is, therefore, 50,000,000 pounds lifted one foot high by the consumption of 94 lbs. of coal.

October, — number of engines employed was 20; consumption of coal, 1,960 tons; water raised, 16,000,000 tons, ten fathoms high. Average duty, 49,000,000 lbs., lifted one foot high, by 94 lbs. of coal.

November, — engines employed was 21; consumption of coal, 1,525 tons; water raised, 13,000,000 tons, ten fathoms high. Average duty, 49,000,000 lbs., by 94 lbs. of coal.

MILLER'S MONOZYMATIC CONDENSER.

The object of this condenser is to condense the steam as it passes from the exhaust pipe of the cylinder, by the application of cold water to the outside of the metal, separate from the steam, and to return the condensed steam — pure water — as feed, to the boiler. The primary object of a condenser is to obtain a vacuum behind the piston, by the sudden reconversion of the steam into water, thereby reducing its bulk. The vacuum obtained in common condensing engines, in good order, is about 13 lbs. to the square inch, which is just about 2 lbs. less than the pressure of the atmosphere, and is therefore so much gain to the engine, excepting the power required to work the air-pump, which must be deducted. The common method of condensing, is to let the steam come in direct contact inside of the condenser, with the cold condensing water, and keep pumping out the hot, at 100°, and supplying the condenser with cold water. The principle of condensing the steam by the outside application of water, is older than the injecting of cold water among the exhaust steam, but it has always been considered an inferior mode of condensation. In Miller's condenser an exhaust pipe conveys the steam from the cylinder, after it has acted upon the piston, to the condenser. This exhaust steam, however, is allowed to pass into a heating vessel, before entering the condenser, where it is condensed in the inside of the tubes of the condenser, by the application of a constant stream of cold water to the outside of the tubes. The condensed steam inside falls to the bottom of the condenser in the state of water, from which it is pumped, and forced into the boiler, as pure feed water, by two air pumps, which thus serve as feed pumps. Before entering the boiler, it passes through a metallic vessel, and is there raised by the exhaust steam to about the boiling point. The great object in condensing the exhaust steam to save power, is to get a good vacuum behind the piston, and the great object in saving fuel is to return the water to the boiler as hot as it is possible to do so, and in as pure a state as possible; this is believed to be successfully accomplished by this arrangement. There is an air chamber on the top of the heater, to let the accumulated elastic gas and air in the water escape from time to time; this can easily be done by the engineer, according to where the heater is situated, by the cock on the top of the air chamber. It was a great improvement in sudden condensation, when the cold water was first applied inside of the cylinder — injected among the steam — instead of on the outside, because it requires so much cold water to condense the steam — no less than 22.24 cubic inches of water to one of water converted into steam. Watt endeavored, by his first condenser, to obtain enough of cooling surface to condense the steam inside by using thin hollow chambers, but he soon resorted to mixing the cold water with the steam again. Hall's condenser, for the same purpose, consisted of a faggot of small copper tubes, but this condenser, we believe, is nowhere in use. Plenty of cooling surface can be obtained by pipes, &c., but owing to the expansion and contraction of the metal, at the joints, there is a continual tendency to leakage, and a leak destroys the whole object of the condenser. To construct a condenser upon principles to obviate the evils of leakage by the expansion and contraction of the metals, has been the object and aim of Mr. Miller. The tubes of the condenser are united by screw joints, with vulcanized india-rubber between the flanges. The steam coming from the boiler, through the heater, has free passage at once to all the condensing tubes. These tubes are of a peculiar construction; each one is double, and the interior end, where the steam at first strikes it, is round and unconnected, and free to expand and contract without affecting the joints.

The steam passes into each pipe, and the cold water is applied both upon the outside, and also upon the inside surfaces; there is therefore a double cooling surface for the steam in each pipe. This arrangement is said to work excellently in practice, and to save a large amount of fuel.

HYDRAULIC REGULATOR FOR STEAM-ENGINES.

THIS regulator, invented by Messrs. Thurston and Green of New York, is a cast iron cylinder, about 18 inches high, and 6 in diameter. This cylinder contains two brass cylinders, with plungers and piston rods attached, one being 3 inches in diameter, and 4 inches high, and the other is 2 inches in diameter, and 12 inches high. Connected with the two inch cylinder at the bottom is an escape faucet, by which the fluid which is forced into that cylinder may escape when open. The piston rod connected with the plunger of the two inch cylinder or pump, is connected at the top with a lever attached to the stem of the steam valve of the engine, and the piston of the three-inch cylinder is connected with the engine in such a manner as to drive the pump's plunger 100 motions per minute. This pump forces the fluid from the outer cylinder into the two-inch cylinder at the bottom, and the faucet is opened just far enough to allow the fluid forced into the two-inch cylinder to escape without the plunger of the cylinder being raised more than four inches, being the amount of play or vacillation allowed this rod and plunger when the engine makes the number of revolutions per minute required. Attached to the upper part of this piston rod is a weight capable of opening the valve at all times when there is not fluid enough forced in to hold the plunger up high enough to close the valve. By this means engines can be held, regardless of the kind of work to be performed, so as not to vary more than half of one revolution per minute; for when the engine increases in speed, by machinery being thrown out of gear, or on account of a higher pressure of steam, the pump is driven faster, more fluid is thrown into the two-inch cylinder than provided for, the plunger in the cylinder is thrown higher up, and the top of the piston rod of the plunger being connected with the steam valve, the valve is partially or entirely closed, so that no more steam can pass the valve than just enough to give the desired number of revolutions. If the engine does not run so as to drive the pumps at one hundred revolutions, there is not fluid enough forced into the two-inch cylinder to keep the plunger up; consequently it drops down and opens the valve, until the exact volume of steam to drive the engine the desired number of revolutions is received. — *N. Y. Farmer & Mechanic.*

IMPROVED GOVERNOR FOR STEAM ENGINES.

JOHN TREMPER, of Buffalo, N. Y., has invented a very simple and beautiful improvement on Governors for steam engines. It can be made at a very small cost in comparison with the common governor.

A vertical spindle receives motion from the main shaft; on this is placed a sliding collar, which is connected by a rod to the throttle valve. The slide, however, has no flexible arms attached to it, to elevate the rod by centrifugal action. The construction and operation are different in principle, entirely, from the common governors. Two straps are attached to the top of the spindle opposite one another, and the lower ends secured to balls on horizontal rigid arms, which are secured to the sliding collar. The straps partake in a moment of the motion of the spindle, and act upon the balls at once on the outer ends of the horizontal arms and lift up the sliding collar in an instant. The action of this governor is by velocity and gravity, the velocity of the spindle and the gravity of the sliding collar. A sudden increase of velocity in the spindle makes the cords of the arms wind around the top of the spindle, and this lifts the sliding collar instantly, when the steam is cut off, and then the gravity of the balls and collar, when the velocity of the spindle is thus checked, soon restores the cord to its angular rigidity. It is a unique system of checking and balancing for governing the quantity of steam required for the engine, so as to preserve a uniform motion of machinery. — *Scientific American.*

WILLIAMS' ALARM WATER GUAGE.

This water guage is constructed simply on the principle, that water will find its own level. A tube, containg a float, is brought into connection with the boiler by two pipes, through which the water flows; a glass tube at one side shows the height of the water. When the water falls to a certain level in the boiler, the float within the tube rests on an arm — that opening a valve produces a whistle or warning to the engineer. The lower cock of the instrument is attached to the boiler on a line with the top of the flues or lowest water line; the tube is sufficiently long to make allowance for the proper fluctuations of water — 10 to 20 inches. No matter how the water foams within the boiler, the indications of the guage are those of solid water.

IMPROVED SAFETY VALVE.

The following is a description of an apparatus patented in England by Messrs. Bloomer & Co., for the prevention of steam-boiler explosions. It consists of a valve, which is screwed to the top of the boiler, over which stands a hollow fluted column about three feet high, forming a box to contain the weights on the valve, and a pillar for a wheel, over which works a flat chain connected with the buoy in the boiler, having at equal distances two long links, one on each side of the pillar.

Two levers, connected with the valve, and fixed on centres, pass between the long links, so that the water in the boiler, rising or falling beyond a given level, depresses the lever, opens the valve, and permits the steam to escape. An index is fixed on the wheel which gives the height of the water in the boiler; the steam is also weighed without the addition of levers, and the weights are securely locked in the pillar to prevent alteration.

MAMMOTH LOCOMOTIVE.

A MAMMOTH locomotive has recently been built for the Camden and Amboy Railroad, weighing 30 tons, and of 350 horse power. The Railway Times gives an account of the mechanical peculiarities of this engine, as follows: This engine differs from other locomotives in several particulars. The first is, the manner in which the motive power is communicated to the wheels, namely, by connecting the cross-head by a rod, with a pendulum, or long lever suspended from a shaft, supported by pedestals fixed on top of the boiler. This lever, vibrating, gives a very slight angle to the first connection rod, and consequently occasions very little friction, between the cross-head and guide. The main connection takes hold with a fork, at the lower extremity of the first connection, and passes back to a wrist in the third pair of wheels; from this passes another connection rod to the fourth or rear wheels — then to complete the arrangement forward, the third pair of wheels has fixed on the centre of the axle, a spur gear, communicating through an intermediate wheel to another fixed on the axle of the second pair or rear truck wheels; these wheels are connected by side rods to the front truck wheels, making the whole eight wheels, or four pairs, driving wheels. Another striking peculiarity of this engine is the manner of heating the water before it enters the boiler. In the first place, the tank is connected by hose to the ash pan, which is made with a double bottom, so as to form a space of three inches between the sheets, to contain water; from this the water passes through an internal pipe, enclosed by the exhaust pipe; thence to the smoke-box, where it passes out to the pumps, which are vertical, and fixed on the outside of the smoke-box, and worked from an arm fixed on the pendulum shaft; by this arrangement the water is heated to nearly the boiling point before it enters the boiler.

The engine is calculated for freight trains, having wheels only four feet in diameter. The boiler is 24 feet in length, and 50 inches in diameter, tapering each way, forming a line on the bottom. The furnace is 47 inches wide and 7 feet long, having a bridge 12 inches from the tube sheet.

IMPROVEMENTS IN LOCOMOTIVES.

MESSRS. REMSEN, and HUTTON, of Troy, N. Y., have taken measures to secure a patent for improvements in Locomotives. The steam is admitted to the cylinders on one side of the pistons only, so that the cylinders are single-acting — the piston rod only acts upon the crank and driving-wheel during one half of the revolution, and that while the crank pin is above the axis. To insure a constant application of power, three cylinders are employed, with their pistons acting upon cranks placed at an angle of 120°, to each other. Each cylinder, however, is so constructed, that the pistons can be operated in both directions, for reversing the motion. One immovable eccentric for each cylinder is made to work the engine both ways, and thus the complicated mechanism of the ordinary reversing gear is dispensed with. Each cylinder is furnished with two valve boxes and two valves, one valve opening and closing the steam and exhaust passages leading to and from one end of the cylinder, and the other, those leading to and from the other end of the cylinder. Both valves are attached to the same rod, and both are always moved when the engine is working, but the steam is only admitted to one valve box at a time. Two steam pipes and two exhaust pipes are thus rendered necessary to each cylinder, one steam and one exhaust communicating with either end. Two main steam pipes only are required, each branching to the separate cylinders, and each provided with a valve for opening and closing its communication with the boiler. By simply opening one valve, and closing the other, the engine may be worked in either direction, according to which valve is opened and closed.—*Scientific American.*

NEW RAILROAD CAR FOR GRAIN, COAL, ETC.

The American Railway Times gives the following description of a new car, for the transportátion of grain, coal, &c., the invention of Mr. Myers, of Philadelphia.

This car consists of two wrought iron cylinders, of sufficient length to suit the track, with the felloe or rim of a railway wheel, slipped over each end and substantially riveted to it. In the centre of each cylinder is placed a partition, the whole length and depth of the same. On the head of each cylinder is fastened the journal, which rests on, and works in boxes placed underneath the frame, and thus connected together. The door extends lengthwise the cylinder, between the wheels; is in four equal parts, and hinged in the usual manner, and is secured by an iron rod, passing through the wheels and over the same. The contents thus revolve with the cylinder, and their abrasion is prevented, by the centrifugal force produced by the usual velocity attained on railways, and the partition placed in the cylinder also effectually prevents the same during the necessary slow motions on the road.

IMPROVED CAST IRON SLEEPERS FOR RAILWAYS.

Mr. Godwin at the British Association suggested an improvement in cast iron sleepers for railways, which consists in substituting a cast iron chair and sleeper for the permanent way of railways, in cases where, from the decay of the wood sleeper, it may be necessary to reconstruct the line. The fastening of the rail to the sleeper is the main feature in the invention, and consists in driving a cast iron wedge between the rail and chair, forcing the rail upwards, and thus producing a simple and permanent fastening. Mr. Godwin suggested, as a further security against the wedges shaking loose, that they may be driven in with sal ammoniac, and thus ensure an immovable and permanent line of road.

IMPROVEMENTS IN VENTILATING RAILROAD CARS.

Paine's Ventilating Car. — The principle upon which this improvement is founded, differs from that of the ordinary systems of ventilating cars in this respect: that, with Mr. Paine's apparatus, the currents of air which pass through the car enter at the top, and pass out through the windows at the side. Hitherto the open windows of cars have been relied upon for supplying fresh air, and the ventilators in the top of the car have been *exhaustive*, designed to draw out the impure air.

The car to which this system is applied is built like any other car, with the exception of the windows, and these form an important part of the apparatus. Instead of opening like a common house window, they open like a door, and each one is opened, say two inches, the opening looking outward, in the opposite direction to which the car is running. The car being set in motion, the friction of the external air upon the points where it comes in contact with the air within the car has the tendency to exhaust the latter, or exercise a *traction*, if we may so express it, upon the whole volume that the car contains. The second part of the invention has for its object, the supplying of external air to the constantly exhausting volume within, free from dust, and in the proper quantity. This is done by apparatus fixed upon the roof of the car. Suppose a tin pan full of water upon the roof, with an opening into the car around and beneath it. Over this tin pan place a lid, made up of short, aggregated tubes, which stand perpendicularly to the water. Now adjust it so that all the air that enters the car at this point, shall enter through this lid, or screen of tubes, and set the car in motion. The air rushes in through the tubes and must take its direction perpendicularly to the water, striking the surface of the water at a right angle, and projecting and depositing upon its surface the dust for the time suspended in it. The air itself passes over the edge of the pan, the lid not coming down to the edge, and enters the car pure. The roof of the car is supplied with a series of ventilators, each of which has wings attached to receive as much air as possible. The air entering these, it will be observed, is not strained of the dust and cinders it contains by passing through the water, but the whole mass of air merely comes in contact with the surface of the water, before it passes over the edge of the pan, and thus deposits its dust, or the dust, by its superior weight, possesses a momentum which carries it through the current as it shifts to pass over the pan, and throws it upon the water before the new current changes its direction.

The advantages of the car are obvious. A fine ventilation is secured, and all dust is obviated. Both these advantages are invaluable, but added to these is the advantage of stillness in the car, all the noise from the outside being obliged to enter the car against the strong current of air passing out of the windows.

There are also two objections to this system of ventilation. The first is that when the car is not moving, (for instance in the station-house,) the passengers will be in danger of becoming stifled, since the rapid motion of the car is necessary in order to force any considerable quantity of air into the car through the ventilators.

The other objection is, that in cold weather the new apparatus will force too much cold air down upon the heads of passengers; and that the open windows, which form an essential part of the plan, will then be found disagreeable.

The New Haven Courier gives the following description of another invention designed to promote the comfort of passengers travelling by railroad: "The invention consists merely in a connection formed between all the cars by inclosing the platforms, so that the external air, with the dust, smoke and cinders, are entirely excluded from the usual ways of ingress. The front of the baggage car is open, but protected from the smoke of the locomotive by a screen. The air rushes in through the front of the car, and circulates freely through the whole length of the train, keeping up at all times a gentle motion of the air, without the possibility of annoyance from dust, &c. It has its advantage over Mr. Paine's ventilator, that when the air is at rest, the passengers have the free use of the ordinary means of ventilation by doors and windows, and thus the intolerable heat is avoided, while there is no fear of the admission of smoke, which forces itself into Paine's ventilators when passing under bridges, or on a wet day, when the wind is dead ahead, and rolls it along the roof."

At the Fair of the American Institute in October, 1852, at New York, some twenty-five different models of improvements for ventilating cars were on exhibition. The two of most apparent importance, were those mentioned above. — *Editor.*

RAILWAY IMPROVEMENTS.

Trink's Double Acting Brake. — The principle of this is to raise the wheels off the track in this manner: The brake, which is made of transverse pieces of wood, forming a frame, is placed behind the wheels, and is connected by a rope or chain with the screw or lever on the platform of the car, by which the brake or frame can be dropped or raised instantly. On this frame or brake are inclined planes forming part of a circle, and when the frame is dropped for the purpose of stopping the train, the momentum of the train causes the cars to run on the axles of the wheels up the inclined plane, thus lifting the wheels off the rails and throwing the weight of the cars on the frame, pressing it on the rails, and acting as a brake. The frame when down, rests upon iron shoes, three upon each side, which are prevented from sliding off the rails by means of flanges on the inside, similar to those on car wheels. The brake thus unites two capacities: First, in raising the cars, by which operation, although the wheels may revolve, yet it is without effect, as they do not rest upon the rails; and secondly, the frame is a heavy brake, creating an immense friction on the shoes, by which, though the train will slide a short distance, it will very soon be stopped. The application of the brake can be done by the engineer, conductor, or passengers, by simply pulling a rope which passes through and on the top of the cars, and a slight pull will detach the catch on the lever, when the frame-work drops from its own weight. One advantage here is, that in case an axle or wheel breaks, the car will rest upon the frame, checking the speed of the train, and communicating intelligence to the engineer that some accident has happened. The winding up of the frame can be done by hand, or steam power, if desired.

Railroad Car Replacer. — This invention, by Mr. S. H. Bean, consists of an inclined plane, constructed of wood, or iron, attached to each end of an axle, which is placed in front of each wheel of the car that has run off the track, which inclined plane extends some distance above the tops of the rail, and by the gravity of the car, slides down a transverse inclined plane to its proper position on the track, after which the replacer is attached to the car, it being of an easy portable nature.

Locomotive Mirrors. — The practice of placing a looking-glass before the engineer in a locomotive, inclined in such a way as to enable him to see the whole train behind him without turning, is gradually becoming universal on the continent of Europe. Many roads in France have adopted this plan, the greater part of those in Austria have tried it successfully, and the locomotives on the line from Brussels to Antwerp have been just fitted with the necessary reflectors. Should a car or any portion of the train become detached, should an axle break, or in short any accident happen, the engineer sees it at once.

Improvement in Boxes for Axles. — An improvement in boxes for axles of railroad cars, has been invented by Messrs. Provest and Smith, of Germantown, Pa., which is thus described: The steps in which the spindles of the car axles run are made in two pieces, so that when any strain may come upon them in the line of the running of the car, they may be forced apart sufficiently to allow the axle to come up into proper position, to prevent the otherwise twisting of it by being cramped between the rails. The two-part step may have a tongue both upon the top and bottom, which may work in corresponding grooves in the top and bottom of the box, or it may slide in a rebate; in either the box may be so provided with flanges as to form a receptacle for the oil. Behind each of these parts of the step, springs are arranged, which admit of the step being opened when turning curves, and closing it when coming on straight lines, thus allowing the axle to adjust itself as the nature of the case may require. The spring behind the step also allows it to yield slightly when the wheels strike against any obstruction on the road, thus taking the sudden jar or strain upon the springs instead of the spindles of the axle, as in cases where the boxes are tight, and which often bend or break the spindle.

Several premiums for improvements in railroad cars, &c., having been offered by Mr. Ray, of Brooklyn, N. Y., through the American Institute, a great number of inventions and improvements were brought out at the fair of the Institute, in October, 1852, at New York. Nearly one hundred different novelties in methods for ventilation, brakes, seats, spark catchers, wheels and axles, rails, &c., were brought forward, all of which seemed to embrace decided improvements on the methods now in vogue. Among them was a sheet or plate iron car, constructed and designed by Mr. F. E. Warren, of New York. The points arrived at in this instance, are greater strength in the car, combined with less weight than is requisite in all passenger cars now in use; greater durability; an increased width ("in the clear") of nine inches, which will enable the car to be fitted up so that three rows of berths or sleeping places for passengers, three tiers high, may be placed in each car, with two passage ways, sufficiently wide to admit of free locomotion in the carriages. The result of this arrangement is, that in one of these cars designed to seat sixty passengers during the day, quite as many can be comfortably and conveniently bedded at night. They can also be ornamented with cast iron ornaments even more beautifully than they are now embossed and ornamented, and at far less expense. In case of an overturn or collision they cannot fly into splinters as at present, and are therefore hardly ever to be so damaged by accident as to be rendered worthless. As a matter of course, they can be finished or fitted up and lighted in any desired style. By the use of non-conducting lining they may be made as impervious to heat in summer as to cold in winter; and they will receive and permanently retain any description of ornamental painting now in vogue for cars or coaches. The supports and braces of these cars are made of plate or drawn iron tubes standing in cast iron plates, and the joints of the thin plate metal, which takes the place of the panelling, floors, and roof of wood in the cars now in use, are made close and very strong by a system of flange riveting. It is understood that this description of car can be afforded at a considerably less cost than the ordinary first class passenger cars now in use, and when no longer serviceable, the materials of which they are constructed will be valuable for other purposes.

SUBSTITUTE FOR THE COW CATCHER.

An invention has been made by Mr. Darling, of Utica, N. Y., designed as a substitute for the cow catcher now generally used in front of locomotives on railroads. The object is to clear the track not only from cows, but all other objects obstructing the passage of the cars.

The cow catcher now in use does not invariably succeed in throwing the obstacle from the track. It frequently passes over it, suffering the obstacle to remain, when the whole train passes over it, often throwing the cars from the track. The design of Mr. Darling's invention is to render more certain the work of clearing the track, and preventing these disastrous occurrences. This is accomplished by setting in motion in front of the locomotive a horizontal wheel which with quick motion sweeps over the track. This wheel runs close to the rails, and either throws aside the opposing obstacle at the instant of contact, or if it falls upon the wheel, it is no less instantly disposed of. The wheel is connected by gearing, to the front axle of the locomotive, and receives a swift circular motion from its movement. An apron of plate iron is wrapped round in front covering about one half of the disc of the wheel and presenting the convexity of its arch forward; so that any object falling upon the wheel is instantly brought against the opposing front of the apron. This, sloping back at the side, the quick motion of the wheel instantly throws the object sideways from the track. — *N. Y. Farmer & Mechanic.*

STRAINS UPON THE DIAGONALS OF LATTICE BEAMS.

The London Journal of Arts and Sciences gives an account of experiments recently made in London upon lattice beams.

The experiments were made on a model 12 feet in length, so constructed that the diagonals in compression, (which were strips of mahogany, let into the top and bottom, but not fastened to them, and the ties which were of hoop iron chains,) must of necessity take their respective bearing and strain; and by the substitution of a dynamometer for any one of the ties, the strain on it could be accurately measured.

The results of the investigation were, that for a parallel beam of one span, supported at each end and loaded at the centre, the strains throughout the diagonals were uniform, and the horizontal strains were greatest at the centre, decreasing uniformly at the points of support. For a similar beam, uniformly loaded over its entire length, the strains at the diagonals commenced at the centre, increasing uniformly to the points of support; while the horizontal strains decreased from the centre to the ends in the ratio of the ordinates of a parabola. These results were arrived at by different methods of reasoning, and the formulæ derived from them were stated to be applicable to the more complex form of a closely intersected lattice, taking into consideration the increased number of triangulations.

ON THE FORM OF IRON FOR MALLEABLE IRON BEAMS, OR GIRDERS.

The following is an abstract of a paper read before the British Association, by Mr. T. M. Gladstone: — It is, said Mr. Gladstone, on the application of wrought iron beams or girders I propose to make some remarks, by contrasting their powers and properties with those of cast iron; to show what form of iron I conceive best adapted for such use, and to state, as a manufacturer, what may be expected as the capabilities of iron works to produce the same beyond previous efforts, so as to meet the increased requirements of the times. It is found that, by converting iron from a cast into a malleable state, the adhesion of the fibres of the metal, under tension, becomes increased from 7 to 27, and indeed much beyond that when the best quality of material is manufactured. At the same time, it is stated that the compressive strength is somewhat reduced. In this latter assumption I do not altogether concur, from a permanent feature in the experiments not being sufficiently taken into account — namely, that in experimenting with wrought iron, at a given extension, from pressure, it is necessary, before you obtain even a medium value of the resistance, a modicum of deflexion must take place to bring into play each of the fibres; consequently, not like as in a rigid cast beam, where the full action of compression acts at once, some allowance must be made for the change from the first position, in calculating the compressive forces. Assuming generally that the increased strength of tensive power of wrought compared with cast iron is 27 to 7, it at once reduces the sixfold area of the bottom web of the iron beam, and nearly reduces to one-half the required sectional area throughout, yet retaining an equal strength for every purpose. In many cases this increase of strength, enabling to reduce the weight, will fully compensate for the difference in price, so that up to this point the market and effective value of both may be said to be equal. The wrought iron beam, however, posseses this material advantage, and that is, it will always give good warning before the point of danger is reached, and this, mainly from its vastly increased deflective power, — indeed, before its maximum is reached a great deflexion can safely take place; therefore, both for life and property its advantage is most conspicuous. With regard to the best form for carrying the greatest weights with the least metal, I have come to the conclusion, from actual experiment on a large scale, that the double T section is the best, provided the flanges are sufficient to prevent lateral action from the load. At the Belfast Iron Works the members can see iron of the section shown in bars of twenty-six feet long, and weighing nearly half a ton, so that it will be seen the mills are now constructed so as to roll iron almost any dimensions which may be required, and such bars, from the breadth of the flanges, have never before been attempted, in the three kingdoms. When I had the honor, some four years ago, to read a paper at the Society of Arts on a means of constructing bridges without any centering of such proportions of iron, no ironmaker would attempt to produce such a proportion of material, while now I have accomplished it, and would have no hesitation in making them much larger if required. I have not a doubt for warehouses, mills, public buildings, and bridges, its value will now become extensively applied and appreciated. As these bars are rolled solid throughout, on comparison I have found they will bear nearly one-third more than any made beams of equal sectional area, — that is, with a beam of which the centre rib is of plate iron and the flanges of angle iron, and riveted thereto, and so distributed as to make the double T form. This is easily accounted for, as you necessarily weaken he whole by its being requisite to introduce riveting, while a due and equal resistance is offered from all parts by the solidly rolled bar.

STRENGTH OF IRON.

The following result of an experiment on *coupling chains* lately made at Manchester, in England, by the London and North-Western Railway Company, will be interesting to the consumers of iron: —

Best Staffordshire Iron — first experiment — diameter of chain $1\frac{1}{8}$ inch; stretched $3\frac{3}{4}$ inches; broke with 27 tons, 10 cwt.

Best Staffordshire Iron — second experiment — diameter of chain $1\frac{1}{8}$ inch; stretched $4\frac{1}{8}$ inches; broke with 25 tons, 0 cwt.

Lowmoor Iron — diameter of chain $1\frac{1}{8}$ inch; stretched 7 inches; broke with 55 tons, 16 cwt.

The Staffordshire Iron was made expressly for the trial, and when great strength is desired, it is proper so to state, as there is a wide difference in the preparation of the different qualities. The New York Herald contains an account of several highly interesting experiments which have recently been made, with a view of testing the strength of iron manufactured from the Franklinite ore of New Jersey. The following table exhibits the strength of this iron, compared with the best manufactures of other countries: —

Best Swedish bar iron, - - - lb.	72,804
Inferior Swedish bar iron, - - -	53,224
Best English bar iron, - - -	61,660
Inferior English bar iron, - - -	55,000
American manufactured from N. J. Franklinite bar iron,	77,000

Iron manufactured of Franklinite, drawn down from a bar about one inch square, and accurately gauged, required a weight equal to 77,000 lbs. per square inch, to tear it asunder. This shows it to be nearly fifteen per cent. better than any other iron known to commerce.

The annexed assay on a bar of iron made from Franklinite, sent to the national forges of the government of France, from the mines in New Jersey, is the best evidence of its importance and immense value:

" The bar obtained by direct treatment of the ore in the Catalan forge, is 25 millimetres by 24.5 millimetres, and presents a section in square millimetres of 612, m. 50.

	Kilograms.	M.
Charge under which bar began to stretch, -	15,000	
Elastic force per millimetre, - - -	24	5
Charge under which the bar broke, - -	25,000	
Absolute tenacity per millimetre, - - -	40	8
Elongation of the bar at the moment of fracture, per millimetre, - - - -		3

Aspect of the fracture, all nerves; the bar was imperfectly welded and contained fissures which diminished the real surface exposed to fraction, in consequence of the absolute tenacity. Had the bar been sound, it would have been greater than here appears; — at the moment of fracture but little heat was disengaged."

IMPROVEMENTS IN IRON SMELTING.

The mode of smelting iron consists in mixing the ore with lime and coal; the former producing a glass or slag with the impurities of the ore, while the coal reduces the oxide of iron to its metallic state. Much heat is required in the process of smelting, but the cold air blown in, as the blast, lowers the temperature and compels the addition of fuel, as a compensation for this reduction. Science pointed to this loss, and now the air is heated before being introduced to the furnace. The quantity of coal is wonderfully economised by this application of science; for instead of seven tons of coal per ton of iron, three tons now suffice, and the amount produced in the same time is nearly sixty per cent. greater. Assuredly this was a great step in advance. Could Science do more?

Prof. Bunsen, in an inquiry, in which I assisted, has shown that she can. We examined the furnaces, in each portion of the blazing mass, so as to fully expose the operation in every part of the blazing structure. This seemingly impossible dissection was accomplished by the simplest means; the furnaces are charged from the top, and the materials gradually descend to the bottom; with the upper charge a long graduated tube was allowed to descend, and the gases streaming from ascertained depths, were collected and analyzed. Their composition betrayed with perfect accuracy the nature of the actions at each portion of the furnace, and the astonishing fact was elicited, that, in spite of the saving produced by the hot blast, no less than 81½ per cent. of fuel is actually lost, only 18½ per cent. being realized. If, in round numbers, we suppose that four-fifths of the fuel be thus wasted, no less than 5,400,000 tons are every year thrown uselessly into the atmosphere; this being nearly one-seventh of the whole coal annually raised in Great Britain. This enormous amount of fuel escapes in the form of combustible gases capable of being collected and economised; yet in spite of well ascertained facts, there are scarcely half a dozen furnaces in Great Britain, where this economy is realized by the utilization of the waste gases of the furnace.

Large quantities of ammonia are annually lost in iron smelting, which might readily be collected. Ammonia is constantly increasing in value, and each furnace produces and wastes at least one cwt. of its principle salt daily, equivalent to considerable money lost.—*Prof. Playfair, on the Results of the Great Exhibition.*

THE MINIE RIFLE.

The following is a description of this weapon, which has lately been ntroduced into the British service. The Minie musket or rifle, most approved and ordered to be generally introduced into the service, is a remarkably well finished article, and lighter and more easily used than the previous percussion muskets. The Minie rifle has four grooves inside, and the mode of loading it is first to bite off the twisted waste paper at the end of the cartridge, pour in the powder at the mouth of the barrel, and by a turn of the thumb and finger, holding the cartridge, reverse the ball that the conical point may be upwards. The ramrod is then drawn and reversed, and the head being concave, or cup form, it has a good purchase over the ball, which is easily rammed home, and does not require a second, or subsequent rammings. The piece is then fired with great ease, and is said to be capable of carrying the ball 1,200 yards, and with correct aim up to 900 yards, the aim for all distances from 300 to 900 yards being taken correctly by a parallel groove marked with the respective distances it is wished the ball should be carried when directed at an object, a slide in the groove being raised or lowered to take the "sight."

Mr. Fairbairn, at the meeting of the British Association, observed that, until of late years, all the gun barrels for the army, and other descriptions, had to be welded upon mandrils, some of them formed by a bar of iron rolled upon the mandril, in a spiral direction, and then welded, by repeated beatings from the muzzle to the breech. Others were differently constructed, by welding the bars longitudinally, in the line of the barrel, and not in the spiral direction adopted in the former process. Now the whole is welded at one heat, and that through a series of grooves in the iron rollers, specially adapted for the purpose. This, with other improvements, has rendered the manufacture of rifles and other arms a matter of much greater certainty and security than at any former period. Admitting the advantages peculiar to this manufacture, it does not, however, affect the principle of the rifle itself, in which there is no alteration, but in every respect similar, even to the spiral grooves, which, I believe, are not altered, but are the same as in the old rifle. This being the case, it has been a question of much interest to know wherein consists the great difference in the practice with the new rifle, as compared with that of the old one. It is not in the gun, and must, therefore, be in the ball, or that part of the charge which generates the projectile force. But, in fact, the improvement consists entirely in the form of the ball, which is made conical, with a hollow recess at the base, into which a metallic plug is thrust by the discharge. The plug is so constructed as that when driven into the ball, it compresses the outer edges against the sides of the barrel, and, at the same time, forces a portion of the lead, from its ductility, to enter the groove, and to give the ball, when discharged, that revolving motion which carries with such unerring certainty to the mark. In the practice which I witnessed, with one of those rifles, on the marshes at Woolwich, the following results were obtained. Out of twelve rounds, at a distance of 700 yards, as near as I can remember, only one bullet missed the target, and the remaining eleven rounds were scattered within distances of about six inches to four feet from the bull's eye. At 800 yards three shots missed the target, and the remaining nine went through the boards, two inches thick, and lodged themselves in the mounds behind, at a distance of about twenty yards. The same results were obtained from a distance of 900 yards, and at 1,000 yards there were very few of the bullets but what entered the target. In these experiments I have to remind you that the end of the rifle was supported upon a triangular standard, and the greatest precision was observed in fixing the sight, which is graduated to a scale in the ratio of the distance, varying from 100 to 1,000 yards, which latter may be considered the range of this destructive instrument.

IMPROVEMENT IN FIRE ARMS, ORDNANCE AND PROJECTILES.

A NINE-POUNDER field battery gun has been proved at the Royal Arsenal, Woolwich, on the rifle principle, and experiments will be shortly made with it to ascertain its merit, compared with the usual nine-pounder field battery gun when charged with spherical shot. The four grooves in the rifle cannon are about half an inch deep by half an inch broad each, and the shot and shell intended to be fired from it are made of the cylindro-conical or sugar loaf shape, with four projecting parts on each, to enter and fill the grooves. Both shot and shell are galvanized, and not liable to rust, and are so smooth that they may be rammed home with the greatest ease, the simple pressure of the hand being sufficient to place them an arm's length into the mouth of the cannon, although they are made to fit more fully than the spherical shot does, and consequently they will have less windage and require a less charge of powder. The sugar-loaf shape of the new galvanized iron shot renders it of a far greater weight than a nine-pounder spherical shot, and the principle on which it will proceed, after being fired from a rifle cannon, being similar to an arrow, instead of revolving in the same manner as spherical shot, is expected to cause it to go more directly to the mark, and to have a much longer range.

Another large piece of ordnance has also been recently constructed at the Royal Arsenal, England. Some idea of its strength may be formed, when it is stated that it is 32 inches in diameter, and has 13 inches of solid metal round the bore, which is only 8 inches in diameter. It is intended for firing solid shot, or shells of the elongated or sugar-loaf form, similar to the Minie rifle balls. This metal has only two grooves, placed horizontally opposite each other, which are of an oval, without any flat part, as in small rifled arms. The weight of this piece of ordnance is 114 cwt.

Some experiments have been made during the past year in Prussia with an explosive ball, that may be fired from the gun as easily as its peculiar cartridge, and that explodes the moment it strikes the object; if combustible, setting it on fire. Experiments made with this missile were perfectly successful. Cases filled with powder or inflammable matter were set on fire, or blown up with certainty, at several hundred paces distance, or nearly full range of the weapon, which is a very long one. The object of the invention is the capability of blowing up an enemy's powder wagons by a weapon that can be more rapidly and easily handled than a rifle if they come within reach.

Improved Rifle Barrel.—Benjamin D. Sanders, Brooke Co., Va., has taken measures to secure a patent for an improvement in rifle barrels. The improvement consists in making the grooves of the barrel of a form somewhat resembling the letter V in their transverse section, that is to say, the bottom of a groove is formed by a single angle, instead of by two angles in the ordinary way. The object of the improvement is to make the patch, when inserted with the ball, fill the grooves more tightly than can be done by the common grooves. The barrel, by the new grooves, is kept more clean, as each patch cleans out the barrel completely in its course, and the explosive force of the powder is more directly confined and exerted upon the bullet than can be done in a barrel where the grooves are not so tightly packed by the patch.—*Scientific American.*

COMMERCIAL STATISTICS OF GREAT BRITAIN.

Mr. Braithwait Poole, in a recent work, gives the following interesting statistics of Great Britain. Pitt and Canning stated the yearly production of the agricultural and mechanical interests of Great Britain at an amount equal to the national debt; but nobody knew how they made it out. The summary of these statistics, however, prove that these great statesmen were right.

Mr. Poole shows that the Railways of Great Britain have cost £240,-000,000; the Canals, £26,000,000; and the Docks, £30,000,000.

The Mercantile Marine consists of 35,000 vessels, 4,300,000 tons, with 240,000 men; and one vessel is lost on an average with every tide. The navy consists of 585 vessels, 570,000 tons, and 48,000 men. Yachts, 250, and 23,000 tons.

The ancient Britons knew only six primitive ores, from which metals were produced; whereas the present scientific generation use fifty. The aggregate yield of minerals is equivalent in value to about £25,000,000 annually.

The agricultural produce of milk, meat, eggs, butter and cheese, is 3,000,000 tons, of the value of £50,000,000. The ale, wine and spirits consumed annually exceed 3,300,000 tons, and £54,000,000; while sugar, tea and coffee scarcely reach 450,000 tons, and £27,000,000. The Fisheries of Great Britain net £6,000,000, annually. In Manufactures, the cotton, woolen, linen and silk altogether amount to 420,000 tons, and £95,000,000; while hardwares exhibit 360,000 tons, and £20,000,000; in addition to which 1,250 tons of pins and needles are made yearly, worth £1,100,000.

Earthenware, 100,000 tons, £350,000,000; glass, 58,000 tons, £1,600,000. The Gazette shows an average of four bankrupts daily throughout England and Wales.

TIN PLATES.

Tin Plates, thin plates of iron dipped into molten tin, which covers the iron completely, are manufactured in South Wales and Staffordshire, to the extent now of about 900,000 boxes annually = 56,000 tons, value £1,500,000; affording employment to upwards of

20,000 individuals. In England, almost every article of tin ware is formed from these plates. Nearly two-thirds of the total manufacture are exported, principally from Liverpool to the United States, where they are also used considerably instead of slates for the roofs of buildings. The trade has been rapidly increasing. The exports of tin plates were for the years ending the 5th January, 1847, declared value, £639,223; 1848, £462,889; 1849, £532,142; 1850, £711,649; 1851, £928,181.—*Poole's Statistics.*

THE LOCK CONTROVERSY.

The London Practical Mechanics' Journal thus reports a paper which was read before the Society of Arts, London, by Mr. Hobbs, the ingenious American lock-picker: Mr. Hobbs began by showing the construction of the old form of what is called the Egyptian or pin-lock; he also showed how readily, by obtaining wax impressions of its vulnerable points, it readily yields up the treasures it would not have touched by profane hands. The first modification of this form was made about forty years ago, and another by Mr. Williams in 1839. The objections to its use were pointed out by the facilities they all afforded in being picked with false keys, which were easily made. These, therefore, were in the abstract without utility for purposes of perfect security.

The ring-lock and the letter-lock were also shown to be in the same predicament. Each ring was moved to that position where it was found not to "bind," and retained there until all the rings had been similarly treated, when the "open sesame" formed the best proof of what he said. The letter padlocks, indeed, Mr. Hobbs alledged to be really less secure than the pin-lock. He greatly amused those present in detailing his adventures in picking a lock of something of this description in the Great Exhibition. There were a number of different locks exhibited in one foreign department. Mr. Hobbs was there with a friend. Mr. Hobbs took up the identical thing that was to puzzle the nations, and examining it with educated lock-picking eyes and fingers, soon conceived a means of overcoming the power objected to him. Cutting off a splinter from a wooden bench near him, and quickly forming it to his purpose, and accomplishing that purpose while his friend was otherwise engaging the attention of the exhibitor, he brought forward the lock, and requested him to show the secret of opening it. The exhibitor twisted the rings about, and got the letters into their proper order. "There!" said the exhibitor. But the charm had no effect. The exhibitor, in despair, consulted his memorandum. That *was* the magical word—there was no doubt—but the cause of the non-success was inexplicable, until Mr. Hobbs kindly explained, that in less than the three minutes in which he began and finished his manipulations, he had discovered the key-note, *and had altered it!* Mr. Hobbs showed the construction of the celebrated Bramah lock, which he had succeeded in picking—to the pocket-loss of £200 to the celebrated and too confident patentee. Mr. Hobbs next demonstrated the non-perfect security of the no less distinguished Chubb form of lock, in which great ingenuity is displayed in the combination of what are called "tumblers;" and concluded by suggesting that the true mode of construction consisted not in multiplying difficulties which, with patience, might be overcome, but by the application of new principles; and he shortly pointed out the advantages resulting in this respect from the elaborate performance, for which his peculiar genius must be held in high respect.

An interesting discussion followed, in which Professor Cowper, Mr. Gregory, Mr. Hodge, and others, took part. The result of which seemed to indicate, that as long as it required so much time and so great ingenuity, in a practised hand, to pick locks, and as long as it would be necessary to give £40 or £50 to become the owner of one of Mr. Hobbs' unpickable locks, the locks of Bramah and Chubb—the best of which, for ordinary purposes, might be obtained for less than £3—would lose nothing of their true value for the common purposes to which they are applied.

NEW MILITARY TACTICS.

Sir Charles Shaw, in a recent letter to a London Journal, on the changes necessarily made in military tactics consequent on the introduction of new and improved weapons into the service, states, that the improved musket-rifle can render cavalry and artillery useless at nine hundred yards distance, and the nail ball, out of the old musket, can do the same (as I have witnessed,) at a distance of six hundred and fifty yards. But suppose I am said to be mistaken as to cavalry and artillery; I believe at this moment there is not a regiment of cavalry that could be brought to make an effective charge against a well served field-battery, owing to the confusion and fear of the horses at the noise and smoke of the cannon. To remedy this, and give the horses confidence, the Russians, in the wars of the Caucasus, in drilling, had batteries before the watering places of the cavalry. The cavalry got no water the morning of the drill, but after some hours of hard work, the horses became thirsty. The cavalry were posted in front of the field batteries, which began to play. Loose reins were given, and, at full gallop, the cavalry passed between the guns of the batteries, and thus lost fear of artillery.

IMPROVEMENTS IN LIFE-BOATS.

Within a comparatively recent period, a circular was issued by the Duke of Northumberland, England, offering a premium of 100 guineas for the best model of a life-boat, and pointing out, as the three principal defects of existing life-boats, the want of self-righting power, inability to free themselves from water, and a heaviness which prevented their being transported along the beach. In consequence of this offer, no less than 280 models and plans were submitted, by different inventors throughout Great Britain. In addition to the three desirable improvements pointed out in the circular, the committee to whom the award of the prize was referred, indicated two other essential qualifications for the prize boat, viz., smallness of cost, and the capability of rowing well.

These qualities were found combined only in the boat constructed by Messrs. Beeching, of Great Yarmouth, to which the prize was adjudged, and on which experiments, thoroughly testing its powers, have been made during the gales of the past year.

A curious instance of the REINVENTION which is of such frequent occurrence, is, that the power of self-righting, the demand for which was received with ridicule by the boat builders of 1850, was actually possessed by a life-boat, for which their silver medal and twenty guineas were given by the Society of Arts, in 1809, to the Rev. James Bremner, of Orkney, who had then for many years had his boat in use, and under severe trial, on the Scotch coast. The Society gave a gold medal and fifty guineas, in 1802, to Mr. Greathead, of South Shields, who designed and built for the then Duke of Northumberland, a life-boat which has hardly been since surpassed.

NEW DRILLING MACHINE.

DURING the past season, a gigantic machine has been constructed, for the purpose of cutting or boring a tunnel through the Hoosac Mountain, Massachusetts, to afford a passage for the contemplated Troy and Boston Railroad. This machine was planned with a view of cutting a circular passage or tunnel, 24 feet in diameter. Its construction is as follows: A large wheel, having a thin rim projecting forward from its outer edge, is attached to a revolving shaft. The rim of the wheel is mounted with steel cutters, which are of such size, and so arranged, as to cut, when in motion, a circular trench or groove in the face of the rock, one foot in width, and of the diameter of the tunnel. The shaft of the drill is supported on a sliding frame, which rests upon a main bed, supported upon flanged carrying wheels $5\frac{1}{2}$ feet in diameter. The main shaft is fed forward with the sliding frame, by means of a powerful screw. The distance through which the shaft, with its wheel and cutters, is made to pass, is five feet for each adjustment of the machine, this distance being the depth of the rim upon the main wheel. Upon the end of the shaft, and in the centre of the circle described by the motion of the cutters, a drill of six inches diameter is attached. This drill enters with the cutters, and to the same distance in the rock. On the rim of the main wheel are buckets to conduct the rock cut away into an adit, or receptacle. The machine is intended to operate as follows: When the approaches to the tunnel are prepared, the drill will be brought up to the face of the rock, upon a track laid for the purpose. The shaft with its wheel and cutters will be put in motion, and fed forward into the rock. The circular trench will be cut, and the small central drill will enter at the same time. When the rim of the wheel has entered the rock to its full depth, the machine will be drawn back, a charge of powder placed in the central hole, and the rock within the circular trench will be removed at one blast. One of the arms of the main wheel is made removable, so as to allow a car to pass under the machine to the rock. The fragments broken away by the blast will then be loaded and drawn back to the mouth of the tunnel. The machine is again fed forward and its successive operations will be the same as already described. The main carriage is properly braced so as to be immovable. The weight of the whole machine is from eighty to ninety tons, the weight of the shaft eleven tons, and the weight of the main wheel is thirty tons. It is to be driven by two stationary engines, of forty horse-power each. The designer and inventor of the machine is Charles Wilson, Esq., of Springfield, Mass.

The practical operation of the machine above described, has not, as yet, been wholly successful. The cutters proved too frail to stand the quartz found in the mica slate, of which the mountain is composed, and were soon broken, and rendered unfit for service. It is proposed to replace these cutters with others of a firmer and more substantial character. The machine has, however, cut into the rock to the depth of about four feet, very smoothly and successfully. The wheel cuts from a 16th to an 8th of an inch at each revolution, and makes five or six revolutions in a minute; which more than meets the warrant of the builders. The core of the rock is blasted while the machine remains close by, but there is no apprehension that it will be essentially injured by the exploding masses of rock. A difficulty, however, presents itself in the disposal of the rock, after it is cut and blasted out, it being a slow and tedious process to break it and draw it out through the machine. This difficulty will prevent the working of the machine for more than a third or half of the time, all the remainder being occupied in removing the stone.

We copy from the Scientific American the following notice of a new drilling machine, invented by Mr. C. W. Coe, of Ohio. There are two improvements in this invention. The first has reference to the feeding motion, and also to the mode of raising the drill from the work. The nut which works the feeding screw has on it a pinion capable of sliding up and down, but causing the nut to revolve by means of a groove and feather. This pinion gears into the driving-wheel when at the upper part of the nut; a rapid motion is then given to the screw, which draws the drill quickly upwards. But when it is desired to give the feeding motion, the pinion is depressed by a lever, and thus released from the teeth of the driving-wheel. The pinion is then moved by two lugs or dogs attached to the inner part of the driving-wheel; now, if the driving-wheel has a motion given to it the reverse way to that used when raising the drill, it is evident a slow feeding motion will be given to the screw. If desirable, of course, more than the two lugs can be used.

The second part of the invention embraces a mode of holding the work to be drilled in any oblique direction. A clutch is employed for this purpose of a hollow conical shape, with a screw on the outside — this clutch is cut open in a vertical direction, so that if the work be placed within, it can be compressed by a taper nut working in the outside screw. A spring is used to open the clutch, when the nut is relaxed, and, as it is attached by arms to the bed of the machine, this clutch can be set to any angle. The bed of the machine is movable, so that the work can be shifted horizontally.

CONVERTING ROTARY INTO RECIPROCATING RECTILINEAR MOTION.

HENRY BAKER, of Catskill, N. Y., has taken measures to secure a patent for a new method of converting rotary into reciprocating rectilinear motion. The invention is more particularly designed for the purpose of driving the bed of a printing press, or the bed of any part of a machine to which it is desired to communicate a reciprocating rectilinear motion from a revolving shaft, but it is also applicable in almost any case where the said change of motion is required. The motion is communicated in the first place from the revolving shaft to one or two wheels or pulleys, around which an endless belt or chain is placed, the said wheels and belt being so arranged that the belt will move in a direction parallel, or nearly so, with the desired reciprocating movement. To the bed or object which is to receive the reciprocating movement, there is attached a ring which lies near to the belt, its inner diameter being about equal to that of the wheels or pulleys on which the belt runs. Two pins slide freely through the periphery of the ring on opposite sides, both pins being parallel with the band, and made to project by springs a short distance into the ring. A stud is attached to the endless band, and is made to project into the ring close within its periphery, at right angles to the pins mentioned. As the band moves, this stud catches one or other of the pins, and propels the ring, and whatever is connected with it. One part of the endless belt or chain, on one side of the wheels, moves in the opposite direction to the other side, alternately, and the sliding pins are so placed, that, when the *stud* spoken of moves in one direction, it catches with one, and when it moves in the other direction it catches with the other, and the pins are drawn back from the ring. At the time the stud on the running belt reaches either of the pulleys, it runs around it on the belt and catches the other pin, and by its reversed movement drives back the ring in the opposite direction to that in which it moved before, and thus by an alternate reversal of the ring by the action of the stud on the pins, there is a continual change of motion from rotary to the reciprocating rectilinear, and there is also an intermittence of the motion, which is very desirable in the working of some machines. — *Scientific American.*

NEW COMPACT GEAR.

THE Scientific American thus notices a new compact gear invented by Messrs. Dibben and Bollman, of New York, and exhibited at the Fair of the American Institute. This invention, exhibiting great ingenuity and skill, consists of an arrangement of cog-wheels; and the main advantage claimed over the system now in use, is the capability which this new plan imparts of varying the speed of shafting, whilst only a pair of geared wheels is used for all the different speeds required. The inventors have three models, each showing a different application of the principle: one is applied to a horse-power, another is for increasing the speed of a propeller, and the third is for an application to water-wheels. A few words will explain the invention as adapted to the latter use; the motion here, however, is compound; two small wheels being employed, we should presume, to reduce the dimensions to a commodious size. On the main shaft is fixed a wheel, which gears into another of the same size, both resembling crown wheels, although the shape of the teeth is somewhat different. Around the rim of the driven wheel is another larger one, of the same description, and in fact, it is all one casting; this last named wheel gears into another fixed one of the same diameter. But now follows the main departure from the old routine; the shaft which carries the driven wheels, instead of being in line, and having its further extremity to revolve in a fixed bearing, is thrown, at that extremity, out of line, and is attached at that end to the face of a wheel at some distance from the centre on which the wheel rotates — in short, it is a crank motion, with the shaft acting as a connecting rod. The consequence is, as the shaft is forced round by the cog-wheel, a species of rocking motion is given to the crown-wheel on the shaft, so that the teeth are alternately thrown in and out of gear — when the teeth on one side are liberated, those on the other are thrown into gear. Such is a general account of the plan; the inventors, according to circumstances, using a universal joint, &c., as may be required, to allow of the peculiar motion. They say, in their statement, that they can vary the speed as many times as the wheel has teeth, without changing the pair of wheels. Another advantage is, that the axis of the driving shaft is in a line with the shafting that is to be driven.

MACHINE FOR CRIMPLING IRON BARS.

Messrs. Slocum and Sales, of Lansingburgh, N. Y., have recently invented a machine for bending bars of iron into a shape that is often employed, particularly for ornamental fences, house work, &c., — the zig-zag shape. The rolling mill employed for this purpose consists of two under rollers placed side by side, and of two upper rollers, — the latter two running in bearings which can slide up and down in the framing, so as to recede from, or advance to, the under rollers. Between these two sets of rollers there slides a bed, which carries the dies intended to impress the desired form on the iron. The invention particularly applies to the construction of these dies. They are formed in pairs, so that the projections of the upper die fit into the recesses of the lower one. Their shape, in general, is angular; and the upper die is so formed with joints, that each angular piece can be forced into its corresponding cavity in the lower die, without the necessity of its fellow projections partaking of the motion. The bar of iron being placed between the dies, which are fixed on the movable table, a chain or cord is attached from the table to the further of the lower rollers, so that the former may be drawn along as the rollers revolve. The upper rollers, which give the pressure, are forced down to their work by weighted levers; hence, when the machine is set in motion, the table and dies are drawn between the rollers, and the first jointed projection of the top die is forced into its recess in the lower die, thus giving the iron bar the desired shape. The table continuing to advance, is caught between the second pair of rollers, which hold the bar from shifting whilst the second projection is descending; and in this manner the process goes on, until the whole length of the bar is fashioned into the shape required. The inventors do not confine themselves to this sort of die alone, but propose another mode also, in which both top and bottom dies are made flexible. — *Scientific American.*

NEW PRESSES FOR BALING COTTON.

THE Mobile Tribune notices an invention of a new press for baling cotton. The only drawback upon it is, that the bales are round, and round bales are pretty generally proscribed. The Tribune says: — "By connecting it to the gin, the cotton is made up at once into bales, by the same power, and at the same time. To appreciate the great degree of compactness to which a bale may be pressed by this machine, one has only to take a small piece of cotton, and press it slightly while rolling it between the fingers. The principle embraced in this machine is precisely similar — and by a continuous layer of cotton revolving round itself under constant pressure, while the rollers are turning, the bale is formed of extreme compactness, requiring no after compressing. It is thought that this mode of forming the bale will supersede the necessity of roping." A further description of this arrangement is given by the inventor as follows:

"The operating part of my press consists mainly of three wooden or iron rollers or cylinders, the length of each being equal to that of the bale which it is intended to form. These cylinders are placed so as to represent a triangle at equal distances apart, and parallel to each other. When used for pressing, their surfaces at first approach so closely together as to be nearly in contact; and as the cotton which forms the bale accumulates between them, they recede from each other under any required pressure, the cotton being fed in between them directly from the cotton gin, by means of an endless apron.

"An endless chain operating on each side of the machine, imparts motion to the cylinders.

"The cotton, in passing into the space between the rollers, revolves upon itself so as to form a cylindrical bale, which goes on accumulating until it is of sufficient size and compactness. At this time, the bale is easily secured by passing the bagging so as to surround the bale — and the next moment, by knocking away the catches, the cylinders recede into slots left in the frame of the machine for the purpose, and the bale lies at your feet, ready for market."

A new cotton press, the invention of Nathan Chipman, of Conn., is also described in the Scientific American. This press is intended to supply the desideratum of a quick motion for the follower, when the cotton is first compressed. As is evident, the cotton yields at first, with comparative facility to the compressing power, but on the bale becoming more compact, it is necessary to employ a greater intensity of power when a less amount of speed is required. The inventor attains his object by employing spiral cams, or, in other words, conical drums with a spiral groove cast or cut around the periphery. Two of these cams are employed, one on each side of the press, and chains winding round them raise the follower, which slides longitudinally within the box containing the cotton. As the chains are attached to the larger part of the cam or conical drum, it is evident that on beginning to work the press with a regular motion, the chains will have to wind around a larger circumference at first than afterwards, and thus their speed, and consequently that of the follower, will gradually diminish, while, in accordance with the well known law of mechanics, the intensity of the power will increase in the same ratio. The motion is transmitted through the agency of geared wheels, and the box for the cotton has a cover capable of being removed at pleasure.

ADORNO'S CIGARETTE MACHINE.

THIS machine consists of two travelling chains, whose parts are made with great accuracy. Each link is composed of 12 pieces, which are cut out of iron by machinery. One portion of the link is fixed on the chain, and the other portion is moveable. It is necessary that the machine be so adjusted as to provide for the proper quantity of tobacco and paper, and which must be regulated to the thickness of very thin paper.

The machine makes and finishes the cigarrettes with greater neatness and perfection than by manual labor; and the economy of tobacco is so great, that, solely in this respect, the price of the entire manufacture by hand labor is wholly saved. More than eighty cigarettes may be made by this machine in a minute. Paper of the proper width and thickness is caused to pass over one of the travelling chains, consisting of links corresponding with the scantling of the cigarette. When the paper has a sufficient number of indents, fine tobacco is put into them, and the waste falls into a trough beneath the machine. As the chain on which the paper is first placed moves forward, a knife, by means of a reciprocating motion across the machine, separates the paper to form the cigarettes, which are finally folded entire, by passing to the other travelling chain; and by pressure from above the cigarettes are completed ready to be removed from the machine. In the English market there is scarcely any demand for cigarettes, but in Spain and the American republics its importance is great. This will be better understood, when we state, that, in Mexico, 8,000,000 dollars worth of cigarettes are consumed in the course of a single year. The consumption of cigarettes in Spain and Havana is proportionably greater.

NEW TYPE-CASTING MACHINE.

At the Fair of the American Institute, N. Y., H. H. Green exhibited a new type-casting machine, which is thus described by the Scientific American. The principal intention of the inventor of this curious little machine has been to cast type under a powerful pressure, so that the letter formed may be a more exact and sharp counterpart of the matrice. The apparatus, which is placed on a stand so as to be conveniently worked by the hand, consists, in the first place, of a small furnace, in which a quantity of type metal is maintained in a molten state by a fire beneath, the fire door being at the side of the furnace. In the midst, and rising above the molten metal, is a force pump, intended to inject a small portion of the fluid metal into the moulding-box. To the pump is fixed a pipe running through the furnace so as to connect with a corresponding aperture in the moulding-box, when the latter is brought forward to the furnace to receive the metal. The moulding-box is made of steel, and the top of it moves on hinges so that it can be lifted up to set the matrice in its place. The matrice or die consists merely of a piece of copper, the shape of the type, and having the particular letter, which is to be cast, sunk into it. As in every description of type, it is only the size of the letter which differs, it follows that the copper matrice alone has to be shifted when it is required to cast a different letter. The moulding-box is made to slide between guides to and fro, and is moved forward to receive the metal by a cam fixed on a shaft, which is worked by hand. On approaching the force pump, motion is given to the plunger by levers acted on by the above-mentioned shaft, and sufficient metal to form a letter is thereby injected into the matrice. This latter operation is aided by a stop-valve, which prevents the flow of metal, and as the shaft withdraws from the furnace, it falls back and permits the injection of the metal as above described. During this operation the box is held together by a species of clamp or spring; a spiral spring then forces the box back, the hold of the clamp is relaxed, and a spring, acting on the newly-cast letter, loosens it so as to allow it to fall into a spout, and from there into a receiving box. The inventor estimates that this machine will cast, on an average, 175 letters per minute. The operation is altogether very unique, and is deserving of high commendation. We therefore willingly award our meed of praise to the inventor for the improvement that he has made in the work of type-casting. The great benefit derived by this machine is that it casts metal 10 per cent. harder than any in use.

NEW METHOD OF MAKING SHOT.

An apparatus for manufacturing shot by means of centrifugal action, has been devised by M. Bonnet, of New York. It is intended as a substitute for shot-towers, and other apparatus now employed for this purpose. It consists in substance of the following parts: A circular trough made of iron, is secured on a vertical shaft, which is made to revolve. The upper part of the trough is of a funnel-shape, and there is a pipe inserted in this funnel for conveying the molten lead into the trough. The sides of the trough are perforated with a number of small holes of different sizes. The metal being poured into the trough, and the shaft made to revolve at the rate of 350 revolutions per minute, the molten lead will fly from the centre to the circumference and through the holes against a circular partition of cloth surrounding the apparatus, at a suitable distance, which depends altogether on the fluidity of the metal and rapidity of the motion.

NEW PRINTING PRESS.

The Lowell Courier gives an account of a new Printing Press recently invented by Mr. Keach of that city. Its main advantage over other presses is said to be its cheapness; and the following is a brief description of its construction: "The method of operating different from the Adams press is that the nippers are rotary, being carried round the platen by a chain geared upon pullies — there being two pairs, by which means impressions are given as fast as the rollers are driven across the *form* one way — one nipper taking in a sheet while the other is carrying out the first on the opposite side. The sheet, after being printed, is carried by the nipper over a fly and thrown off, without any belting or bellows arrangement. The impressions are given by the moving up of the bed of the press, operated by the common toggle-joint, while the lever which drives up the toggle is 'shipped' from one pin or driver in the side of the main shaft gear, to another on the opposite side. A stationary frisket keeps the sheet from dropping upon the inking rollers. The nippers are simple clamp fingers, operated by a spiral wire spring."

An improvement in Printing Presses is also announced by Mr. Dinsmore, of Pennsylvania. The object of this invention is to make a cheap press of a convenient form to be worked by hand, but capable of doing a greater amount of work in a given time than the common press. The printing is performed by passing the paper round a cylinder hung in a carriage, which is moved backwards and forwards along a stationary frame or railway, upon which is fixed a type-bed which carries the form, and at each end of which there is a feeding-board, from which the sheets are supplied to the cylinder. The cylinder is made to revolve by the movement of the carriage revolving in opposite directions. It is furnished with two sets of fingers, which take a sheet from each feeding-board, alternately, the cylinder carrying the sheet over the form and printing it as the said carriage moves towards the feeding-board; the fingers release the sheet at the proper time by suitable mechanism. — *Scientific American.*

IMPROVEMENT IN POWER LOOMS.

The Scientific American describes the following improvements in Power Looms, devised by Mr. Reynolds, of Columbia County, N. Y. The first part of the improvements relates to the harness motion usually employed in plain weaving; he attaches the leaves above and below to straps, cords, or chains, which are connected to the peripheries of two rollers, whose axes are hung in suitable bearings one above and the other below the harness, in a plane which equally divides the space between the front and back leaves; the straps or cords, from the two leaves of the harness, pass in opposite directions around the rollers spoken of, hence, if a rocking motion be given to one roller, and the other be left free, one leaf will be raised and the other depressed alternately. It is a desideratum, in weaving at a high speed, that the warp be always opened to a certain width at the line where the shuttle passes through, and that the upper and lower threads of the shed always occupy the same position when the shed is open; if a suitable motion be given to keep the shed open, it only requires to be opened just wide enough for the shuttle to pass through; to do this the back leaf — that furthest from the filling or weft — must be moved further than the front leaf. The way to produce this difference in motion, consists in making that portion of the periphery of each of the rollers mentioned, to which the back leaf is attached, and which are termed compensating rollers, of a larger diameter than the portion to which the front leaf is attached; by properly regulating this difference in the parts of a roller, the required effect is produced. Another improvement relates to the stop motion of a loom; the fork of the common stop motion, to arrest the action of the loom when a weft thread breaks, is made in one piece of steel or iron, and must really be made stronger than the work it has to perform, as the shuttle frequently strikes against them, if, by any accident, it is thrown from the raceway of the lay; when this happens, the tines are either bent or broken, and to repair this, the loom has to be stopped for a considerable time. The tines are detached by Mr. Reynold's plan, and they are inserted in an elastic socket, in which they can easily be placed; this allows of their being made of metal or wood, whalebone, or split rattan — the last material is preferable. The girl attending the loom keeps a number of spare tines on hand, and when one becomes bent or broken, she puts in another, and thus saves the labor of machinist and tenter in repairing the said stop motion; the bent tines can be straightened again, and very slight interruptions are thus occasioned to repair such breakages.

The improvements of Mr. Reynolds, enables power looms to be driven at a far higher velocity, than they now can be, and thus a most important impulse will be given to the art, as it respects economy in repairs, saving of time in stoppages, and the greater quantity of work done in a given time.

MANUFACTURE OF BAGS BY MACHINERY.

The Stark Mills, of Manchester, N. H., are now engaged in the weaving of bags, which is accomplished by the so-called "seamless bag-loom." This loom produces a bag of any required length or size, weaving sides and bottom without seam, of strong and durable material, in the space of a few minutes. About one hundred and twenty hands are now employed in the manufacture, and 30,000 bags a week are made, which can be afforded at 25 cents each, or four per cent. off for cash.

IMPROVEMENTS IN SPINNING.

Mr. W. Rouse, of Taunton, Mass., has recently made some valuable improvements on the self-acting spinning mule, which are thus described in the Scientific American. The improvements of Mr. Rouse are designed to simplify the construction of the mule, in relation to governing the revolution of the spindles in laying the thread on the cops, and in backing off, preparatory to the said laying on, by a cam barrel having an irregularly formed periphery, both in its length and circumference. The cam is made to give motion to the spindles, by means of a finger which bears continually on its periphery, and which is attached to a swinging frame, furnished with toothed segments that gear with toothed wheels upon a shaft, which, through a train of gearing, drives the spindles. The cam is made to revolve at the time the backing off should be performed, and also during the time the mule is running up to the beam, when the winding of the thread on the spindle is to be performed. Its periphery is of such a form, circumferentially, that the finger will be running towards the axis at the proper time for backing off, and from the axis at the proper time for laying on. Thus, by causing the segments to move in opposite directions, it drives the spindles in opposite directions. The cam is of such a form on that part where the finger bears during the running of the carriage, as to drive the spindles with a constant accelerated motion, which is necessary, owing to the decreasing diameter of the cop towards the top, where the laying on of the thread finishes; its circumferential form varies at different parts of its length, which gives it the longitudinal irregularity of form spoken of before; this is to suit the degree of speed, and the amount of back-off, at different stages of the building of the cop, the form of which is a constantly changing one, from the commencement to the termination of laying on the last inch of thread. The finger spoken of having a slow movement from end to end of the cam, it gives a changing movement to the segments, and consequently to the spindles of the cops. There are some other minor improvements connected with the working of this cop-making cam. It is well known that the self-acting spinning mule is a complicated machine, and does not produce such good work as the carriage worked by hand. The improvements of Mr. Rouse greatly simplify the construction of the mule by reducing the number of parts, and

8

substituting other mechanical devices, which make a better thread and also build a better cop.

CROSSLEY'S PATENT CARPETS.

THE following is a description of a new style of Carpets invented by Mr. Thomas Crossley, of Roxbury, Mass., and recently patented.

First. The Patent Ingrain Carpeting is woven plain, without colors or figure, in two or more substantial plys or layers of cloth, and ingrained or connected together at various points, which is done by causing the warp of one ply or layer at such points to be woven in and become a part of the other ply or layer.

By thus ingraining together the several plys of cloth, great strength and firmness is given to the fabric. And generally the nearer such points of ingrained cloth come together, the better may the carpet be expected to wear. In the patent ingrain carpeting this ingraining occurs at short intervals. In ordinary ingrain carpeting, the ingraining or connecting together of the several plys is regulated wholly by the kind or size of the figure woven; as, for instance, in large figures where the several objects combined to make up the pattern are bold and striking, there will be found great quantities of plain or open cloth in sections of considerable size when the several plys of cloth are not at all connected together. This absence of ingraining is wholly unavoidable, as when the pattern is woven the contrast between the figure and the ground cannot be preserved but by keeping the colors of the several plys, and therefore the plys themselves, entirely separate. Hence people generally prefer small figures to large ones, owing to the greater amount of ingraining, and consequently of service contained in the former over the latter.

Secondly. The cloth after being sheared and dressed, receives the pattern and colors from blocks or rollers, upon one or both sides. When both sides are figured, the back or under surface is stamped first with one style of pattern and colors, and the face or upper surface with an entirely different style of pattern and colors, — giving a variety of style never before obtained in any other kinds of carpeting.

Another new and important feature in the Patent Ingrain Carpeting is discovered in the fact that the colors stamped upon one surface do not appear through on the other side. This is prevented by the peculiar construction of the cloth. No other fabric of woolen, or where wool is a component part, has ever been printed upon one side, without more or less showing through upon the other surface.

Felt Carpets. — This novel style of Carpets manufactured at the Bay State Mills, Lawrence, are printed in block work, and designed according to weight either as a floor cloth or drugget. The threads of wool are not spun or woven, but drawn out and laid together, the whole mass being felted like a hat body. Fabrics of this character are also put together, showing a different color on either side, and designed for coats to be made up without lining. The Bay State Mills make this cloth with a white ground, about 40 inches wide, weighing from 4 to

24 ounces per yard, and print it in elegant carpet designs, showing the richest combination of brilliant colors, and furnish it at 75 to 90 cents per yard.

SEWING MACHINES.

The effect of the introduction of the power-loom and spinning frame upon hand labor, seems about to be repeated so far as the needle woman is concerned, in the introduction and general use of the various sewing machines. Six of these machines are now in general use viz: That of Elias Howe, Jr., patented Sept., 1846, sold for $125. 2. That of I. M. Singer, sold for $125. 3. That of A. B. Wilson, patented Nov., 1850, sold for $50. 4. That of J. M. Magnin, — a French invention. 5. That of Morey and Johnson, of Massachusetts. 6. That of Dr. Otis Avery, patented Oct., 1852, sold for $25.

The machine of Mr. Howe was the first practical invention of the kind, and it is claimed that all the subsequent inventions infringe upon his patent. He uses two threads, and an accurate idea of his seam will be formed by twisting two threads together and imagining them so disposed as that the point where they cross each other is always in the cloth, one of them forming the visible portion of the stitch on one side, and the other on the other. The machines of Singer, Wilson, and Morey and Johnson, use needles of a kind different from Howe's, but produce the same stitch as his. Of these four, all are equally correct and good in respect to mechanical principles, but as they differ widely in many particulars, one being vertical and another horizontal, one carrying its own cloth and another requiring that it should be carried by hand, actual trial can alone decide which is the best for practical use. The N. Y. Tribune states, "that it has seen shirts, pants, coats, shoes, and the like, made by them, in all of which the strength of the seams are satisfactory. In most, if not in all cases, the material would give way and tear, but the sewing would not rip. The perfect regularity of the stitches made by these machines renders them very useful for fancy work like shirt bosoms. For an inch of seam, three inches of thread are used. A person with a machine will do from five to ten times as much work as with the needle. In several large shops they are used, and many persons wear garments made by them without a suspicion of the fact."

Magnin's machine operates with a single thread, and produces what is known as the tambour stitch. It may do for embroidery, and has even been arranged with several needles and used for that purpose, but it is worth nothing for sewing. Its principal defects are, that when one stitch is broken the whole seam will unravel; that it requires eight inches of thread for every inch of sewing; and that in fancy work it gives different results on the two sides of the cloth.

The machine invented by Dr. Avery was first exhibited at the Fair of the American Institute in New York, in October, 1852. The arrangement is comprised in two cam wheels, two shafts, two spools, two needles, two crank wheels, and a weight. The crank wheels turn the cam wheels, and these communicate motion to the shafts, and the shafts work the needles, between which the cloth to be sewed is placed. The cloth is held in its place and drawn along as fast as it is sewed by the weight. The spools contain the thread, and unwinding, furnish a supply as fast as it is needed. The peculiarity of the machine, however, consists in the stitch, which is of such a nature that each is independent of the other. The seam will not rip if a few stitches be cut; and seams of all shapes and kinds can be sewn with equal facility. It uses more thread than either of the other American machines, but less than the French. In respect to rapidity of work, there is no great difference. The great advantages of Avery's machine are its more simple mechanism and its greater cheapness.

The Scientific American furnishes a description of an additional sewing machine recently invented by Mr. Titèman of New York. In this machine two threads are used to form the stitch, one being in the form of a loop, and the other thread being passed through the whole series of loops, thus preventing them from following the needle when it is withdrawn. The arrangement is very compact, and is well adapted to sew, besides the ordinary sort of work, any thing in a circular or endless form, To admit of this variety of sewing the work is placed around the outer circumference of a hollow cylinder, as on a bed, and is moved forward for another stitch by an endless chain revolving inside, which is furnished with a number of points or teeth projecting through a slot that grasps the cloth which is being sewed. On the cylinder are fixed a vertical standard and slides from which the needle works like wire vertically. This needle has two eyes, one near the point and the other close to the head. Within the cylinder is placed the apparatus for forming the thread (which is carried into the cloth by the needle,) into a loop, and then securing the loop by a longitudinal thread. This last mentioned arrangement consists principally of a circular shuttle (or, rather, the shape is of an oblate spheroid,) with one part cut away, so as to form a point, which is used to open a way for the shuttle to pass through the loop. The shuttle has a recess, which contains a bobbin for supplying the longitudinal or lock thread. When the needle is made to descend with its attached thread (which is supplied from a bobbin,) it perforates the cloth, and continuing its course, passes through an aperture in the cylinder. Whilst in the act of returning a portion of the thread (which at that moment is rather slack,) is caught by the point of the shuttle and extended into the form of a loop. By a novel arrangement, the loop is freed from the shuttle, although the thread from the shuttle bobbin remains within the loop, thus holding it from re-passing the cloth. The work is pressed down in the cylinder by a spring, and is moved at each successive stitch by an endless chain, as before mentioned, the motion of which is repeated by a ratchet wheel; all of which gearing as well as the main driving shaft, &c., is contained within the cylinder. We must mention that the proper tension of the vertical thread is maintained by two neatly contrived fingers, which grasp it until the needle has entered the cloth, when they relinquish the duty to the needle.

WEAVING AND PRINTING CARPETS AND SHAWLS.

JAMES MELVILLE, of Renfrewshire, Scotland, has enrolled a patent for an invention, the peculiarity of which is, the weaving a duplex fabric, or, in other words, two foundations or backs of fabrics, connected together by a long pile of the material, forming the face of the pieces—the pile being afterwards severed transversely, to form distinct pieces of pile fabrics—without the use of intermediate slips or needles for raising and adjusting the pile. This important system of weaving is as simple as it is ingenious. Instead of weaving both backs, so that each shot of weft in the upper and lower backs is thrown at the same time, in the same vertical line, the lower back is always kept several shots ahead of the upper one; that is to say, the woven portion of the lower back always extends several shots further forward on the reed side than the upper one. Then, during the process of weaving, the angular distance between the two sheds of the upper and lower backs, regulates the length of the intervening pile of wool. This system is carried out by adding to the ordinary reed a species of secondary reed, carried by the slay in front of the usual reed. The latter acts only on the lower shed, whilst the secondary reed, the dents of which project down from the lower edge of their frame-bar, is similarly confined to the upper shed, and each shot of weft in the upper shed is held until secured by the succeeding one, by a row of hooks on a holding-frame passing across the piece.

Another portion of the improvements embodies a system of printing shawls and other goods, by stretching the fabric on an impression cylinder of large diameter, such cylinder being arranged to work in concert with a printing roller, on which the "repeat" of the pattern is engraved. In printing a border by this plan, the two opposite parallel edges of the piece are stretched on the large cylinder in a line with the cylinder ends, and the color apparatus being set on a rail in front of the cylinder, the two borders are printed in succession; and the printing apparatus being then detached, is removed to another cylinder, to make way for the succeeding color on the first. The printing roller is so contrived as to be capable of the most accurate adjustment to the impression cylinder on each change, so as to keep perfect register; and the attendants are thus enabled to print all the colors in a series of pieces by continually running through a series of impression cylinders, with the corresponding color rollers, one after the other. By another modification, Mr. Melville also prints shawls and other fabrics stretched upon a square table, hung vertically, the printing roller revolving in fixed bearings, whilst the table traverses in contact with it. But the most curious process is that in which the pattern is engraved upon a conical printing roller, and the fabric is stretched on a square table, revolving on a vertical plane. If a shawl corner is to be printed, the pattern is so placed on the roller that the angle shall be on the widest end of the cone, a diagonal line drawn through the center of the corner coinciding with the axial line of the cone. Then, as the shawl revolves on its table, the impression is successively laid on, so that the corner device shall exactly fill up the corners of the fabric. Another peculiar plan consists in stretching some classes of square fabrics upon a round table, when wet, so that the square temporarily assumes a circular form. In this state it is printed by a conical roller, and a peculiar distorted effect is obtained by reason of the corners of the piece being very little stretched, whilst the parallel sides, which have undergone excessive stretching, will shrink to their original state in drying, thus contracting the impression at those parts. We are, of course, enabled to give but a mere outline of these valuable improvements here.

IMPROVEMENTS IN THE MANUFACTURE OF PAPER.

The following is a description of a process lately brought out in England for the manufacture of paper, by Messrs. Coupier and Mellier. The first part of this invention consists in manufacturing pulp for paper-making from straw and other similar vegetable matters, and from the bark of the osier or chestnut-tree, by the use of a boiling solution of hydrate of soda or potash, in conjunction with other chemical means, and without mechanical operations.

The patentees conduct their processes as follows:—They make use of an open vessel with a perforated false bottom, on which are placed the materials to be operated on, previously cut or otherwise divided into short lengths. From the top of this vessel (which is to be closed while the operation is proceeding) a pipe leads to a second vessel capable of holding from 60 to 70 gallons, in which is placed the alkaline solution, and which is employed at a strength of from 7° to 10° Baume. The end of the pipe in the first vessel is provided with a rose-head. When the process is to be commenced, steam is to be turned on into the alkaline solution, and its temperature raised to the boiling point. An excess of steam is then admitted, and the solution forced through the pipe, and dispersed in a shower over the straw; when the solution is exhausted in this way, a fresh supply is introduced, and this operation repeated. A communication is established between the vessels by another pipe from underneath the false bottom of the first, and a circulation of the heated liquor is thereby maintained for about eight hours. Hot water is then forced through, and this washing is continued until the liquor comes off of a strength of about 1° Baume. Cold water is then supplied to the materials, and passed through until it comes off clear. In order to bleach and disaggregate the fibres, they are then submitted to the action of a solution of hypochlorite of alumina, or other hypochlorite, of a strength of about 3° Baume, and again washed in hot water in order to remove the superfluous bleaching liquid. This reduces the mass to the condition of half stuff which is manufactured into paper according to the usual modes, operating with or without the addition of rag pulp. The quantity of alkaline solution consumed by the above process will be about thirty to forty gallons for every hundred weight of fibre, and of hypochlorite about 25 per cent. of the weight of fibre. The hydrate for the alkaline solution may be obtained by dissolving soda or potash in lime water, and decanting the clear liquor; and the hypochlorite of alumina for the bleaching process by dissolving sulphate of alumina in a solution of hypochlorite (common chloride) of lime. The waters obtained by the first process when evaporated, yield a resinous soap, which may be mixed with other materials, and burnt as fuel, or used in the unmixed state. The above process is applicable also to flax waste, cotton waste, hemp, tow, &c., but does not supersede the necessity of first converting these materials into half stuff.

The second part of the invention consists in treating wood shavings (pine, ash, elm, and beech are suitable for this purpose) with nitric acid in order to obtain therefrom a pulp to be used in the manufacture of paper.

In carrying this part of the invention into effect, the patentees employ two vessels in connection with each other, having perforated false bottoms on which the shavings to be operated on are placed in a damp state, and pressed. About 80 per cent. by weight of white nitric acid, (of a strength of 36° Baume,) diluted to about 5° or 6° Baume, is then added to the shavings in one of the vessels, and after standing about four hours, heat is applied until ebulition commences, and nitrous fumes are evolved. These fumes are caused to pass into the second vessel, where they come in contact with the damped shavings, and are partially converted into hyponitric acid. When the boiling has been continued for a sufficient time, the shavings are subjected, for about two hours, to the action of solution of hydrate of potash or soda, of a strength of about 2° Baume, in the manner before described, are washed, and they are then bleached by hypochlorite of alumina, using, however, only about two per cent. by weight of the materials in making the solution. This last operation, with the aid of subsequent washings, converts the shavings to a state of half stuff, which may be used alone or with rag pulp, according to the usual methods. The acid liquor employed in operating on the first batch of shavings, after having about 40 per cent. of the weight of the materials added to it, is used for treating another quantity, the nitrous fumes evolved being applied as before described. By evaporating the used acid liquors, oxalic acid may be obtained, as well as an acid of a character analogous to nitropicric acid.

PAPIER-MACHE.

Mr. C. Bielefeld, of London, has obtained a patent for the manufacture of papier-mache, of which the following is a description, as given in Newton's Patent Journal. "Sheets of papier-mache, of considerable thickness, have been commonly produced by causing numerous sheets of paper to be successively pasted together and dried, until the required thickness of sheet is obtained. The desired thickness of sheet has also been obtained by piling a suitable number of sheets of paper in a wet state (as they come from the paper-mould or seive) one upon another, and then expressing the water by a press, and drying the sheet, so produced, whilst in a state of compression, between metal plates. Sheets of less thickness have been made by running the pulp on to a mould or seive, having a frame thereon corresponding in depth to the thickness of sheet required, and then pressing such sheets between felts and drying them. Moulded ornaments, and other articles of papier-mache have been usually manufactured by reducing fibrous and other matters by grinding, in a suitable machine, to the consistency of stiff dough or putty, and then moulding and drying the same. The above remarks are made in order to point out more clearly, the nature of this invention, which consists in rolling or pressing fibrous and other matters, ground to the state of stiff dough or putty, into sheets, and treating such sheets with oil and heat, in like manner to that in which sheets and moulded articles of papier-mache, made by the above methods, have been heretofore treated.

Either flat or roller presses may be used in carrying out this invention. The press which the patentee prefers to employ consists of a rectangular moving table, with a pressing-roller above it. The table has a rack on each side, and is supported in such a manner that it may be moved to and fro at the same surface speed as the pressing-roller; for which purpose two cog wheels are fixed on the axis of the roller, and gear into the racks affixed to the table; and the roller is kept pressed down upon the table by weighted levers. The table supports a wooden platform, somewhat larger than the intended sheet of papier-mache; over this platform is spread a sheet of moistened canvass or other suitable fabric; and upon the fabric is laid a rectangular or other frame of wood, corresponding in height to the thickness of the sheet of papier-mache, or substance in the nature thereof, to such an extent, that considerable pressure will be necessary to reduce the same to the level of the frame. Over the composition another sheet of moistened canvass or other fabric is laid; and then the pressing-roller being caused to rotate, the table carries the platform, with the plastic papier-mache thereon, beneath the roller. The composition is passed several times beneath the roller, until it is considered to be sufficiently pressed; after which the upper sheet of moistened fabric is removed, and a flat frame or rack of wood (composed of numerous bars) is laid upon the sheet of papier-mache; then the wooden rack and platform, with the sheet of papier-mache between them, are turned over; and the platform and the first-named sheet of canvass are now removed,—leaving the papier-mache upon the rack to dry. During the process of drying, the sheets are turned over from time to time; and the patentee prefers, when time and season will permit, to dry by the ordinary atmosphere in sheds, or otherwise in rooms, heated to a slight degree above summer heat; the longer the time allowed for drying the better will be the result. The sheets, by day, are placed in a stove, heated from 150° to 180° Fahr., and left therein until heated throughout; and they are then immersed in boiled oil, which is kept at a temperature of from 150° to 180°. The sheets are kept in the oil for a greater or less time, according to the thickness thereof and the degree of saturation desired; for sheets of one inch thick, half an hour has been found sufficient. After saturation with oil, the sheets are again dried on racks, either by the atmosphere in sheds or in heated rooms; and when they appear to be dry, they are kept for some time in a stove, heated to 180°. The patentee states, that the above is the practice pursued by him when the sheets are to be used for forming partitions in steam and other vessels, and for panelling and other work of the cabins of such vessels, or the parts of railway and other carriages, and for making furniture and other structures where it is desirable to use a material that shall be little affected by extremes of temperature.

The sheets, produced as above described, may be cut into the desired forms, and framed together in panels or otherwise; and the surfaces may be planed, smoothed, and polished, as when operating on other papier-mache; and they may be varnished without painting, in which case various effects may be obtained by mixing colors with the fibrous materials employed; or the papier-mache may be painted and ornamented in like manner to carriage-painting. Various compositions of fibrous with other matters may be used in carrying out this invention; but the patentee prefers the following, although he does not confine himself thereto:—He makes a paste by boiling together 80 lbs. of water, 32 lbs. of flour, 9 lbs. of alum, and 1 lb. of copperas; with this paste he mixes 15 lbs. of rosin, dissolved by 10 lbs. of boiled oil, adding 1 lb. of litharge; and then he adds to the mixture from 55 to 60 lbs. of dry rag-dust or other suitable fibre, and grinds the whole together. He has found that paper makers' "half stuff" or pulp may be used, when deprived of fluidity to such an extent that it is of a like consistency to stiff dough or putty. When size is used in preparing the fibrous and other matters, it is best to employ a hollow pressing roller, heated by steam. In the manufacture of sheets of papier-mache by the above process, if one or both of the fabrics, which are used when pressing, be left adhering to the surface or surfaces of the sheet, instead of removing the same previous to drying, the fabric or fabrics will continue to adhere when the sheet is finished and form part thereof.

VALUE OF PAPER IN ARCHITECTURE.

There is, says Dickens' "Household Words," a *paper* church actually existing near Bergen, which can contain nearly one thousand persons. It is circular within, octagonal without. The relievos outside, and the statues within, the roof, the ceiling, the Corinthian capitals, are all of papier-mache, rendered water-proof by saturation in vitriol, lime water, whey, and white of egg. We have not yet reached this pitch of audacity in our use of paper; but it should hardly surprise us, inasmuch as we employ the same material in private houses, in steamboats, and in some public buildings, instead of carved decorations and plaster cornices. When Frederick II. of Prussia set up a limited papier-mache manufactory at Berlin, 1765, he little thought that paper cathedrals might, within a century, spring out of his snuff boxes, by the sleight of hand of advancing art. At present, we old-fashioned English, who haunt cathedrals and build churches, like stone better. But there is no saying what we may come to. It is not very long since it would have seemed as impossible to cover eighteen acres of ground with glass, as to erect a pagoda of soap bubbles; yet the thing is done. When we think of a psalm sung by one thousand voices, pealing through an edifice made of old rags, and the universal element bound down to carry our messages with the speed of light, it would be presumptuous to say what can and what cannot be achieved by science and art, under the training of steady old Time.

QUARTZ CRUSHING MACHINE.

A NEW and very well contrived machine has been constructed in New York, by Mr. John A. Collins, for the purpose of extracting gold from quartz rocks. On a round cast iron plate, which forms the bed plate of the machine, six or more conical wheels, whose axes converge toward the center, are made to travel round, and to crush in their way the pieces of rock which are put under them. The necessary pressure and the motion are given by an ingenious contrivance, which consists of another circular plate resting on the wheels, and which is fixed by keys on the axis, this axis being put in motion by a steam engine. Above the second plate is a third, connected with the first by vertical columns, and held down to the required pressure by india-rubber springs, so that if a piece of rock is harder than the others, the wheel, rising over it, presses the springs, which give back a stronger counter pressure, sufficient to crush the piece; at least, it prevents any danger of breaking the machinery.

By the above arrangement, there is no friction in the machine, either by rotary axes, or by sliding pieces. There is only rotation of wheels on plane surfaces, so that very little power is consumed by the machine itself. There are necessary contrivances to make a current of water pass over the powdered rock.

LATH CUTTING MACHINE.

THE following is a brief description of a lath cutting machine invented and patented by Henry C. Smith, of Cleveland, Ohio.

A series of rotating knives are keyed into a cylinder, which is placed over the log to be cut. The cylinder is one foot in diameter, and the length of the log is four feet. Grooves are planed in this cylinder, about one inch deep, for the reception of the knives. These knives, when placed in the cylinder, are of such width as to set out from its face one-half of an inch, and are some twenty-five in number, being placed the width of the lath apart, and are the length of the log or cylinder. As the log rotates under these knives, they are caught in the same, and revolve similar to one roller rolling under another, and are forced into the log by the action of a rack. The knives are thus constantly in the log, and feed upon the same at the rate of the thickness of a lath at one revolution of the log, or say one-third of an inch, so the surface that passes under them comes over cut into the thickness of the lath ; it will also be observed that these cuts are just the width of the lath apart, and this surface is presented to the clipping knife, which has a reciprocating motion, and cuts the laths from the log as it revolves against its edge. This knife also advances to the log at the same rate that the rotating knives move downward ; this is done by means of the screws at the sides, cut upon the shafts which move the iron frame forward toward the log, and upon which another iron frame is placed for securing the clipping knife, the edge of which advances on a center with the log. This iron frame rests upon rollers, so that the friction is but little, while the knife is playing back and forth. It will be observed, that the laths are cut off from the log, similar to cutting of veneering. By the inclination of the apron under the log upon which the laths fall, they are conveyed to the end of the machine. The reciprocating motion of the clipping knife prevents any chicking or shivering of the lath, which makes them equal to sawed lath.

NEW BRICK MACHINE.

This machine, the invention of Messrs. Mower and Woodworth, of Boston, operates as follows: — The clay used, enters the machine dry, and by means of a combination of rollers and sieves is reduced to a uniform degree of fineness. The pulverized clay then passes into the press of the machine, where there are moulds for six bricks, into which it falls, and immediately receives two severe blows from above, succeeded by powerful pressure from below. These blows and pressure give it the shape and character of bricks directly. The clay, in the shape of bricks, is now delivered from the machine upon a little frame so rapidly, that it requires the constant labor of two men to put the bricks into wheelbarrows. They are thus forthwith conveyed directly to the kiln, without the necessity of any intermediate process whatever. The moulds being exactly shaped, and made of metal, and the clay being, by the immense force brought to bear upon it, perfectly fitted to the moulds, these unburnt bricks have a marble-like smoothness of surface, and an exquisite accuracy of shape, altogether surpassing those made in the ordinary way. The number of bricks which this invention is capable of making in a given time can easily be estimated. At each revolution of the machine, six new bricks are delivered ; and the number of revolutions is seven or eight in a minute. The number made in an hour thus certainly exceeds twenty-five hundred. When it is recollected that this number can be continued day after day, without regard to the accidental changes of weather, the great capacities of the machine for accomplishing a large amount of work in a short time, are apparent. It should be observed, that although it is no part of the plan that the clay used in the machine should be at all wet, yet the pulverization of the lumps of the material in the first part of the process brings out a slight degree of moisture, so that the powder which is subjected to pressure is slightly damp; and this doubtless adds somewhat to the tenacity and firmness of the bricks. This dampness, however, does not exceed that which is usual in bricks when they are considered dry enough to be placed in the kilns.

The hammer or ram which descends upon the clay in the moulds weighs about four thousand pounds. The mechanical force which is brought to bear upon each brick is estimated at one hundred pounds. The whole weight of the machine, including the pulverizer and screens, exceeds twenty tons. The cost is $3,200.

The bricks, when burnt, are found to have shrunk less than those made in the ordinary way, probably on account of their greater density; and, for the same reason, they retain their smoothness of surface and accuracy of form. On breaking one, its compactness and soundness are immediately obvious. As they thus can absorb but little moisture, they are capable of standing the frost of the severest climate without injury. An experiment in a crushing machine, by the superintendant of the Capitol at Washington, showed the strength of the bricks to be sixteen thousand six hundred pounds to the square inch. At the same time it was found that, by the absorption of one of the bricks and the atmospheric evaporation together, during fourteen hours, there was consumed less than half a gill out of a gallon of water.

The actual use of the bricks, so far as we have heard, justifies all the expectations which would be formed from a knowledge of the process of their manufacture, and shows that they are in no respect inferior to those made in the ordinary way. Indeed, they are unquestionably better. We are told that they have been used in buildings with entire satisfaction, and that some of them exposed during the last winter, in sidewalks in Boston, remain as perfect as when they were laid. The best quality of bricks can be made by these machines at a less expense than the coarse common bricks made by the ordinary processes.

The present invention is so different, both in principle and operation, from all former machines, and is so perfect in theory, simple in construction, and successful in its results, that we can hardly doubt that its use will eventually entirely supersede that of all other processes.

We derive the foregoing facts from the Boston "To-Day." — *Editor.*

A CIRCULAR SAW RUN WITHOUT AN ARBOR.

An invention has recently been made by Mr. A. C. George, of New Hampshire, by which a circular saw can be run without an arbor, in such a manner as to cut a board nearly the width of the saw. The main principle by which this is effected, is, we understand, by the application of small trucks applied to the external part of the disc, and by which the necessary motion is communicated, and the saw held at the same time in place.

IMPROVED PLOUGH.

Measures to secure a patent for improvements in ploughs have been taken by J. B. Wilder, of Belfast, Me. The nature of the invention consists in employing a revolving mould-board, so arranged and attached to the share and land-side plate, that it may be turned independently of the share, which also revolves. By this improvement both the mould-board and share can be shifted to either side of the land-side plate, so that the dirt or sod may be turned in either direction. The object in making the mould-board in this manner is to allow of its having an independent motion irrespective of the share, which hitherto has not been done. In every improvement of this kind, with revolving share and mould-board, the two have been always connected, so that the efficacy of the latter has been materially sacrificed in order to make it suit in the opposite positions to which it may be required to be altered.—*Scientific American.*

MACHINE FOR PICKING UP STONES.

The New England Farmer describes a machine recently devised for picking up stones, one of the most laborious duties of the farmer. The arrangement consists of a large cylinder on a common axle and cart wheels, containing four rows of teeth or lifters. Gearing on the hubs of the wheels and on the ends of the cylinder, gives the latter a rotary motion, when the teeth pick up the stones and deposit them in a box. When the box is full, the cylinder is raised and the load carried off and upset as from a common cart.

PLASTERING MACHINE.

A machine for the purpose of superseding manual labor in the operation of plastering walls, has been invented by Isaac Hussey, of Ohio. It consists of a movable frame upon rollers that can be adjusted to suit any height, and of a smaller frame sliding within it. The latter serves to support a mortar box containing the trowel, which is raised and lowered by means of a drum and endless chain. When in operation the trowel is supplied with mortar by a rod and follower, which are worked by a lever, the quantity being regulated or shut off, as required, by a slide that covers the opening in the box. For plastering ceiling it is only requisite to raise the mortar box to the top of the frame, and for side walls it is adjusted accordingly by turning it to a proper position. For this last-named operation the box is shifted by the sliding frame, which is moved back and forth for that purpose by means of the already mentioned lever. There are also various cords and pulleys attached to the machine for facilitating the operations of the different parts, which are included in the invention and form a part of it.—*Scientific American.*

DITCHING MACHINE.

The following is a description of a machine recently invented by Charles Bishop, of Ohio, for the purpose of excavating ditches by horse power. The machine is provided with a revolving excavator, the shaft or axle of which lies in the direction of the length of the ditch. The excavator is of a screw form, and is operated by an endless chain. The ditch is cut of a semi-circular form, and it deposits the cut clay or other kind of excavated earth in a box, from whence it is delivered at one side of the road by scrapers attached to the endless chain, the machine being propelled forward by a friction wheel, or roller, moving in the ditch, and operated by the excavator's shaft. — *Cleveland Visiter.*

PATENT SPOONS.

Inventions generally claim the attention of the public from their real, or fancied importance, but occasionally some are brought into notice from their very insignificance, or from some inherent absurdity in their design or object. Of such a character as the latter class, is an invention of Mr. I. C. Taylor, of Ohio, of a spoon for administering medicine, which is thus described in the claim of the patent granted February, 1852. "I claim the particular construction of my spoon with a sliding bottom, and a piston slide, exactly fitting the cavity of the spoon, and the sliding rod so arranged, that it may be slid in the same moment that the slide tongue or bottom is drawn out, thereby quickly emptying the spoon of its contents.

"I do not claim that my spoon should be a graduating or measuring spoon, but merely for administering medicines already graduated by a physician."

MANUFACTURE OF GUTTA-PERCHA.

The following is a general description of the method of preparing and manufacturing gutta-percha, as followed in the large English establishments. The crude blocks of gutta-percha, as received from the docks, are in the first place cut into slices by means of a machine formed of a circular iron plate of about sixty inches diameter: in this iron plate are three slots placed radially for the reception of as many knives or cutters; the blocks being placed in an inclined wooden shoot, an end of each is set in the plane of rotation of the cutters; the slices thus cut off are transferred in baskets, though machinery might readily be applied for the purpose, to a wooden tank containing hot water, in which they are left to soak until they are found to be in a plastic state. The next part of the process is to subject the material to the action of a *mincing* cylinder, somewhat similar to that used by paper makers for the conversion of rags into pulp; afterwards, the whole is thoroughly cleaned in cold water tanks; and when the gutta-percha is found to be very impure, which is frequently the case as an article of commerce, a solution of common soda or chloride of lime is added to the water. From the cold water tanks the material is conveyed to the masticating machine, in which it is secured by the doors being bolted down. By this operation it is subjected to very great pressure, and this part of the process is the same as that used in the manufacture of caoutchouc. From the masticating machine it is passed between large metal rollers, and thus converted into extensive sheets, of thicknesses regulated by the distance between the rollers. Sometimes it is passed two or three times between the rollers. These sheets are cut into bands of various widths by vertical knives placed at the end of the web or cloth by which the sheets are moved away from the rollers. The sheets are either cut into the proper width for lathe bands, or are stamped out for shoe soles, and various other purposes.

MANUFACTURE OF COMBS.

The greatest comb manufactory in the world is in Aberdeen, Scotland; it is that of Messrs. Stewart, Rowell & Co. There are 36 furnaces for preparing horns and tortoise-shell for the combs, and no less than 120 iron screw presses are continually going in stamping them. Steam power is employed to cut the combs, and an engine of fifty horse power is barely sufficient to do the work. The coarse combs are stamped or cut out — two being cut in one piece at a time, by a machine invented in England in 1828. The fine dressing combs and all small tooth combs, are cut by fine circular saws, some so fine as to cut 40 teeth in the space of one inch, and they revolve 5,000 times in a minute. There are 1,928 varieties of combs made, and the aggregate number produced, of all these different sorts of combs, average upwards of 1,200 gross weekly, or about 9,000,000 annually; a quantity that, if laid together lengthways, would extend about 700 miles. The annual consumption of ox horns is about 730,000; the annual consumption of hoofs amounts to 4,000,000; the consumption of tortoise shell and buffalo horn, although not so large, is correspondingly valuable; even the waste, composed of horn shavings and parings of hoof, which from its nitrogenized composition, becomes a valuable material in the manufacture of prussiate of potash, amounts to 350 tons in the year; the broken combs in the various stages of manufacture average 50 or 60 gross in a week; the very paper for packing costs $3,000 a year.

A hoof undergoes eleven distinct operations before it becomes a finished comb. In this great comb factory, there are 456 men and boys employed, and 164 women — in all 620 hands.

NORMANDY'S FRESH WATER CONDENSER.

An apparatus has been devised in France by M. Normandy, for converting sea water into fresh, for use on ship-board.

Briefly described, it is a series of discs, placed one above the other, communicating by concentric galleries, and placed in a vapor bath at a pressure a little above that of the atmosphere. "The sea water," says the inventor, "circulating in the galleries heated by the surrounding vapor, gives off a certain quantity of vapor, which, mingling with the atmospheric air, introduced by a tube from the outside, finally condenses as perfectly aerated fresh water in a refrigerator, which is also in communication with the atmosphere. No other means of agitation or percolation is so efficacious or economical." The apparatus which is free from the defect of depositing salt while distillation is going on, is rather more than three feet in height, and eighteen inches diameter. It will yield two pints of water per minute, at an expenditure of about $2\frac{1}{4}$ lbs. of coal for each 45 lbs. of water.

MACHINE FOR PRINTING CALICO.

A new calico machine has been invented by Dr. R. L. Hawes, of Worcester, which will print twelve different colors at one operation. In relation to this machine the Boston Transcript says: —

It was but quite recently — within five years, we believe — that it was not thought practicable to print calico with the use of more than six colors at one operation. If additional colors were required to complete the design, they were given by hand blocks. Latterly, however, the English inventors have produced machines that will print eight and ten colors, but it has remained for an American to outstrip them all in this important branch of mechanic art. The principal improvements introduced into this machine (for which application for a patent has been made,) consists in the mode of applying pressure to the print rollers, by which a yielding pressure of several tons may be given to each roller with great ease; also in the construction of the frame work in a peculiar manner, so that either print roller may be removed from the machine without disturbing the others. By means of these improvements, this machine is made to operate with nearly the same facility and ease as any six color machines hitherto constructed. The weight of the machine is eight or ten tons, standing some nine or ten feet high, and necessarily has, not only great strength, but a very nice adjustment of its parts to enable the operator to print twelve colors on the cloth, so that each shall be exactly in its place, and this, too, when cloth is passing through the machine at the rate of *a mile per hour.*

MANUFACTURE OF BEET ROOT SUGAR IN IRELAND.

The subject of cultivating the beet root, with a view to the manufacture of Sugar, is now engrossing a good deal of public attention.

Ireland is said, by Mr. Sullivan, the chemist to the Museum of Irish Industry in Dublin, to possess great capabilities for the production of beet root in large quantities, and of very superior qualities — the Irish root possessing at least as much saccharine matter as that of France or Germany. The statistics of beet root sugar are curious and instructive. In 1841, the production of this article in Europe was estimated at 55,000 tons; in 1847, it was said to be 100,000 tons, and in 1850, 190,000 tons. The manufacture is said to be rapidly increasing, and realizing a great profit to those who are engaged in it.

IMPROVEMENT IN THE MANUFACTURE OF SUGAR.

The following is a description of some new processes for the manufacture of sugar, recently patented in England, and introduced with success into Cuba.

The new processes are fourfold in their character, comprising, first, a new mode of obtaining the saccharine juice from the cane; secondly, a new mode of defecating and filtering the juice so obtained; thirdly, the boiling and concentrating of the juice; and fourthly, the crystallization and final curing of the sugar. By the first improvement, in the construction of the cane press, a difference in the yield of the cane is obtained, as compared with the old rolling mill, of about 20 per cent. In the new machine, the pressing tubes are reduced in length from 30 inches to 12, the first four of which are parallel, and 3 inches wide — the next four inches of their length being taper, and terminating with a width of but 1½ inch, the smaller contracted point extending as far as the exit end of the tube. By this change of form, the entire removal of the elasticity in the "magas," occupying the tubes is removed, and after the cane has been collapsed by the severe pressure, and its breadth at the same time gradually lessened, every fibre and cell is made to assume new relative positions — not one remains unruptured, and an increased quantity of the juice is consequently expelled at the trough. In addition to this advantage, there is obviously a more equal distribution of power in each revolution of the machine; the deleterious chlorophyl, or coloring matter, of the outer portion of the cane is not expelled with the juice, as in the ordinary apparatus; the machine may be more easily fed, and weighs considerably less than rolling machines generally in use.

The juice, when expelled from the cane, is unavoidably mixed with numberless minute fragments of cellular tissue, albumen, and other extraneous matters, which, if not speedily removed, tend to produce the acidification of the liquid. The present mode of defecation and filtration consists in raising the temperature of the liquor to 150° Fahr., when a quantity of lime is thrown in for the purpose of neutralizing the free acid, and assisting in the coagulation of the albumen; the temperature is increased to 180° Fahr., when, after allowing time for settling, the scum is removed, and the clear liquor drawn off into the "grand" copper, where it is subjected to boiling heat, when the feculent and other albuminous matters are kept constantly removed from its surface. The more completely these impurities are removed, the greater will be the brightness and value of the finished product. In the new process the juice passes through a wire strainer direct from the spout of the mill into the clarifiers, where it is raised to boiling heat by the application of steam, at which temperature it is kept for about three minutes, by which time the whole of its albuminous constituents and feculent matters will have been coagulated and chemically separated, but will, of course, still remain mechanically mixed, and, in the form of light fleck, pervade the entire bulk of the fluid. These substances are then effectually removed by a process similar to that employed in the manufacture of paper. A drum of about two feet in diameter and from four to five feet in length is made to revolve slowly in a small semi-circular tray or vessel. This drum is covered with fine wire cloth, through which the water forces its way, leaving a muddy coating of extraneous matters on the other side, which coming in contact as it revolves with a fixed scraper, similar in principle to the "doctor" employed in calico printing, is made to fall off in a state something like dry mud into a receptacle prepared for it. The process is self-acting. It takes in its own supply of foul liquor from an elevated cistern, delivers the clear juice into the evaporating pan, and discharges the refuse as we have already stated.

Up to this stage the advantages obtained must be evident to all who are acquainted with this interesting branch of manufacture. The liquor being received direct from the press, avoids the necessity of the use of liquor pumps; the clarifiers, not being used as subsiding vessels, are not required to be so large; the loss of juice in the removal of the scum and in the sediment is prevented; the use of the "montjus" is rendered unnecessary; the coagulation of the albuminous matter is more rapidly obtained; the evaporating process may follow immediately after the pressing of the canes; and finally, the self-cleansing filter performs its work much better than any continuous process of skimming, and renders unnecessary that watchful attendance which is now so imperatively necessary in order to obtain the required brightness and color of the sugar. The saving of manual labor by these improvements is self-evident.

On the various modes of boiling and concentrating the juice at present in use, whether by a series of semi-globular pans, the vacuum pan, Gadsden's pan, or the apparatus of Mr. Crossly or Mr. Schroder, it is not necessary now to speak, the principle involved in one and all of them being the same — that of evaporating the fluid from the saccharine matter. The inventor of the process now under consideration, contends that, in all the existing arrangements for the separation of the water from the sugar, boiling under any form, or the use of surfaces or pipes heated by steam, must be totally excluded, if the formation of molasses is to be prevented. It is a well established fact that a thermometer placed in a solution heated by steam or the direct action of fire furnishes no indication of the temperature to which the liquid is exposed, as a vast amount of latent heat is absorbed by fluids in their formation into steam. To the forgetfulness of this simple fact are to be traced many of the fatal mistakes at present connected with the manufacture of sugar.

Thus, while the temperature of the syrup during ebullition in a vacuum pan indicates as low perhaps as 180° Fahr., the copper worm, against which portions of the sugar are constantly brought into contact, is equal to and often above 220° Fahr.; the consequence of which is the destruction of the color, and an injury to the crystallizing powers of the sugar. By an arrangement which Mr. Bessemer terms a hot air evaporator, the concentration of saccharine fluids may now, however, be effected without the slightest injury to color or quality, and in an increased quantity.

This apparatus consists of a tank of thin plate iron, of about 10 feet by 8 feet, and 2½ feet in depth, which has a false bottom, curved so as to form two parallel segments of a cylinder. Above these and coincident with them is a hollow drum of 18 inches in diameter, mounted on an axis, and upon which is formed a broad spiral blade in the shape of a screw, or "creeper," the thread of which is about fifteen inches in depth, and the convolutions three-quarters of an inch apart; and between each of the blades or threads of the screw, holes are formed spirally from one end of the drum to the other. At one end of the hollow drum, air, supplied by a blowing fan, and heated to 150° by passing along a flue, is made to enter, which escapes through the holes in the drum in a radical direction, and sweeps like the hot breath of the simoon over the wet surfaces of the various revolving blades, absorbs the moisture thus exposed to its action, and passes off in an invisible vapor. Upwards of six thousand square feet of evaporating surface is thus obtained in the small space of 10 feet by 8 feet. The screws make about eight revolutions per minute, and as they revolve, the more concentrated portions of the fluid are washed off as they descend into the fluid, and fresh portions are being constantly brought up on the surface of the screw, to be in like manner subjected to the hot-air blast. Finally, after three or four hours, the whole of the surplus liquor is carried off; the remaining fluid is sufficiently concentrated, and assumes a thick gelatinous appearance; and the screw, made to revolve in the opposite direction, expels the solution from the tank ready for the process of crystallization. By this process the sugar is not at any time exposed to a hotter surface than 140°. No boiling, consequently, takes place, no slea is formed, and not one grain of crystallizable sugar is converted into molasses. The entire cost of fuel for evaporation is saved, the waste heat of the chimney and waste steam of the engine being alone employed, and the apparatus costs less than the ordinary vapor pans; it can be worked with a small amount of wind or water power. Three hogsheads of sugar, it is stated, can be obtained where two only are now produced, whilst the quality will be superior in color and taste, and will be perfectly free from molasses.

The separation of the crystals from the mother liquor in which they are found is effected in a most ingenious and efficient manner by the use of the air pump. The transformation from the most repulsive and unwholesome-looking black sugar into a fine white sugar is completed in one-seventh of a second by this process. The principle adopted is precisely that employed in "gassing" lace — an operation resorted to for the purpose of removing the minute filaments of cotton adhering to the surface of the fabric. In the case of the crystals of sugar, a thin film of fluid matter is required to be removed from the surface of the crystal, and this is effected by bringing it in contact with water — a material which would as quickly dissolve the crystal itself, as the flame of the gas would destroy the delicate and fragile web of the bobbin net. How can the water be thus brought into contact with the sugar for such a short period, and in such a manner as only to remove the outer coating of molasses, and leave the crystal uninjured? The process is a very simple one. A table of nine feet in circumference is made to revolve eight times per minute, having a coating of sugar spread over it to the depth of half an inch, and which consequently moves over a space of 72 feet per minute. At one part of its revolution the table is made to pass under a pipe of two inches in diameter, from which a shower of water is falling, and as the pipe is but one-sixth of a foot in diameter, and the table passes it at the rate of 72 feet per minute, it follows that each portion which comes under the falling water will be retained only 1-432 of a minute in each revolution. This table being covered with thin brass wire gauze, has placed immediately under it a vacuum chamber, into which the falling water, carrying with it the semi-fluid coating of molasses, is drawn as the table revolves, the crystallized sugar remains on the surface pure and white, and is delivered by a scraper into the hogshead placed for its reception.

IMPROVEMENTS IN THE MANUFACTURE OF ROSIN OIL.

By an improved process patented by Mr. Thuck, of England, the acid, naphtha, and oil, are produced successively from the rosin as follows: —

A still is filled to about two-thirds its contents with rosin, amongst which, by means of a pipe fitted with a perforated coil near the bottom of the still, a jet of steam is introduced at or before the time of lighting the fire. As in the first stage of heating, the rosin is very apt to boil over, the still must be disconnected from the condenser to avoid the injury and explosion that might ensue, were the boiling rosin to enter the condenser. The heat must be gradually increased till it reaches 325° Fahr., when acid will be discharged, and the temperature must not be kept stationary till the acid ceases to flow. During the whole of the distillation, steam is injected by the pipe above mentioned; it passes through the rosin, and carries off the naptha with it in the form of vapor. The quantity of naphtha so produced is about 15 per cent. of the bulk of the rosin under treatment.

The acid and naphtha being run off, the temperature is raised to 550° Fahr., and oil passes off as vapor, and is condensed, being in quantity about 25 per cent. of the rosin. When the oil ceases to flow, the temperature is raised to 600° Fahr., when more oil will be produced, to the extent of about 12½ per cent. of the rosin; after this, the fire may be extinguished. The residuum left in the still resembles pitch, and may be put to similar uses; it is run off by a duct at the bottom of the still. The oil is partially purified as it passes off, by the injection of steam by means of a pipe entering the still near the top, and fitted with a rose.

The patentee next proceeds to describe his processes for purifying the oil, and qualifying it for lubricating purposes. The oil produced at a temperature of 550° Fahr. is re-distilled, being mixed with 5 per cent. of slacked lime. The heat is gradually raised to 550° Fahr.; but steam is injected by both of the pipes already mentioned, when it is at about 300°, and by this means the oil is bleached and purified. It is, however, again passed through this process, caustic being substituted for the slacked lime. The oil is then placed in a bleaching kettle, or pan of any convenient form, and heated to 225° Fahr. by a steam pipe entering and coiled in the lower part of the kettle. Steam is also injected through another pipe and rose, till the oil is fused, when the coloring matter produced in it by the atmosphere will be expelled, and the oil will be ready for use.

The oil originally produced at a temperature of 600° Fahr., is treated in the same way as that produced at 550°, except that at 300° steam is injected only by the lower of the two steam pipes — it being injected by the other at 600°. The oil produced in this case is called by the patentee, "currier's or tanner's oil." A still finer oil for painters is obtained from oil originally produced at 650° — the same being treated as in the last process — the steam being injected by the upper pipe, only when the heat reaches 650°. This oil is afterwards boiled, and suitably prepared for admixture with pigments.

NEW USE OF THE LEAVES OF THE PINE, (PINUS SYLVESTRIS.)

We publish the following, as one of the scientific curiosities of the year, without in any way vouching for its correctness. Our information is, however, derived from a usually reliable source, the National Intelligencer, of Washington.

Not far from Breslau, in Silesia, in a domain called the Prairie of Humboldt, there exist two establishments as astonishing for their produce as for their union. One is a manufacturer which converts pine leaves into a sort of cotton or wool; the other offers to invalids, as curative baths, the waters used in the manufacture of that vegetable wool. Both have been erected by M. De Pannewitz, inventor of a chemical process by means of which it is possible to extract from the long and slender leaves of the pine a very fine filaceous substance which he has named woody wool, because, like the ordinary wool, it can be curled, felted, and woven. All the aucular leaves of the pine fir, and of the coniferæ in general, are composed of a bundle of fibrillæ extremely fine and tough, surrounded and held together by a resinous substance under the form of a thin pellicle. When by decoction and the use of certain chemical agents the resinous substance is dissolved, it is easy to separate the fibres, to wash them and free them from all foreign substances. According to the mode of preparation employed, the woolly substance acquires a quality more or less fine, or remains in its coarse state; in the first instance it is used as wadding, in the second to stuff mattresses. If the pine has been preferred to the other kinds of pitch trees, it is on account of the length of its needle-shaped leaves. It is thought that a similar result might be obtained from other trees of the same species. The tree can be stripped of its leaves when quite young without any injury. The operation takes place when they are still green. A man can gather two hundred pounds of leaves a day. It was first advantageously substituted for cotton and wool in the manufacture of blankets. The hospital of Vienna bought five hundred, and, after a trial of several years, has adopted them entirely. It has been remarked, among other advantages, that no kind of insects would lodge in the beds, and its aromatic odor was found agreeable and beneficial. These blankets have since been adopted by the penitentiary of Vienna, the charity hospital of Berlin, the maternity hospital, and the barracks of Breslau. Its cost is three times less than that of horsehair, and the most experienced upholsterer, when the wool is employed in furniture, could not tell the one from the other. This article can be spun and woven, resembling the thread of hemp for its strength; it can be made into rugs and horse-blankets.

In the preparation of this wool an ethereal oil of a pleasant odor is produced. This oil is at first green; exposed to the rays of the sun, it assumes an orange yellow tint; replaced in the shade, it resumes its former green color; rectified, it becomes colorless. It differs from the essence of turpentine extracted from the same tree. It has been found efficient in rheumatism and gout; also as an anthelmintic, and in certain cutaneous diseases. Distilled, it is used in the preparation of lac of the finest kind. It burns in lamps like olive oil, and dissolves caoutchouc completely in a short time. Perfumers in Paris use it in large quantities. It is the liquid left by the decoction of the pine leaves which has been so beneficial in the form of bath. The bath establishment is a flourishing one. The membranous substance, obtained by filtration at the time of the washing of the fibres, is pressed in bricks and dried; it is used as a combustible, and produces, from the rosin it contains, a quantity of gas sufficient for the lighting of the factory. The production of a thousand quintals of wool leaves a quantity of combustible matter equal in value to sixty cubic metres of pine wood.

Experiments made in the United States since the publication of the above process, have entirely failed in producing any practical result, and we have little faith in the value of the scheme.—*Editor.*

CURIOUS EXPERIMENT IN WOOL GROWING.

In a lecture recentlyt delivered by Mr. Owen at the Society of Arts, the professor detailed he particulars of a highly interesting experiment, which resulted in the establishment of one of the very few instances in which the origination of a distinct variety of domestic quadruped could be satisfactorily traced, with all the circumstances attending its development well authenticated. We must premise it by stating that amongst the series of wools shown in the French department of the Great Exhibition, were specimens characterized by the jury as a wool of singular and peculiar properties; the hair, glossy and silky, similar to mohair, retaining, at the same time, certain properties of the merino breed. This wool was exhibited by J. L. Graux, of the farm of Mauchamp, Commune de Juvincourt, as the produce of a peculiar variety of the merino breed of sheep, and it thus arose: —

In the year 1826, one of the ewes of the flock produced a male lamb, which, as it grew up, became remarkable for the long, smooth, straight, and silky character of the fibre of the wool, and for the shortness of its horns. It was of small size, and presented certain defects in its conformation, which have disappeared in its descendants. In 1829, M. Graux employed this ram with the view to obtain other rams, having the same quality of wool. The produce of 1830 included one ram and one ewe, having the silky quality of the wool; that of 1831 produced four rams and one ewe, with the fleece of that quality. In 1833, the rams, with the silky variety of wool, were sufficiently numerous to serve the whole flock. In each subsequent year the lambs have been of two kinds — one preserving the character of the ancient race, with the curled elastic wool, only a little longer and finer than in the ordinary merinos; the other resembling the rams of the new breed, some of which retained the large head, long neck, narrow chest, and long flanks of the abnormal progenitor, whilst others combined the ordinary and better formed body, with the fine silky wool. M. Graux, profiting by the partial resumption of the normal type of the merino in some of the descendants of the malformed original variety, at length succeeded, by a judicious system of crossing and interbreeding, in obtaining a flock, combining the long silky fleece with a smaller head, shorter neck, broader flanks, and more capacious chest. Of this breed the flocks have become sufficiently numerous to enable the proprietor to sell examples for exportation. The crossing of the Beauchamp variety with the ordinary merino has also produced a valuable quality of wool, known in France as the Mauchamp Merino.

The fine silky wool of the pure Mauchamp breed is remarkable for its qualities, as combining wool, owing to the strength as well as the length and fineness of the fibres. It is found of great value by the maufacturers of Cashmere shawls, being second only to the true Cashmere fleece in the flexible delicacy of the fabric, and of particular utility when combined with the Cashmere wool, in imparting to the manufacture qualities of strength and consistence, in which the pure Cashmere is deficient. Although the quantity of the wool yielded by the Mauchamp variety is less than in the ordinary merinos, the higher price which it obtains in the French market — 25 per cent. above the best merino wools — and the present value of the breed, have fully compensated M. Graux for the pains and care manifested by him in the establishment of the variety, and a council medal was awarded to him.

PROTECTOR GAS METERS.

It is well known that the meter in general use is open to many objections, among which may be enumerated that it is not infallible, and that it can be tampered with to defeat the purpose for which it is intended. Mr. J. Laidlaw, of New York, has recently devised a meter for the purpose of obviating these defects, his object being to guard the gas companies against fraud on the part of a dishonest consumer, and also to make the public certain that they receive the amount of gas for which they pay. The most common manner by which the gas companies were defrauded was by tilting the meter to one side, so that more gas was consumed than was actually registered. On the part of the consumer it was complained that it was in the power of the company, by altering the level of the water in the meter to make him pay for more gas than he had used. These proceedings are prevented by such an arrangement, chiefly in the disposition of the pipes, that all unfair attempts are useless or defeat their own object. The proper quantity of water is maintained by using a pipe, down which the water flows when too much is poured into the meter; this pipe leads the water into a lower chamber, where it is drawn off by a syphon to the outside of the meter, provision being made that the gas cannot force the water out. If the meter is tilted to one side it is still quite efficient, and if tilted forward, the gas is cut off and cannot act on the drum, consequently the lights are extinguished. There is also a very handsome apparatus intended to test each meter before it leaves the hands of the maker or the gas company; this apparatus is on the principle of the gasometer, in fact it is a small one. There is a clock-faced index attached to it, which serves to check the accuracy of the meter. — *Scientific American.*

AMERICAN CHRONOMETERS.

Until within a recent period the chronometers of the best character used in the American marine, were exclusively of English manufacture. Chronometers are now, however, manufactured in this country equal, if not superior to any produced elsewhere. The Grinnell Arctic Expedition was supplied with the best English chronometers, and also with American ones, manufactured by Bliss & Creighton, of New York. On the return of the expedition it was found that the error of the English instruments was five times greater than that of the American. One of the New York chronometers, in particular, was subjected to the severest tests to which it is possible to subject instruments of such delicate construction; yet so exquisitely was it provided with adjustments and compensations for the very great extremes of temperature to which it has been subjected, that, having suffered all sorts of exposure to which such instruments are liable in a Polar winter, it was returned with a change in its daily rate, during a year and a half, of only the eighteen thousandth part of one second in time. In stating this fact it will be born in mind that the temperature registered during the winter in Wellington Straits was actually 46° below zero.

NEW ILLUMINATING APPARATUS FOR LIGHTHOUSES.

A NEW illuminating apparatus for lighthouses, has been recently brought out by Mr. Wilson, of Providence, and Dr. Meacham, of Cincinnati. The improvement consists in a combination of the dioptic and catoptic methods of illumination, and the arrangement of the lamp and reflector is thus described in the Providence Journal:— "The lamp, which is of great illuminating power, has three concentric wicks, the diameter of the larger being $2\frac{3}{4}$ inches, with a separate oil chamber for each, and to which, by a simple arrangement of the conveying tubes, the oil is carried and constantly kept at its proper level, thereby dispensing with the rack-and-pinion for raising the wicks, as well as all the clock-work and pumps heretofore found indispensable in lamps of this kind.

The reflectors, which are arranged both above and below the light, are constructed upon a die, the form of which is obtained by the revolution of a parabola around an axis perpendicular to its own, and passing through its vertex; and the diameter of the lamp and the focal distance of the reflectors are so graduated to each other, that the most luminous portion of the light shall always be in this universal focus.

To prevent the escape of any radiant light, a cylindro-plano-convex lens, having the same common focus, is placed between the middle and lower reflectors, which transmits and refracts it in a line parallel to a horizontal plane passing through the light. By this arrangement all the light evolved is thrown out in a horizontal belt, and is equally luminous or brilliant at all points. The cost of this apparatus is about $300."

SAFETY FLUID LAMPS.

TWO inventions have been brought out during the past year, designed to obviate and prevent the frequent explosions of lamps containing and burning the various fluids known as camphene, burning fluid, &c. These two inventions, by Prof. Horsford, of Harvard University, and Mr. Newell, of Boston, are founded to a greater or less extent upon the principles developed by Davy, in the Safety Mining Lamp.

The lamp constructed by Mr. Newell is made as follows: — In the center of the lamp, extending to the bottom, is a fixed cylinder of fine tinned wire gauze, having a mesh of 500 to the inch. A tube of like gauze screws on to the wick disc, and confines the wick; this tube slips down inside of the gauze cylinder spoken of. The can for containing the camphene, or turpentine and alcoholic mixture, is made with a disc of this wire gauze in the spout and under the lid. The wick disc is also perforated with a number of fine holes, which thus establish a communication with the interior of the lamp and the external air. Should the contents of the lamp at any time be fired, as during the filling, the combustion is wholly confined within the gauze tube running up the centre of the lamp, or rather, to the narrow space between the external and internal tubes; and all flame is prevented from reaching the fluid contained in the body of the lamp. On the other hand, the small perforations in the wick disc, at once relieve the interior of the lamp from the pressure of gas, or vapor generated by overheating, and at the same time prevent the passage of flame from without.

The arrangement in the lamp devised by Prof. Horsford, is somewhat different from that of Mr. Newell's, but is intended to accomplish the same purpose.

DISINFECTING LAMP.

A simple and economical apparatus for disinfecting apartments, and purifying the air, has been used for some time by various medical gentlemen in Boston. It is simply this: — Take one of any of the various kinds of glass lamps — for burning camphene, for example — and fill it with chloric ether, and light the wick. In a few minutes, the object will be accomplished. In dissecting rooms, in the damp, deep vaults, where vegetables are sometimes stored, or where drains allow the escape of offensive gases, in outbuildings, and in short, in any spot where it is desirable to purify the atmosphere, burn one of these lamps. One tube, charged with a wick, is quite sufficient. This suggestion is really worth remembering for the comfort of a sick room, because it is easily accomplished, agreeable, and more economical for purifying than any process now known.

ON THE LIGHTHOUSE ESTABLISHMENT OF THE UNITED STATES.

The almost universal complaint of the utter inefficiency of our lighthouses, has at length led Congress to take measures for an examination into the truth of the reports, and the causes of the defects, if such existed. In accordance, therefore, with a resolution, a Board of officers was appointed with instructions to inquire into the condition of the lighthouse establishment of the United States, and make a general detailed report and programme to guide legislation in extending and improving our present system of construction, illumination, inspection, and superintendence. The Board consisted of Commodore Shubrick and Commander Du Pont, of the Navy, Gen. Totten and Col. Kearney, of the Engineers, Prof. A. D. Bache, Superintendent of the Coast Survey, and Lieut. Jenkins, of the Navy as Secretary. The results of the investigations of these officers have been given in a voluminous and valuable report to Congress, which discloses a state of things in reference to our lighthouses, which is highly discreditable to the nation, and requires instant change. It appears that there is no system whatever, no proper mode of determining the position or character of the lights; that the lights themselves are of a kind obsolete in Europe, badly placed, badly constructed, badly furnished, and badly tended; that the towers are not always well placed, and are very frequently badly built; and that with a very low useful effect, our lighthouses cost as much as, or more than, a proper system of first rate lights. The remedy proposed is a simple one, — the establishment of a permanent Lighthouse Board, properly constituted, who shall superintend the arrangement of all lights; employ competent persons to select proper sites, and determine the character of the lights, which are to be of the most efficient construction; competent engineers to design the lighthouses, and superintend their construction; proper persons to test the quality of the supplies purchased, and to deliver them in proper quantities to the keepers; and, finally, shall draw up a set of proper regulations for light keepers, and see them attended to.

We also learn from the Report, that there is not in useful effect, a single first class light on the coast of the United States. That the lights at Neversink, (two lens,) New York, and the second order lens light at Sankaty Head, Nantucket, are the best lights on the coast of the United States. That there are few, if any, reflector lights on the coasts of the United States, better in useful effect than the third order lens light, erected by the Topographical Bureau, on Brandywine shoal, while the economy of the lens light is in the ratio of at least 4 to 1. That the Fresnel lens is greatly superior to any other mode of lighthouse illumination, and in point of economy is nearly four times as advantageous as the best system of reflectors and Argand lamps.

The whole subject of lighthouse illuminations and improvements, although one of occasional discussion in Congress, and in certain circles, within the last ten years, has not occupied the public mind to any great extent in this country; while in Europe generally, but more especially in France, England, Scotland, and Ireland, the ablest and most distinguished statesmen, philosophers, and philanthropists, have devoted themselves, for the last twenty-five years, to this subject, in endeavoring to apply practically the aids which science and the mechanic arts have developed. Experiments to ascertain the truthful practical test of the relative useful and economical value of illuminating apparatus, and their accessories, in the most minute detail, have been made by Fresnel, Faraday, Stevenson, and other distinguished individuals; the results of their investigations have been published to the world, and their conclusions have served for the formation of a system for lighthouse illumination, approximating to perfection. Legislation, too, has taken a prominent part in this important branch of the public service in Europe. In 1825, the French government adopted definitely the French system on the coasts of France, and took, as the basis of their future lighthouse establishment, the programme proposed by the Board organized for that purpose, at the head of which was Admiral Rossel, of the French navy. About this time the subject, which Sir David Brewster had foreshadowed in 1811, was revived in England and Scotland, through Col. Colby and Mr. Stevenson, the engineer of the Northern lights, (and the distinguished architect of the Bell Rock tower;) however, no important step was taken on the English side of the Channel, to introduce the Fresnel apparatus, until after a most careful and rigid examination, and until after trials of comparative usefulness and economy with that and the reflector apparatus. Although the Fresnel lens has met with much favor in England, and has been gradually getting into use, until nearly one-half of the sea coast lights have been changed since 1837, still Scotland has introduced a larger number in proportion to extent of coast, than the Trinity Board. Notwithstanding these improvements in the lights of Great Britain, the subject was again taken up by the House of Commons in 1845, and since then a large number of lens apparatus have been introduced both in Great Britain and in the colonies, and the rape-seed oil, on account of its superiority and economy, has been substituted for the best sperm oil, in most of the lighthouses of the kingdom. While improvements in illuminating apparatus, and construction, ventilation, combustibles, &c., have made rapid progress in lighthouse engineering in Europe, hardly any attempt has been made in this country to improve the lights, and no efficient protection is now afforded to the immense foreign and domestic commerce, which is now daily risked upon our dangerous and ill-lighted coasts.

TO PREVENT WOOD FROM WARPING.

Francois Tachet, of Paris, has taken out a patent for the following method of preparing wood, to prevent it from warping or shrinking. The ordinary method of doing this is to employ two or more thin pieces, which are united together with the grain cross-wise, by means of glue or liquid cement, but this only partially answers its intended purpose, as glue, or cement, applied in a liquid state, is always liable to be affected by a moist atmosphere, and the expansion produced thereby, and the subsequent unequal contraction in drying, causes a certain amount of warping. Now the object of the patentee is to unite pieces of wood together, so as to render them independent of atmospheric influences, and this he effects by employing the cement in a dry and powdered state, and applying heat to the exterior of the pieces of wood to be united, so as to effect the melting of the cement by transmission. The cement which the patentee employs is gum lac, alone or in combination with other materials. This he reduces to a powder, and sprinkles evenly over the surface of one of the pieces of wood to be united. He then lays the other pieces of wood on the cement-covered surface, and repeats the process of sprinkling cement and applying thicknesses of wood, according to the ultimate required thickness to be produced. He then clamps the pieces of wood together, and applies sand, heated to about 300° Centigrade, to the exterior surfaces, and continues this applicaiion of heated sand until the cement is melted, when the sand is removed, and the air admitted to cool the wood and set the cement. When quite cold, the prepared wood is removed from the clamping press, and may then be applied to any useful purpose. — *London Mechanic's Magazine.*

EFFECT OF STEAM ON TIMBER.

Mr. Violitter has lately presented to the Academy of Science in Paris, a communication on the dessication of different kinds of wood by steam. He stated that steam raised to 482° Fahr., was capable of taking up a considerable quantity of water, and acting upon this knowledge, he submitted different kinds of oak, elm, pine, and walnut, about 8 inches long, and half an inch square, to a current of steam at 7½ pounds pressure to the square inch, but which was afterwards raised to 482°. The wood was exposed thus for two hours. It was weighed before it was exposed to the steam, and afterwards put into close stopped bottles until cool, when the samples of wood were again weighed, and showed a considerable loss of weight, the loss of which increased with the increase of the temperature of the steam. For elm and oak, the decrease in weight was one-half, ash and walnut two-fifths, and pine one-third. The woods underwent a change of color as the heat was rising from 392° to 482°; the walnut became very dark, showing a kind of tar, formed in the wood by the process, which was found to have a preserving effect on the wood.

It was found that wood thus treated became stronger — having an increase in the power of resisting fracture. The maximum heat for producing the best resisting fracture power for elm, was between 302° and 347°, and between 257° and 302° for the oak, walnut and pine. The oak was increased in strength five-ninths, walnut one-half, two-fifths for pine, and more than one-fifth for elm. These are but preliminary experiments, which may lead to very important results, and are therefore interesting to architects especially. By this process, the fibres of the wood are drawn closer together — and maple and pine treated in the steam to a temperature of 482°, were rendered far more valuable for musical instruments, than by any other process heretofore known.

ENCOURAGEMENT OF THE FINE ARTS.

The British Society of Arts, in order to afford the greatest facilities for the study and prosecution of painting and drawing, have recently had prepared under their direction, boxes of colors, and sets of mathematical instruments, which are sold at the following prices. The box of colors retails for one shilling, and contains the following colors — gamboge, lake, light red, ultramarine, vermillion, indigo, yellow ochre, Vandyke brown, sepia, burnt sienna, — and three hair pencils. The cases of instruments are of two kinds: — 1. Those necessary for learning the elements of geometric construction; viz., a graduated boxwood ruler and set-square, a pair of six inch compasses, with moveable pen and pencil legs in a slide box; these are sold to the public for half a crown. 2. Those necessary for affording artisans and others who have some knowledge of drawing, the means of putting their drawing into practice in their various trades, viz., a pair of six inch compasses, with pen and pencil legs, a drawing pen, a bow pencil, a bow pen, and a boxwood protractor: these are sold for six shillings.

INSTRUMENT FOR OBTAINING CORRECT REPRESENTATIONS FROM NATURE.

At the Belfast meeting of the British Association, Mr. H Twining presented an ingenious instrument, designed to aid in obtaining correct representations of objects from nature. This little instrument was on the principle of a theodolite; by which the angular positions of the several objects in a scene in nature, which the artist had resolved to transfer to his canvas, could be accurately recorded in his note-book, and afterwards, at leisure, by the aid of a square frame of crossing threads, accurately placed in a picture of any determined size, according to certain simple rules, which the author pointed out.

CULINDRON PIANO.

The above is the name applied to a new form of the piano, invented by Messrs. Speer & Marx, of N. J. The novelty of this instrument consists in the form of the sounding board and the consequent arrangement of the strings, &c. In order to obtain a larger surface for sound than would otherwise be possible, the sound board is shaped cylindrically, forming an upright pillar, with the strings keyed on the exterior. There is, accordingly, a great difference in the arrangement from that of the ordinary piano, as the strings, &c., are placed in a vertical instead of a horizontal position. But the chief improvement consists in the sounding board, which from its peculiar shape, presents many advantages of tone as well as of larger surface. There is a pedal attachment for *piano* and *forte* in the usual manner, which is connected with the top of the cylinder.

ON THE PRESERVATION OF FRUIT.

At a late meeting of the Farmers' Club of New York, Mr. W. R. Smith, of Wayne County, Pa., gave an explanation of a new method which he had adopted for preserving fruit. He introduced no foreign substance, but preserved the fruit entirely in its own juice, extracted by a chemical process, without sugar or alcohol. He had a few thousand bottles, all produced from his own farm. About three years ago he commenced experiments to attain a superior method of preserving. At first they failed, and hundreds of bottles spoiled in color or taste; but now they had, though not brought to perfection, attained a very superior degree of preservation. It was a principle that two fluids, with a porous substance between them, would unite. So, in preserving fruits in alcohol, the weightier fluid, or juice contained in the fruit, was replaced by the lighter fluid, alcohol; and we eat alcohol instead of fruit; while in preserving them in Sacharine juice the flavor went entirely into the syrup, leaving the fruit comparatively tasteless. The plan pursued of preserving the fruit in its own juice, obviated these difficulties, by making the syrup of equal density with the juice within the fruit, thereby preserving both aroma and flavor. Success, Mr. Smith said, depended not so much on skill, as on close attention to every manifestation, and choosing the fruits and vegetables at the moment they were fit for the dessert. The cherry, as generally brought to market, was not wholesome, but when ripe and fresh it was very healthy. From the various specimens produced, tomato, raspberry, quince and peach were remarked as most perfectly preserved, containing the natural aroma and taste of the fruit.

PRESERVATION OF EGGS.

M. Chambortd in the *Belgique Industrielle* gives the following receipt for the preservation of eggs: —

"By submitting a thin stratum of the white and yolk of eggs about 1-12 inch thick upon glass or porcelain plates, to the heat of an oven, a mass will be obtained after 24 hours drying, readily pulverized, and which is not altered by the action of the air after drying again a day. Each pound of powdered eggs thus prepared, when desired for use requires two pounds of cold water, with which it is to be beaten up, and is equivalent to fifty eggs, and may be used for omeletts, pastries, or other culinary purposes."

A MUSEUM OF DOLLS.

M. Jules Lecomte, in the *Courier des Etats Unis*, gives the following account of a collection of dolls which is soon to be exhibited in Paris. He says, "At first there seems only a fanciful and useless idea in such a collection. But reflection and examination soon demonstrate how curious, instructive, philosophical, geographical, and historical is this collection which at first seems so puerile. The attempt has been to bring together an incredible variety of types of races, of dresses and customs, which comprehends all countries and several centuries. There are, for example, five dolls of the fifteenth century, which give an exact representation of the fashions of that time, and a carefully prepared picture of the kind of beauty then admired, and tell more about that epoch than many great books, which it would take a great while to read, could do. Here is the doll with which a noble young lady under Charles VI. amused herself at the time the council of Constance was burning John Huss. Here is the model of Yseult with the white hands, giving the prize of the tournament to the valiant Chevalier Jean de Bethencourt, who was not long after to discover the Canary Islands; here is the model of the proposed costume of the soldiers of Lancaster, the defenders of the red rose at the battle of Wakefield. Here is, on the hurdle, the figure in miniature of a sufferer of the first inquisition of Spain in 1478. Here is the exact costume worn by the Princess Mary, daughter of Charles the Bold, on the day of her marriage with Maximilian, of Austria. I remarked that the hair of the Princess is red, and I imagine this is the local color. You can thus see the interest of this odd museum. Spain has furnished for it almost all her religious orders, and under the hair-shirt or the robe, the type of the monk, his head covering, his complexion, his air. There is a puppet which enabled the nobles to judge how Montesquieu killed the Prince of Conde at the battle of Jarnac, a dancing figure of that time, making undoubtedly a part of some popular spectacle, which represents Charles IX. armed with the contested arquebus which Catherine de Medicis put into his hand on the day of Coligny's death. The image of the dead Marguerite de Valois, the first wife of Henry IV., on her bed of state. Models of the native inhabitants which were found by the Dutch in the Indies, when they founded Batavia. Puppets, with which noble misses under Casimir V., King of Poland, amused themselves. The model presented to the king for the grand uniform of the order of St. Michel, founded in 1665. The costume of the Doge Francesco Erizzo in 1631. A figure dressed as did the widow of James III., of England, who died at St. Germain. The state-dress of the Doge's wife, Gremani, or her way to throw the ducal ring into the waves of the Lido. Here are four dolls found at Ecouen in the cells of the pupils there: one represents a young musqueteer. And, finally, the puppet arranged by David, by which he submitted to the Emperor Napoleon the model of the coronation dress. These indications may give some idea of the extreme curiosity of this singular collection. It furnishes a type of almost every part of the world. Savages are represented by figures of great simplicity of execution. There are religious images and pagan idols, Egypt and Hindostan, the Bosphorus and the Mississippi, Canada and China, all are represented. Wood, paste-board, paste, earth, skin, porcelain, wax, are materials of which all these bodies are made; the remains of all epochs of all countries. The ingenious collector purchased costumes at the Crystal Palace Exhibition, at great expense, of Swiss, Italians, Indians, Laplanders, and even the exact costume of rose-colored satin in which Queen Victoria was crowned. He has spent more than 100,000 crowns in forming this museum of the human race, and human coquetry. The latest individuals placed in his glass cases, are beautiful dolls, half a metre in height, showing models of the various fashions of the last winter.

NEW METHOD FOR TAKING IMPRESSIONS OF STAMPS, SEALS, &C.

To take exact impressions of stamps, or in fact of any device, raised or imprinted, that is sunk upon paper, cut a piece of card-board, say to the breadth of half an inch, with which form a ring just the dimensions of the impression to be taken; then pour within the said ring, which surrounds the spot, melted fusible metal; the carding will prevent the metal from running away, and in a few minutes it will cool and take the impression, without the slightest injury to the paper from which it was taken. It need not be said that the impression, &c., taken, must be the same as the original. Fusible metal is a compound of eight parts of bismuth, five of lead, and three of tin, which liquifies at 212°, and below that if one part of quicksilver be added. — *London Chemist.*

IMMENSE MANUFACTURING ESTABLISHMENT IN ENGLAND.

The London Times gives the following account of a new and immense establishment now erecting at Bradford, England, for the manufacture of alpacas. The magnitude of this concern, says the Times, may be inferred from the fact that it is calculated to cover six statute acres of ground. The principal building will be a massive stone edifice, with considerable architectural pretensions, having a single room in it of 540 feet long, and the machinery will include the latest inventions of acknowledged merit. The engines to move the immense mass of machinery required are calculated at 1,200 horse power. The gas works alone will be equal to those of a small town, and will be erected upon White's hydro-carbon system, at a cost of £4,000; it is estimated that 5,000 lights will be required, and the gas works are constructed for a supply of 100,000 cubic feet of gas *per diem.* In addition to this extensive factory, Mr. Salt is building seven hundred cottages for the workpeople in the immediate neighborhood. The site is at a place which has been named Salt-Aire, being on one of the banks of the river Aire, and will be approached by a tubular bridge over the river, which is also to be of elegant construction. The estimated cost of the whole is not known, but has been spoken of as upwards of half-a-million sterling. Unrivalled for extent as these works are at present, perhaps, in the world, and with masonry also of the most substantial character, and machinery the most perfect, it is said that a cotton mill is in contemplation at Bolton, of nearly, if not quite equal magnitude.

REDUCTION OF PRICES BETWEEN 1810 AND 1851.

Amid the busy innovations of this active time, it is very difficult to appreciate as it deserves the great social progress which has been made in defiance of all obstacles within the last forty years. The immense fall, for example, which has taken place in the cost of all articles of food and clothing that enter into the consumption of the working and middle, as also of the higher classes, is in its effect equivalent to a social change of the most important kind. The London Athenæum furnishes the following differences in the cost of commodities in England in the year 1810, and in the year 1851. The price of a hat in 1810 was 20 shillings, and in 1851, it had fallen to 7 shillings — or if a laborer's weekly wages had been paid for in hats, he would have had three times as great a supply in the present year as he had forty years ago. A gown cost 21 shillings in 1810 — and only 6 shillings in 1851. Calico was 2 shillings and 9 pence a yard against 6 pence at present. Tea was 8 shillings per pound against 4 shillings now. Brown sugar was 10 pence — now 4 pence. Salt was 18 shillings per bushel, and has now fallen to 1 shilling. A bushel of flour was 20 shillings in 1810, — and 5 shillings in 1851. In reply to these facts it may be said that this rate of money wages has fallen with money prices. This assertion is difficult of proof. In some few cases money wages has declined, but as a general result, they have not declined in the same ratio as money prices. Therefore the condition of the people is materially improved, inasmuch as the real or commodity price of the labor of the English working classes is probably as much as one-half, or three-fourths better than it was in 1810.

MISCELLANEOUS NOVELTIES.

Dipthera Bonnets. — This name has been applied to a new style of bonnets, brought out during the past year in Paris, which are manufactured from the well known polished or "patent leather."

Improved Slates. — A manufacturer in Wurtemburgh has invented a mode of applying a surface coating to sheet-iron, which enables it to take freely the mark of a slate pencil. It is said to be much lighter, and much less liable to injury, than a common slate.

New Enamel for Cards. — Zinc white, instead of the lead salt, is now used with great success for the enameling of cards.

Improvement in Purifying Gas. — Peat charcoal has been substituted with economy and success in some of the English gas works instead of the lime ordinarily used.

The London Athenæum states, that an architect of that city, has found that the ordinary window-sashes may be made of glass, instead of wood or iron as at present; — and from the greater beauty of the material, it is obvious that sashes of red, blue or green glass — according to the taste of the glaizer or according to the other decorations of the window — would add considerably to the brilliant effects of a fine shop front.

NATURAL PHILOSOPHY.

NEW ARRANGEMENT OF THE VOLTAIC PILE.

M. La Grange in the Comptes Rendus of April 5th, states that he has found a means of rendering the current of the voltaic pile perfectly constant and invariable, even for weeks or months, of whatever metals the electrodes may be formed, and whether they be set in action by two liquids as in the combination of Bunsen, or by one, as in that of Volta. This continuity of electric action is obtained in the same way that we obtain the continuity of the calorific action of a stove, which is furnished below with a grating to let the ashes fall, whilst we continually add fuel at the top. The method which he employs is simple and fulfils all the conditions which can render it practicable in an industrial point of view — instead of increasing the expense it diminishes it.

Let us first see the disposition of a single pair with one liquid. Take a vessel with a hole in the centre of the bottom, such as a flower pot, and round the hole let one end of a cylindrical diaphragm of cloth be attached by cement to the bottom of the pot. The axis of the hollow cloth cylinder when erect, will coincide with the axis of the vessel, and its height is somewhat less than the walls of the latter. Within the diaphragm is placed a stick of very hard coke, such as is found in the gas-retorts, surrounded by small grains of the same coke, and round the diaphragm a cylinder of amalgamated zinc, and some acidulated water, furnished drop by drop from a reservoir above. Let us now unite the two poles by a conducting wire, and see what takes place in the interior of the apparatus. The acidulated water, which continues to drop into the vessel, will pass in part over the margin of the cloth diaphragm on to the grains of coke, which will thus be continually bathed by the movement of the liquid, without being inundated, so that the polarization will be suspended, and the bubbles of hydrogen will be freely disengaged through the interstices between the particles; besides which, the lower strata of the acidulated water, in consequence of the pressure which they have to support, will filter slowly through the cloth, which will not be the case to any extent with the upper and middle strata. Now these lower strata are precisely those which contain the sulphate of zinc, which it is necessary to eliminate. The result is an electric current, which is perfectly constant until the entire disappearance of the zinc, and which is obtained with no more care than that of keeping the reservoir filled.

His method of uniting a number of pairs is as follows: The stone ware pots in which they are contained, which are three or four diameters in length, and consequently have the appearance of tubes, are united and cemented into a bundle or block, which is readily transported from place to place. The upper surface being horizontal, small gutters are employed to convey the acidulated water to each pot. With this arrangement by placing a second reservoir above the pile and altering the nature and elevation of the diaphragm, it is easy to employ a second liquid, which may be made to fall directly drop by drop on the grains of coke, such as nitric acid;—it may be used with advantage when very weak, and when it will no longer serve for the battery of Bunsen, from its ceasing to absorb hydrogen. The liquids on leaving the pots are collected, and may continue to be used until saturation.

IMPROVED TELEGRAPHIC BATTERIES.

A SERIES of experiments was recently made on the sub-marine telegraph between England and France, by Mr. Reid, of London, for the purpose of testing a pair of double needle instruments and two new batteries which he had constructed. One of these instruments was placed in the company's office at Dover, and the other in the French office at Calais, with a battery to each. Two of the sub-marine wires were then connected with the instruments, and put in circuit with the batteries. The length of the sub-marine cable in the channel is about 24 miles, and about five miles of land telegraph on each side, making in round numbers a circuit of 68 miles. The battery that was to work this distance formed a strong contrast to the present battery now in use, the length being only 4 inches by 1½ deep, and the weight 1 lb. 5 oz., while the old common battery used on the lines is 36 inches long, 7½ inches wide, 8½ inches deep, and weighs 64 lbs. Some of the telegraph clerks in the office smiled incredulously when Mr. Reid connected the miniature battery with the instrument, but were surprised to find the signals to and from Dover and Calais quite equal to the signals they were receiving from their former batteries. The next experiment was for the purpose of testing an improvement in the double needle instrument, and will require the utmost stretch of faith on the part of our readers to believe. It was as follows:—The miniature batteries were removed from the instruments on each side of the channel, and a piece of zinc, three-fourths of an inch square, and a piece of silver to correspond, were then introduced into the mouth of the operator at the office in Dover, and instructions sent to do the same at Calais. The wires, attached to these pieces of metal were then connected with the instruments, and by this simple means, and by the simplest of all batteries, the telegraph clerks sent several messages to and fro from England to France. The next experiment was similar to this, only a larger piece of zinc and a larger piece of silver were introduced into the mouth of the operator. The result was an improvement of the signals. On a subsequent occasion, in the presence of a large number of scientific gentlemen, the instruments with the miniature batteries transmitted all the commercial messages, prices of stocks, funds, &c. It was thought that during these operations the miniature battery would become exhausted; on the reverse, it improved, and seemed perfectly to maintain its character.

An improvement of the well-known Grove's batteries has been recently introduced on one of the telegraphic lines between Boston and New York. It has been found that in the battery, if instead of immersing platinum strips of one or two square inches in the exciting fluid, platinum wire be used, an equally powerful effect is produced. If the zinc element be as small, it will, so long as it lasts, be of equal avail. But since the zinc is constantly and necessarily decomposed by the action of the acid, so great a reduction in size is not advisable. But the platinum never wastes. In the prime cost of a battery, the platinum is by far the largest item, and by its reduction, the expense of a battery is diminished about *one-half.* In order to retain the platinum in its place, the end of the wire that is immersed in the fluid, may terminate in a bead, either of platinum or of glass. The weight of this bead will counteract all tendency of the wire to bend or curl, and will keep it constantly immersed in the fluid. The reduction in the size of the plates, does not modify, in the least, the nature of the working current.

The London Athenæum gives the following account of a new galvanic battery recently exhibited in that city by Mr. Martyn Roberts. The battery consisted of fifty plates of tin about six inches by four, — each plate being adjusted between two plates of platinum of the same size. These were placed in stone-ware cells about two feet deep, which were filled with diluted nitric acid. The object of these deep cells was, to obtain a marketable product which should be sufficiently valuable to cover the cost of the agents employed to effect the development of electricity. The upper stratum of nitric acid acts on the tin, and forms with that metal an oxide, which falls off from the plate the moment it is formed, and is precipitated as a hydrated oxide of tin to the bottom of the cell. This oxide is combined with soda; and as stannate of soda is extensively employed in dyeing and calico printing; it is stated that this product will yield a profit of 20 per cent. on the cost of the battery but this is a point which we are not at present in a position to determine. The electrical action of the fifty pairs of plates was considerable. The current was employed to exhibit the electrical light, and the effects produced were certainly very brilliant. It was not possible to compare it with the result obtained from a Grove's battery, but we judge their powers to be nearly equal. An experiment made on the decomposition of water gave about 27 cubic inches of the mixed gases, oxygen and hydrogen, per minute. We cannot but regard this very ingenious arrangement as an improvement on the ordinary batteries, as far as economy is concerned, where an electric current is required, since the stannate formed must always be of considerable commercial value. It is curious, too, that the stratum of fluid in the immediate neighborhood of the voltaic plates is kept uniformly of the same specific gravity, notwithstanding that the acid is rapidly removed. The oxide of tin formed takes down water with it, and at the same time establishes a current by which fresh acid is applied to the plates. We were informed that the battery continued in most uniform action for sixteen hours.

KILLING WHALES BY ELECTRICITY.

The New Bedford Mercury describes a process invented at Bremen, and brought forward at New Bedford, for killing whales at the moment of striking them with the harpoon, by means of electricity. The object of the expedient is to produce an immediate paralysis of the vital powers of the whale at the moment at which he is struck, so as to obviate the danger, the labor, and the hazard of loss, from the struggles of the whale after he is struck. The process is thus described by the Mercury.

"The electricity is conveyed to the body of the whale from an electro-galvanic battery contained in the harpoon, and so arranged as to re-conduct the electric current from the whale through the sea to the machine. The machine itself is simple and compact in construction, enclosed in a strong chest weighing about 350 pounds, and occupying a space in the boat of about three and a half feet long by two feet in width, and the same in height. It is capable of throwing into the body of the whale, eight tremendous strokes of electricity in a second, or 950 strokes in a minute, paralyzing in an instant the muscles of the whale, and depriving it of all power of motion, if not actual life."

This invention has been partially tried by the Captain of a Dutch whale ship, which left for the Pacific in July, 1851. This vessel was provided with three rotation machines of various sizes, in order to ascertain the degree of power necessary to secure sperm, or right whales; one machine containing one magnet, another four, and another fourteen.

The Captain, in a letter dated New Zealand, Dec., 1851, writes as follows: —

"The first experiment we made with the new invention was upon a shark, applying the electricity from the machine with one magnet. The fish after being struck, instantly turned over on its side, and after we had poured in upon him a stream of electricity for a few moments by turning the handle of the machine, the shark became stiff as a piece of wood. We next fell in with a black fish. As soon as the whale iron was thrown into him, and the machine handle turned, the fish began to sink. The operator then ceased turning the machine, and the fish immediately rose, when the machine was again set in motion, upon which the fish lay stiff on the surface of the water, and was taken alongside of the ship. At this time we made use of the four magnet machine.

"We saw sperm, and other whales, and lowered our boats, but were unsuccessful in getting fast to them, as they disappeared on our approaching them; while at all other times the weather was too boisterous to permit us to lower our boats. Thus we had but one chance to try the experiment upon a whale, which was made with the four magnet machine. The whale upon being struck made one dash onward, then turned on his side and was rendered perfectly powerless. Although I have as yet not been fortunate enough to test the invention in more instances, I have the fullest confidence in the same, and doubt not to be able to report the most astonishing results on my return from the Arctic Seas, where I am now bound.

THE ELECTRICAL PROPERTIES OF FLAME.

PROF. BUFF, of the University of Giessen, has recently published an interesting paper on the electrical properties of flame. He has come to the conclusion that gaseous bodies, which have been rendered conductable by strong heating, are capable of exciting other conductors, solid as well as gaseous, electrically.

Two small strips of platinum were introduced into a glass tube closed at one end; they were separated by an interval of a thin line of air. The air within the tube could not be heated to a degree sufficient to permit the electricity of two of Daniell's cells to pass through it. When the glass became soft by heating, and both pieces of platinum were permitted to touch it, a strong deflection of the needle of the galvanometer was the consequence.

When the strips of platinum were exposed to the direct action of the flame of a spirit lamp, the first notice of the passage of the electricity was obtained, when they were placed at about three inches above its extreme point, and began to show signs of redness. The deflection increased as the strips were lowered in the flame. When the flame was strongest there was a permanent deflection of 70°. The flame current passed always from the hottest platinum strip through the separating interval of gas to the other strip. When the metallic wires or other conductors, connected at one end, are brought into contact with highly heated gas, it formed an electric circuit. One platinum wire was introduced into the obscure centre of the flame of a lamp, and the other wire was brought near the outer surface of the flame, a current of electricity immediately exhibited itself, which passed through the flame from the inner to the exterior wire. By properly connecting a platinum wire, which was dipped into the centre of the flame, with a condensing plate, the latter became charged with negative electricity, and hence Prof. Buff concluded that positive electricity is given off by the outer surface of the flame.

ANIMAL ELECTRICITY.

Prof. Beckeinsteiner, of Lyons, in investigating the origin of the electrical power exhibited by the Torpedo, Gymnotus, &c., was struck by the analogy of the cells of electric fishes with certain minute vessels, united by nerves and moistened by mucus, which exist in nearly all kinds of animals, and are found most developed in man at the period of the greatest strength, but collapsed and dried up in old age. He began a series of experiments, and after three years' investigation has lately published the following results: When the temperature is below 32°, the wind north and the sky clear, expose a cat to the cold until his fur lies close to the skin and appears greasy; expose your hands to make them equally cold; then take the animal on your knees, apply the fingers of your left hand on its breast, and pass your right hand down its back, pressing moderately; at the fifth or sixth pass you will receive a slight electric shock. At first the cat appears pleased, but as soon as it feels the shock it jumps away, and will not stand a repetition of the experiment during the same day. After the experiment the animal looks tired; some days after it loses its appetite, seeks solitude, drinks water at rare intervals and dies in a fortnight. The same experiment has succeeded with rabbits; they die the same day. It is unsuccessful with dogs. Once only it has been made on a cow; she was tied to an iron ring; the ground was frozen; one hand was placed on the breast, and the other passed down the back, when such an electric shock occurred that Mr. B. was thrown to the ground. The cow appeared very much irritated, but it was impossible to know if she suffered from it, since she was killed by a butcher three days afterwards.

ELECTRO-MAGNETIC MOTIVE POWER.

A patent has been taken out in England, by Dr. Kemp, for an arrangement of machinery for the obtaining of a maximum power from numerous short strokes of electro-magnetic power, acting on one long piston-rod in the cylinder of a hydraulic press, thus neutralizing the difficulty which is presented of the rapid decrease of force with the increase of the magnetic distance. This result is obtained by an arrangement of cylinders and pistons, in pairs, connected by levers, in such manner, that as one ascends, the other descends, and forces water, in a continuous circle, through valves into a chamber in connexion with a long cylinder and piston, or hydraulic press, in connexion with the prime moving crank of the engine. — *London Builder.*

ON THE HEATING EFFECTS OF ELECTRICITY AND MAGNETISM

The following is an abstract of a lecture delivered before the Royal Institution, England, by Mr. Grove, the eminent writer and experimenter on electricity and magnetism.

After remarking on the predisposition, during the early periods of philosophy, to refer all unusual phenomena to preternatural causes, and on the like disposition in later times to introduce, or at all events to develope, the notion of fluids as agents which effected the more mysterious phenomena of nature, such as light, heat, electricity and magnetism, Mr. Grove, continues: — Air being proved analogous in many of its characters to fluids as previously known, the idea of fluids, or an ether was carried on to other unknown agencies appearing to present effects remotely analogous to air or gases. Sound was included by some in the same category with the other affections of matter, and as late as the close of the last century, a paper was written by Lamarck to prove that sound was propagated by the undulations of an ether. Heat was at an early period so viewed. Mr. Grove, however, in a communication published in 1847, shewed that what had hitherto been stumbling blocks in this theory of heat, viz., the phenomena presented by what have been called latent and specific heat, might be more simply explained by the dynamic theory. His object at present was to extend this view to electricity and magnetism, which extension was, in his opinion, supported by many analogies. The ordinary attractions and repulsions of electrified bodies present no more difficulties when regarded as being produced by a change in the state or relations of the matter affected, than did the attraction of the earth by the sun, or of a leaden ball by the earth; the hypothesis of a fluid is not considered necessary for the latter, and need not be so for the former class of phenomena.

In the cases of heating, or ignition of a conjunctive wire, or conducting body, through which what is called electricity is transmitted, we have many evidences that the matter itself is affected, in some cases temporarily, in others, permanently changed; thus if a wire of lead is ignited to fusion by a voltaic battery, the fused lead being kept in a channel to prevent its dispersion, it gradually shortens, and the molecules seem impressed with a force, acting transversely to a line of directions, of the electricity; at length the lead gathers up in nodules which press on each other, to use a familiar illustration, as do a string of figs. With magnetism we have many instances of the molecular change which a ferreous or magnetic substance undergoes when magnetised. If the particles are free to move as for instance iron filings, they arrange themselves symmetrically. An objection may be made arising from the peculiar form of the iron filings, but Mr. Grove has shown, that the supernatant liquid in which magnetic oxide had been formed, and which contains magnetic particles, not mechanically, but chemically divided, exhibits when magnetised a change in the arrangement of the molecules, as may be seen by its effect on transmitted light; a molecular change is also evidenced by the note or sound produced by magnetism, and by other effects.

Assuming that the molecules of iron change their position *inter se*, upon magnetisation, then by repeated magnetisation in opposite directions, something analogous to friction might be produced; — and just as a piece of caoutchouc when elongated produces heat, so a bar of soft iron when subjected to rapid changes in its magnetic state, might be expected to exhibit thermic effects. (This Mr. Grove has been enabled to effect in a sensible degree.)

The effect of electricity in the disruptive discharge, as in the voltaic arc and the electric spark, would seem at first sight to offer greater difficulties of explanation on the dynamic theory. The brilliant phenomenal effects of the electric discharge, and the apparent absence of change in the matter affected by it, would at first lead the observer to believe that electricity was a specific entity. With ordinary flame, or the apparent effects of combustion, however, the idea has to a great extent been abandoned that such visual effects are due to specific matter, and it is regarded by many as an intense motion of the particles of the burning body. So with electricity. If in regard to the disruptive discharge it can be shown that the matter of the terminals, or of the intervening medium is changed, the necessity for the assumption of a fluid or ether ceases, and to say the least, a possibility of viewing electricity as a motion or affection of ordinary matter is opened. To make evident the relation of the electrical discharge to combustion, and the fact that the terminals were themselves affected, the voltaic arc was taken first between silver, and then between iron terminals; in the first case a brilliant green-colored flame was produced, and in the second a redish scintillation, as in the ordinary combustion of the metals. The known transport of particles of the terminals from one pole to the other, and the different effects of different intervening media on induction, are instances of the train of molecular changes consequent upon electrical action.

Hitherto the polarity of the gaseous medium existing between the metallic or conducting terminals of the electrical circuit was only known as a physical polarity and not shown to have an analogous chemical character with that existing in electrolytes anterior to electrolysis; — but Mr. Grove stated, that he had recently shown, that mixture of gases having opposite electrical, or chemical relations, such as oxygen and hydrogen, or compound gases such as carbonic oxide, were electro-chemically polarized, or had their electro-negative, or electro-positive elements thrown in opposite directions; thus, if a silvered plate be made positive in such gases it is oxidized; if negative, the dark spot of oxide is reduced. Here, as in other experiments, was an effect on the terminals, and an effect of polarization of the intermedium. In the experiments hitherto referred to, solid terminals had been used; it became important to examine what would be the effect of liquid terminals, for instance, water: the spark, or disruptive discharge of electricity was readily obtained from its surface, but hitherto no voltaic battery had been found to show a discharge at any sensible distance from the surface of water. A nitric acid battery consisting of 500 cells had been constructed by Mr. Gassiot, which as regards intensity of action was probably the most powerful ever constructed. With this Mr. Grove was able to shew an experiment which he had first made when experimenting with Mr. Gassiot some time ago, and which produced the effect he had long sought for, viz., a quantitative or voltaic discharge at a sensible distance from the surface of water.

The experiment was made as follows:—a platinum plate forming the anode of the battery was immersed in a capsule of distilled water, the temperature of which was raised. A cathode, or negative terminal of platinum wire, was now made to touch for an instant the surface of the water, and immediately withdrawn to a distance of about a quarter of an inch; the discharge took place, the extremity of the wire was fused, and the molten platinum attached to the wire, but kept up by the peculiar repulsive effect of the discharge, was exhibited as it were suspended in mid-air, giving an intense light, throwing off scintillations in directions away from the water, and only detaching itself from the wire when agitated. Here water in the vaporous state must be transferred, for the immersed electrode gave off gas, without doubt oxygen, and the molecular action on the negative fused platinum resembled, if it were not identical in character with, the currents observed on the surface of mercury when made negative in an electrolyte. It may be objected to the theory proposed, that electrical effects are obtained in what is called a vacuum, where there is no intermedium to be polarized; but this objection though not applicable to the projection of the terminals, could hardly be discussed until experimenters had gone much farther than at present in the production of a vacuum. The experiments of Davy and others had shown that we are far from obtaining any thing like a vacuum where delicate investigations are concerned. The view of ancient philosophers, that nature abhors a vacuum, which had been much cavilled at, and was supposed to be exploded by the discovery of Torricelli, Mr. Grove thought had been unjustly censured; giving the expression some degree of metaphorical license, it afforded a fine evidence of the extent and accuracy of observation of those who were unacquainted with inductive philosophy as a system, but who necessarily pursued it in practice. Whether a vacuum was possible might be an open question; experimentally it was unknown.

TERRESTRIAL MAGNETISM.

Col. Sabine, in his address before the British Association at their last meeting, gives the following summary of the recent progress of the study of terrestrial magnetism.

The magnetic phenomena, or as it is now customary to call them, the three magnetic elements, declination, inclination and magnetic force, appear to be everywhere and in both hemispheres the resultants of a duplicate system of magnetic forces, of which one at least undergoes a continuous and progressive translation in geographical space, the motion being from west to east in the northern hemisphere, and from east to west in the southern. It is to this motion that the secular change in all localities is chiefly, if not entirely, due; affecting systematically and according to their relative positions on the globe the configurations and geographical positions of the magnetic lines, and producing conformable changes in the direction and amount of the magnetic elements in every part of the globe. The comparison of the earlier recorded observations with those of the present epoch gives reason to believe, that viewed in its generality, the motion of the system of force which produces the secular change has been uniform, or nearly so, in the last two or three centuries. Under favorable conditions the regularity of this movement can be traced down to comparatively very minute fractions of time. By the results of careful observations continued for several years at the observatory of St. Helena, — where, in common with the greater part of the district of the South Atlantic, the secular change of the declination exceeds eight minutes in the year, and from its magnitude therefore may be advantageously studied, — every fortnight of the year is found to have its precise aliquot portion of the annual amount of the secular change at the station. This phenomenon of secular change is undoubtedly one of the most remarkable features of the magnetic system; and cannot with propriety be overlooked, as it too frequently has been, by those who would connect the phenomena of terrestrial magnetism generally, mediately or immediately with climatic circumstances, relations of land and sea, or other causes to which we are assuredly in no degree entitled to ascribe secular variation, and who reason therefore as if the great magnetic phenomena of the earth were persistent, instead of being, as they are, subject to a continual and progressive change. It may confidently be affirmed that the secular magnetic variation has no analogy with, or resemblance to, any other physical phenomenon with which we are acquainted. We appear at present to be without any clue to guide us to its *physical causes*, but a way is preparing for a future secure derivation of its *laws* to be obtained by a repetition, after a sufficient interval, of the steps which we are now taking to determine the elements corresponding to a definite epoch.

The periodical variations in the terrestrial magnetic force, are small in comparison with the force itself; but they are highly deserving of attention on account of the probability that by suitable methods of investigation they may be made to reveal the sources to which they owe their origin and the agency by which they are produced. To investigate these variations by suitable instruments and methods, to separate each from the others, and to seek its period, its epochs of maximum and minimum, the laws of its progression, and its mean and numerical value or amount, constituted the chief purposes for which magnetic observatories were established for limited periods at certain stations in Her Majesty's dominions, selected in the view that by a combination of the results obtained at them a general theory of each at least of the principal periodical variations might be derived, and tests be thus supplied whereby the truth of physical theories propounded for their explanation might be examined. We are just beginning to profit by the collocation and study of the great body of facts which has been collected. Variations corresponding in period to the earth's revolution around the sun, and to its rotation around its own axis, have been ascertained to exist, and their numerical values approximately determined in each of the three elements, the Declination, Inclination, aud Magnetic Force. We unhesitatingly refer these variations to the sun as their *primary source;* since we find in whatever part of the globe the phenomena are observed, the solstices and equinoxes are the critical epochs of the variation whose period is a year, whilst the diurnal variation follows in all meridians nearly the same law of local solar hours. To these unquestionable evidences of solar influence in the magnetic affections of the earth, we have now to add the recently ascertained fact, that the magnetic storms, or disturbances, which in the absence of more correct knowledge were supposed to be wholly irregular in their occurrence, are strictly periodical phenomena, conforming with systematic regularity to laws in which the influence of local solar hours is distinctly traced.

But whilst we recognise the sun as the primary cause of variations whose periods attest the source from whence they derive their origin, the mode or modes in which the effects are produced constitute a question which has been and may still be open to a variety of opinions: the direct action of the sun as being itself a magnet, its calorific agency occasioning thermo-electric and galvanic currents, or in alternately exalting and depressing the magnetic condition of substances near the earth, or in one of the constitutents of its atmosphere, — have been severally adduced as hypothesis affording plausible explanations. Of each and all such hypothesis the facts are the only true criterion; but it is right that we should bear in mind that in the present state of our knowledge, the evidence which may give a decided countenance to one hypothesis in preference to others does not preclude their possible co-existence. The analysis of the collected materials and the disentanglement of the various effects which are comprehended in them, is far from being yet complete. The correspondence of the critical epochs of the annual variation with the solstices and equinoxes rather than with the epochs of maximum and minimum temperature, which at the surface of the earth, in the subsoil beneath the surface, or in the atmosphere above the surface, or separated by a wide interval from the solstitial epochs, appears to favor the hypothesis of a direct action; as does also the remarkable fact which has been established, that the magnetic force is greater in both the northern and southern hemispheres in the months of December, January, and February, when the sun is nearest to the earth, than in those of May, June, and July, when he is most distant from it; whereas if the effect were due to temperature, the two hemispheres should be oppositely instead of similarly affected in each of the two periods referred to. Still there are doubtless minor periodical irregular variations which have yet to be made out by suitable analytical processes, which, by their possible accordance with the epochs of maximum and minimum temperature, may support in a more limited sense, not as a sole but as a co-ordinate cause, the hypothesis of calorific agency so generally received, and so ably advocated of late in connexion with the discovery by our great chemist and philosopher, of the magnetic properties of oxygen, and of the manner in which they are modified and affected by differences of temperature. It may indeed be difficult to suppose that the magnetic phenomena which we measure at the surface of the globe, should not be in any degree influenced by the variations in the magnetic conditions of the oxygen of the atmosphere in different seasons and at different hours of the day and night; but whether that influence be sensible or not, whether it be appreciable by our instruments or inappreciable by them, is a question which yet remains for solution by the more minute sifting of the accumulated facts which are now undergoing examination in so many quarters.

To justify the anticipation that conclusions of the most striking character, and wholly unforseen, may yet be derivable from the materials in our possession, we need only to recall the experience of the last few months, which have brought to our knowledge the existence of what may possibly prove the most instructive, as it is certainly at first sight the least explicable of all the periodical magnetic variations with which we have become acquainted. I refer to the concurrent testimony which observations at parts of the globe the most distant from each other bear to the existence of a periodical variation or inequality, affecting alike the magnitude of the diurnal variations, and the magnitude and frequency of the disturbances or storms. The cycle or period of this inequality appears to extend to about ten of our years; the maximum and minimum of the magnitudes affected by it being separated by an interval of about five years, and the differences being much too great, and resting on an induction far too extensive, to admit of uncertainty as to the facts themselves. The existence of a well-marked magnetic period which has certainly no counterpart in thermic conditions, appears to render still more doubtful the supposed connexion between the magnetic and calorific influences of the sun. It is not a little remarkable that this periodical magnetic variation is found to be identical in period and in epochs of maxima and minima with the periodical variation in the frequency and magnitude of the *solar spots* which Mr. Schwabe has established by twenty-six years of unremitting labor. From a cosmical connexion of this nature, supposing it to be finally established, it would follow, that the decennial period which we measure by our magnetic instruments is, in fact, a *solar period*, manifested to us also by the alternately increasing and decreasing frequency and magnitude of obscurations on the surface of the solar disc. May we not have in these phenomena the indication of a cycle or period of *secular change in the magnetism of the sun*, affecting visibly his gaseous atmosphere or photosphere, and sensibly modifying the magnetic influence which he exercises on the surface of our earth.

We recognise in terrestrial magnetism the existence of a power present everywhere at the surface of our globe, and producing everywhere effects indicative of a systematic action; but of the nature of this power, the character of its laws, and its economy in creation, we have as yet scarcely any knowledge. The apparent complexity of the phenomena at their first aspect may reasonably be ascribed to our ignorance of their laws, which we shall doubtless find, as we advance in knowledge, to possess the same remarkable character of simplicity which calls forth our admiration in the laws of molecular attraction.

It has been frequently surmised, and the anticipation is, I believe, a strictly philosophical one, that a power which, so far as we have the means of judging, prevails everywhere in our own planet, should also prevail in other bodies of our system, and might become sensible to us, in the case of the sun and moon particularly, by small perturbing influences measurable by our instruments, and indicating their respective sources by their periods and their epochs. As yet we know of neither argument nor fact to invalidate this anticipation; but, on the contrary, much to invest it with a high degree of probability.

ON THE MOTION OF FLUIDS FROM THE POSITIVE TO THE NEGATIVE POLE, OF THE CLOSED GALVANIC CIRCUIT.

WIEDEMANN has communicated to the Prussian Academy of Sciences, a memoir on the mechanical action of the voltaic circuit which is of essential interest and importance. The apparatus employed consisted of a porous earthenware cell, closed at the bottom and terminated above by a glass bell firmly cemented to the upper edge of the cylinder. Into the tubulure of the bell a vertical glass tube was fitted, from which a horizontal tube proceeded so as to permit the fluid raised to flow over into an appropriately placed vessel. A wire serving as the negative pole of a battery passed down through the glass bell into the interior of the porous cylinder, where it terminated in a plate of platinum or copper. Outside the porous cylinder another plate of platinum was placed and connected with the positive pole of the battery. The whole stood in a large glass vessel, which, as well as the interior porous cylinder, was filled with water. The intensity of the current was measured by a galvanometer. As soon as the circuit was closed, the liquid rose in the porous cylinder and flowed out from the horizontal tube into a weighed vessel. The results obtained by means of this apparatus were as follows:—

1. The quantity of fluid which flows out in equal times is directly proportional to the intensity of the current.

2. Under otherwise equal conditions, the quantities of fluid flowing out are independent of the magnitude of the conducting porous surface.

To avoid any uncertainty arising from the laws of the flow of liquids through small orifices, Wiedemann measured the intensity of the mechanical action of the current by determining the height of a column of mercury which would hold the transferring force in equilibrium. For this purpose a graduated tube or manometer filled with mercury was attached to the extremity of the horizontal tube above mentioned: with different currents and porous surfaces of different extent, the mercury in the manometer rose to different heights. By the measurements of these heights the following results were obtained:—

3. The height to which a galvanic current causes a fluid to rise, is directly proportional to the intensity of the current and inversely proportional to the extent of the free porous surface.

The mechanical action of a galvanic current may also be referred to its simplest principles by the following proposition: —

4. The force with which an electric tension, present upon both sides of a section of any given fluid, urges the fluid from the positive to the negative side, is equivalent to a hydrostatic pressure which is directly proportionable to that tension.

In this manner, therefore, we obtain a simple measure of electric tension and its mechanical action in terms of atmospheric pressure, and consequently of gravity.

The above laws hold good only for fluids of the same nature. When different fluids are subjected to the action of the currents, the mechanical action is greatest upon those which oppose the greatest resistance to its passage. The requisite data are still wanting to determine the precise connection between the mechanical action and the resistance; but observations made with sulphate of copper, of different degrees of concentration, appear to show that the quantities of fluid transferred in equal times by currents of equal intensity, are nearly proportional to the squares of the resistances.

MAGNETIC SCIENCE.

An article in the London Builder, alluding to the discovery made by Mr. George Little, electrical engineer, in which continuous streams of electricity can be produced from single magnets, and be made to decompose water, produce constant power in electro-magnets, and work the chemical printing and double needle telegraph, states that the magnetic science is still in its infancy, and starts the idea that it may be possible to witness such a temporary subversion of the cohesive forces in a deal board, or a stone wall, as would enable a magician like Faraday to pass through it as if it were so much air or so much dust in the sunbeam.

EXTENSION AND USE OF THE MAGNETIC TELEGRAPH.

From the report of the Superintendent of the U. S Census, and from other sources, we derive the following facts relative to the extension, construction and use of the magnetic telegraph in the United States and elsewhere. The telegraphic system is carried to greater extent in the United States than in any other part of the world; and the numerous lines now in full operation form a net-work over the length and breadth of the land. The receipts of the "Magnetic Telegraph Company" extending from Washington to New York, from its organization in January, 1846, to July, 1852, were $385,641. This company was the first organized in this country and its capital stock is only $370,000. It has six wires from Washington to Philadelphia, and seven from Philadelphia to New York. The number of messages sent over this line in the six months ending July, 1852, was 154,514, producing $68,499 23. It is perhaps the most productive line in the world.

The amount of business which a well-conducted office can perform is immense. Nearly seven hundred messages, exclusive of those for the press, were sent in one day over the Morse Albany line, and, a few days after, the Bain line at Boston sent and received five hundred communications. Another office with two wires, one five hundred, the other two hundred miles in length, after spending three hours in the transmission of public news, telegraphed, in a single day, four hundred and fifty private messages, averaging twenty-five words each, besides the address, sixty of which were sent in rotation, without a word of repetition. The instruments cannot be worked successfully without skilful operators, good batteries and machines, and thorough insulation of the conductors. The expense of copper wire, which was at first used, has caused it to be superseded by that of iron, which is found to answer the purpose as well, though the wire in this case must be of increased size. About 300 pounds of iron wire are required to a mile. The cost of construction, including wire, posts, labor, &c., is about $150 per mile. The average performance of the Morse instrument is to transmit from 8,000 to 9,000 letters per hour.

In the majority of electric telegraphs in actual use, batteries composed of heterogeneous metals, chiefly zinc and platinum, moistened by a liquid or liquids, are employed for the generation of force. The earth itself has been made to furnish a supply of electric force; in other words, a single pair of zinc and copper plates have been buried sufficiently below the surface to be in the wet subsoil, when the earth, saturated with water, represents the sand saturated with acid-water of an ordinary battery cell. By this means a current of low intensity can be obtained, even when the plates are miles apart. The earth acts as the return wire to any given number of distinct wires, without in the least affecting the regularity of the action of any of them.

The only constant and economical battery which is used in the United States is Grove's, of cups of zinc with strips of platinum in an earthenware or porcelain cup, which cup is filled with nitric acid, which is placed inside of the zinc cup, in a tumbler containing diluted sulphuric acid. The main battery on a line (from 30 to 50 cups) requires renewing only once in every two weeks, and daily in local batteries of two or three cups.

Messages passing from one very distant point to another have usually to be rewritten at intermediate stations; though by an improved method the sea-board line has in good weather transmitted communications direct between New York and Mobile, a distance of nearly 1,800 miles, without intermediate re-writing. By the Cincinnati route to New Orleans, a distance of nearly 2,000 miles, the news brought by an Atlantic steamer at 8 o'clock, A. M., has been telegraphed from New York to that distant point, and the effects produced on the market there returned to New York by 11 o'clock, A. M. The Congressional reports from Washington are usually received simultaneously in Baltimore, Philadelphia and New York; and all that is necessary at the intermediate stations is the presence of an operator to receive the message as it is developed on paper by the instruments.

To show the great extent to which telegraphing is now carried, and its importance to the community, reference may here be made to the arrangements of the newspaper press in New York, and their expenses for telegraphic dispatches. The Associated Press, consisting of the seven principal morning papers published in New York, paid during the year ending November, 1852, nearly $50,000 for dispatches, one-third of which was for foreign news. The several newspapers composing this Association paid during the same time about $14,000 for special and exclusive dispatches.

The telegraphs in England are the next in importance and extent to those in this country. They were first established in 1845, and there is about 4,000 miles of wire in operation.

The charge for transmission of dispatches is much higher than in America, one penny per word being charged for the first fifty miles, and one farthing per mile for any distance beyond one hundred miles. A message of twenty words can be sent a distance of 500 miles in the United States for one dollar, while in England the same would cost seven dollars.

In June, 1852, the sub-marine telegraph between Dover and Ostend was completed, and on the 1st of November the first electric communication was established direct between Great Britain and the continent of Europe. By a line of wires between London and Dover, via Rochester and Canterbury, in connection with the sub-marine cable across the Straits of Dover, instantaneous communication is obtained between London, Paris, Sweden, Trieste, Cracow, Odessa and Leghorn. The wires are also being carried onward to St. Petersburg; also to India and into the interior of Africa.

A project has been formed for constructing a sub-marine telegraph between Great Britain and the United States. It is proposed to commence at the most northwardly point of Scotland, run thence to the Orkney Islands, and thence by short water lines to the Shetland and Faroe. Thence, a water line of 200 to 300 miles conducts the telegraph to Iceland; from the western coast of Iceland, another sub-marine line conveys it to Kioge Bay, on the eastern coast of Greenland; it then crosses Greenland to Juliana's Hope, on the western coast of that Continent, in 60° 42′, and is conducted thence by a water line of about 500 miles, across Davis's Straits to Byron's Bay, on the coast of Labrador. From this point the line is to be extended to Quebec.

The entire length of the line is approximately estimated at 2,500 miles, and the sub-marine portions of it at from 1,400 to 1,600 miles. The peculiar advantage of the line being divided into several sub-marine portions is that if a fracture should at any time occur, the defective part could be very readily discovered and repaired promptly at a comparatively trifling expense. From the Shetland Islands it is proposed to carry a branch to Bergen, in Norway, connecting it there with a line to Christiana, Stockholm, Gottenburg and Copenhagen;

from Stockholm a line may easily cross the Gulf of Bothnia to St. Petersburg. The whole expense of this great international work is estimated considerably below £500,000.

Another enterprise has been actually started, with every prospect of consummation. A portion of the line is being prosecuted with vigor, and the company propose transmitting intelligence between the Old and New World in four or five days. A charter has been granted by the British Colonial Government to the "Newfoundland Electric Company," with a capital of £100,000, to construct a line of telegraph from Halifax, N. S., to Cape Race, touching at St. Johns, and crossing the Island of Newfoundland to Cape Ray, thence by a sub-marine line of 149 miles, across the gulf of St. Lawrence, a landing being made at Cape East, on Prince Edward's Island and going through that island, it crosses Northumberland Straits by another sub-marine line of 10 miles, landing at Cape Torment in New Brunswick, and so on to the boundary of the United States, whence by an independent line to New York, the connection is completed. The total distance traversed by this line will be between 1,400 and 1,500 miles, of which 150 are sub-marine. It is stated that steamers can make ordinary passages between Cape Race, Newfoundland, and Galway, Ireland, in five days.

Three several attempts have been made to connect England and Ireland by a telegraphic line, but as yet the enterprise is unsuccessful. In the last attempt, the contractors had got within seven miles of the Irish coast all right; and when they found they could not reach the land, they began to arrange for marking the end of the rope with buoys,—when it unfortunately slipped away from them and sank in deep water:—and the whole task must be commenced anew.

The telegraph between Paris and Bordeaux is probably the most perfect line of magnetic communication in existence. The wires, ten in number, go the whole distance under ground. They are five inches a part, and form a hollow square. To guard against humidity, they are supported upon wooden blocks, with the necessary isolation, and encased in a coating of gutta percha and lead.

A sub-marine line between France and Algiers, a distance of 400 miles, is about to be constructed by the French Government.

In Prussia the wires are generally buried about two feet below the surface, and carried through rivers in chain pipes. About 1,700 miles of telegraphic lines are in operation.

In France about 750 miles, and in Germany about 3,000 miles are completed.

In Austria, Saxony, Bavaria, Tuscany, Holland, Italy, Spain and Russia, great progress has already been made in establishing lines of telegraph, and communication will soon be had between the capitals of every State on the European Continent.

In India, a line has been laid between Calcutta and Kedgeree, 71 miles, and an extensive system is projected for that country.

The following interesting description of the telegraph in India is given for the instruction and encouragement of those interested in the prosecution of telegraph lines through somewhat similar regions of our own country:

From Calcutta to Rajmoole, the conductor is laid under ground, in a cement of melted resin and sand. From that village through the remaining distance to Kedgeree it is carried over ground on bamboo poles, 15 feet high, coated with coal-tar and pitch, and strengthened at various distances by posts of saul wood, teak and iron wood from America. The bamboo posts are found to resist the storms which have uprooted trees, the growth of centuries. Though the bamboo soon decays, its amazing cheapness makes the use of it more economical than that of more durable and more costly materials. The branch road from Bishlopore to Moyapore passes through a swamp; the country is little less than a lake for five months; the conductor runs on the foot paths between the island villages, and for some miles crosses rice swamps, and creeks on which no road or embankment exists.

The most difficult and objectionable line was selected to test the practicability of carrying the conductors through swampy ground, and it has been perfectly successful. The Huldee River crosses the Kedgeree line half way, and varies in breadth from 4,200 to 5,800 feet. A gutta percha wire, secured in the angles of a chain cable, is laid across and under the river, and the chain is found to afford perfect protection from the grapnels of the heavy native boats which are constantly passing up and down.

The overground lines differ totally from those in use in any other country in this important respect. No wire is used. Instead of wire a thick iron rod, $\frac{3}{8}$ of an inch diameter, weighing one ton to a mile, is adopted—the heaviest wire elsewhere used being only one cwt. to the mile. The advantages of these substantial rods are these: they possess a complete immunity from gusts of wind or ordinary mechanical violence; if accidentally thrown down they are not injured, though passengers and animals may trample on them; owing to the mass of metal, they give so free a passage to the electric currents that no insulation is necessary; they are attached from bamboo to bamboo without any protection, and they work without interruption through the hardest rains; the thickness of the wire allows of their being placed on the posts without any occasion for the straining and winding apparatus, whereas the tension of wire exposes them to fracture, occasions expense in construction and much difficulty in repairs; the thick rods also admit of rusting to take place without danger to an extent which would be fatal to a wire; and lastly, the rods are no more costly than thin wire, and the welding occasions no difficulty.

The importance of this discovery of the superiority of rods over wire will be fully appreciated in a country like India, where the line must often run through a howling wilderness, tenanted by savage beasts or more savage men. The lines must therefore protect themselves, and this is secured by the use of thick rods.

The entire expenditure on this line was about 450 rupees a mile, and it is estimated that the future overground lines will be at the rate of 350 rupees a mile for a double line, river crossings and erection of offices being a separate charge. The pecuniary returns from the Calcutta and Kedgeree line were originally calculated at about 200 rupees a month, but they have been more than three times that amount. A rupee is about 56 cents U. S. currency.

BATCHELDER'S IMPROVED TELEGRAPHIC REGISTER.

THE following account of a new telegraphic register, invented by Mr. Batchelder, of Boston, we copy from the "To-Day." This instrument, like those used in the Morse and Bain offices, requires the employment of the telegraphic alphabet of dots and lines. It consists of a cylinder, about six inches in diameter, around which is rolled a rectangular sheet of pink tissue or silver paper, exactly as it is bought, since it requires no peculiar preparation. This cylinder slowly revolves; and the writing is effected by means of a pointed copper wire, heated by a small alcohol lamp, which is pressed against it, and withdrawn at intervals, according as the circuit is opened or broken. It proves that the heat of the wire is sufficient to blanch the paper as it touches it, and thus turn its pink color to yellow; and so the characters appear in yellow upon a pink ground. Effecting the change of color in this simple way, is not, however, the only merit of the invention. The wire and lamp are upon a stand, so connected with the clock work machinery necessary for the other parts of the apparatus, of whatever form, that they move very slowly down the cylinder; so that, after it has made one revolution, the second line does not fall again upon the first, and interfere with it, but comes a short space below. The result of this is, that, when the paper is full, it can be removed from the cylinder, and read like a common printed page, across from left to right, in lines following under each other. These papers can thus be conveniently preserved for future reference.

The operation of the machine is beautiful, and its simplicity is apparent from the few words we have found it necessary to employ in describing it. In stating its further advantages, we expect only to be understood by those who are acquainted with the technical terms of telegraphing, when we say that it does not require the use of a local or office circuit, and can be used with a closed or open circuit, as may be preferred; and that the motion of the recording part, of the instrument is produced by the action of an axial magnet, or a deflecting needle.

The advantages enjoyed by this instrument, in simplicity, accuracy, and legibility, are so apparent, that it would seem as if it must commend itself at once to the attention of the telegraph companies, and be introduced into those offices, at least, where the telegraphic alphabet is employed.

ON THE PHYSICAL LINES OF MAGNETIC FORCE.

THE following is an abstract of a lecture recently delivered before the Royal Institution, England, by Prof. Faraday, "on the physical lines of Magnetic Force." A magnet presents a system of forces perfect in itself, and able, therefore, to exist by its own mutual relations. It has the dual and antithetic character belonging to both static and dynamic electricity; and this is made manifest by what are called its polarities — *i. e.*, by the opposite powers of like kind found at and towards its extremities. These powers are found to be absolutely equal to each other; one cannot be changed in any degree as to amount without an equal change of the other; and this is true when the opposite polarities of a magnet are not related to each other, but to the polarities of other magnets. The polarities, or the *northness* and *southness* of a magnet, are not only related to each other, through or within the magnet itself, but they are also related externally to opposite polarities, (in the manner of static electric induction,) or they cannot exist; and this external relation involves and necessitates an exactly equal amount of the new opposite polarities to which those of the magnet are related. So that if the force of a magnet *a* is related to that of another magnet *b*, it cannot act on a third magnet *c*, without being taken off from *b*, to an amount proportional to its action on *c*. The lines of magnetic force are shown by the moving wire to exist both within and outside of the magnet; also, they are shown to be closed curves passing in one part of their course through the magnet; and the amount of those within the magnet, at its equator, is exactly equal in force to the amount in any section, including the whole of those on the outside. The lines of force outside a magnet, can be affected in their direction by the use of various media placed in their course. A magnet can in no way be procured, having only one magnetism, or even the smallest excess of northness or southness one over the other. When the polarities of a magnet are not related externally to the forces of other magnets, then they are related to each other; *i. e.*, the northness or southness of an isolated magnet are externally dependant on and sustained by each other. Now all these facts, and many more, point to the existence of physical lines of force external to the magnets as well as within. They exist in curved, as well as in straight lines; for if we conceive of an isolated straight bar magnet, or more especially of a round disc of steel magnetized regularly, so that its magnetic axis shall be in one diameter, it is evident that the polarities must be related to each other externally, by curved lines of force; for no straight line can at the same time touch two points having northness and southness. Curved lines of force can, as I think, only consist with physical lines of force. The phenomena exhibited by the moving wire confirm the same conclusion. As the wire moves across the lines of force, a current of electricity passes or tends to pass through it, there being no such current before the wire is moved. The wire when quiescent has no such current, and when it moves, it need not pass into places where the magnetic force is greater or less. It may travel in such a course that if a magnetic needle were carried through the same course it would be entirely unaffected magnetically, *i. e.*, it would be a matter of absolute indifference to the needle whether it were moving or still. Matters may be so arranged, that the wire, when still, shall have the same diamagnetic force as the medium surrounding the magnet, and so in no way cause disturbance of the lines of force passing through both; and yet when the wire moves, a current of electricity shall be generated in it. The mere fact of motion cannot have produced this current; there must have been a state or condition around the magnet and sustained by it, within the range of which the wire was placed; and this state shows the physical constitution of the lines of magnetic force. What this state is, or upon what it depends, cannot as yet be declared. It may depend upon the ether, as a ray of light does, and an association has already been shown between light and magnetism. It may depend upon a state of tension, or a state of vibration, or perhaps some other state analogous to the electric current, to which the magnetic forces are so intimately related. Whether it of necessity requires matter for its sustentation will depend upon what is understood by the term matter. If that is to be confined to ponderable or gravitating substances, then matter is not essential to the physical lines of magnetic force, any more than to a ray of light or heat; but if, in the assumption of an ether, we admit it to be a species of matter, then the lines of force may depend upon some function of it. Experimentally, mere space is magnetic; but then the idea of such mere space must include that of the ether, when one is talking on that belief; or if, hereafter, any other conception of the state or condition of space rise up, it must be admitted into the view of that, which just now, in relation to experiment, is called mere space. On the other hand, it is, I think, an ascertained fact, that ponderable matter is not essential to the existence of physical lines of magnetic force.

ON THE LOCATION OF COMPASSES IN IRON SHIPS.

The following paper was read at the meeting of the British Association, Belfast, by Capt. E. W. Johnson, of the iron ship of war, Trident. He says: — While the Trident was in the basin at Woolwich, it occurred to me to try whether a position could be discovered where the influences of the ship's iron upon the compass were so equalized, as to render the amount of deviation so small as to be of no practical importance. The correct magnetic direction of the ship's head having been determined by a compass on the shore, and that proving to be near to one of the points of maximum deviation, (the standard compass on the quarter deck there indicating 20° *westerly* deviation,) I moved the standard compass several feet further *forward* in the centre line of the ship, and there found the *westerly* deviation increased to 29°. I now commenced to move the compass aft, six or seven feet at a time, observing the deviation at each position, and found the *westerly* deviation *decreased;* and on placing the tripod of the compass directly over the rudder-head, *easterly* deviation was produced; and hence it followed that there must be a position somewhere between the last two places of observation where there would be no deviation while the ship's head remained in the same direction. This position I practically discovered by moving the compass a few inches at a time, till it indicated the correct magnetic direction of the ship's head. The question which now remained to be proved was, to what extent the deviations of the said compass had been lessened (or what they actually were) when the ship's head was placed upon different points; and I was gratified to find that after swinging the vessel, and observing upon the eight principal points, the compass placed as before described, proved to be correct within a quarter of a point. It is necessary to mention, that the Trident has wooden beams under the quarter deck, aud therefore it remains to be seen to what extent such observations may be useful in vessels which have iron beams. It will also be requisite to ascertain, by actual observation, how far a position so selected shall prove advantageous when the ship changes her geographical position; and as the Trident is about to proceed to the southern hemisphere, and is amply provided with instructions and the means of ascertaining such changes, and as I shall swing her again on every point before she leaves, we may hope for much useful information on this important subject. I must observe, that it may not always be practicable to find the position of no deviation, or where the influences of the iron in the ship upon the magnetic needle are equalized, because such a point might be found in a most inconvenient position, or be too near movable ironwork, machinery, &c.; but if we succeed in approximating towards it, and thereby reduce the deviations within moderate limits, a point of great practical importance will be gained in navigation.

Mr. John Gray, of Liverpool, has published a letter, in which he proves, by the example of the Sarah Sands, that the compass can be as accurately adjusted in iron vessels as in those of wood. He says: "This steamboat has been a most valuable agent for the determination of a mooted point now being investigated, whether iron ships undergo a very important change after crossing the equator, or not. For years I have entertained the opinion that, for all practical purposes, the adjustment on Professor Airy's principle will answer equally well in both north and south latitudes, and which this vessel has demonstrated beyond all doubt. Simultaneous bearings were taken by Captain Thompson and his chief officers, in various parts of the Straits of Magellan, and the result clearly showed that no deviation whatever took place."

RELATION BETWEEN THE SPOTS ON THE SUN AND THE MAGNETIC NEEDLE.

According to observations made by M. Rodolphe Wolf, Director of the Observatory at Berne, it appears that the number of spots on the sun have their maximum and minimum at the same time as the variations of the needle. It follows from this, that the cause of these two changes on the sun and on the earth must be the same, and consequently, from this discovery, it will be possible to solve several important problems, whose solution has hitherto never been attempted.

ARAGO ON THE PHYSICAL CONSTITUTION OF THE SUN.

FROM a paper recently submitted to the French Academy by M. Arago, we copy the following extracts. They embody many of the author's investigations and results, and are of the most interesting character.

After briefly reviewing the phenomena of the solar spots, and the peculiar radiance, less luminous than the rest of the orb, with which they are surrounded, — the penumbra, — M. Arago says: — This penumbra, first noticed by Gallileo, and carefully observed by his astronomical successors in all the changes which it undergoes, has led to a supposition, concerning the physical constitution of the sun, which at first must appear altogether astonishing. According to this view the orb would be regarded as a dark body, surrounded at a certain distance by an atmosphere, which might be compared to that enveloping the earth, when composed of a continuous bed of opaque and reflecting clouds. To this first atmosphere would succeed a second, luminous in itself, and which has been called the *photosphere*. This photosphere, more or less removed from the interior cloudy atmosphere, would determine by its circumference the visible limits of the orb. According to this hypothesis, spots upon the sun would appear as often as there were found in the concentric atmospheres corresponding vacant portions, which would permit us to see exposed the dark central body. Those who have studied with powerful instruments, professional astronomers, and competent judges, acknowledge that this hypothesis concerning the physical constitution of the sun, supplies a very satisfactory account of the facts. Nevertheless, it is not generally adopted; recent authoritative works describe the spots as scoriæ floating on the liquid surface of the orb, and issuing from solar volcanoes, of which terrestial volcanoes are but a feeble type.

It was desirable then, to determine, by direct observation, the nature of the incandescent matter of the sun, but when we consider that a distance of 95,000,000 of miles separates us from this orb and that the only means of communication with its visible surface are luminous rays issuing therefrom, even to propose this problem seems an act of unjustifiable temerity. The recent progress in the science of optics, has, however, furnished the means for completely solving the problem.

None are now ignorant that natural philosophers have succeeded in distinguishing two kinds of light, viz., natural and polarized. A ray of the former of these lights exhibits, on all points of its surface, the same properties; whilst, with regard to the polarized light, the properties exhibited on the different sides of its rays are different. These discrepancies, manifest themselves in a multitude of phenomena which need not here be noticed. Before going further, let us remark, that there is something wonderful in the experiments which have led natural philosophers legitimately to talk of the different sides of a ray of light. The word "wonderful" which I have just used, will certainly appear natural to those who are aware that millions and millions of these rays can simultaneously pass through the eye of a needle, without interfering one with the other. Polarized light has enabled astronomers to augment the means of investigation by the aid of some curious instruments, from which great benefit has accrued already, — among others, the polarizing telescope, or polariscope, merits attention. In looking directly at the sun with one of these telescopes, two white images of the same intensity, and the same shade will be seen. Let us suppose the reflected image of this orb to be seen in water, or a glass mirror. In the act of reflection the rays become polarized, the lens no longer presenting two white and similar images; on the contrary they are tinged with brilliant colors, their shape having experienced no alteration. If the one be red, the other will be green; if the former be yellow, the latter will present a violet shade, and so on; the two colors being always what are called complementary, or susceptible, by their mixture, of forming white. By whatever means this polarized light has been produced, the colors will display themselves in the two images of the polarizing telescope, as when the rays have been reflected by water or glass. The polarizing telescope, thus furnishes a very simple means of distinguishing *natural* from polarized light.

It has been long believed, that light emanating from incandescent bodies, reaches the eye in the state of natural light, when it has not been partially reflected, or strongly refracted, in its passage. The exactitude of this proposition failed, however, in certain points. A member of the Academy has discovered that light emanating under a sufficiently small angle, from the surface of a solid or liquid incandescent body, even when unpolished, presents evident marks of polarization; so that in passing through the polarizing telescope it is decomposed into two colored pencils. The light emanating from an inflamed gaseous substance, such as is used in street illumination, on the contrary, is always in its natural state, whatever may have been its angle of emission. The means used to decide whether the substance which renders the sun visible is solid, liquid or gaseous, will be nothing more than a very simple application of the foregoing observations, in spite of the difficulties which appeared to arise from the immense distance of the orb.

The rays which indicate the margin of the disc, have evidently issued from the incandescent surface under a very small angle. The question here occurs, — The margins of the two images, which the polarizing telescope furnishes, do they, when viewed directly, appear colored? — then the light of these margins proceeds from a liquid body; for any supposition which would make the exterior of the sun a solid body is definitely removed by the observations of the rapid changing of the form of the spots. Have the margins maintained their natural whiteness in the glass? then they are necessarily gaseous. The incandescent bodies which have been studied by a polariscope, the light being emitted under angles, are the following: — of solids, forged iron and platinum; of liquids, fused iron and glass. From these experiments it may be said, you have a right to affirm, that the sun is neither fused iron nor glass; but what authority have you further to generalize? My response is this; following the two explanations that have been given of the abnormal polarization which presents rays emitted under acute angles, all ought to be the same, with the exception of the quantity, whatever be the liquid, provided that the surface of emergence has a sensible reflecting power. There would remain only the case, in which the incandescent body would, as to its density, be analogous to a gas; as for example, the liquid of an almost ideal rarity, which many geometricians have been led to place hypothetically, at the extreme limit of our atmosphere, where the phenomena of polarization and colorization may perhaps disappear. I shall however, anticipate a difficulty which may suggest itself. It ought to be observed, that the lights proceeding from two liquid substances, may, according to the special nature of these substances, not be identical in reference to the number and position of the black bands of Frauenhofer, and which these prismatic hues offer to the eye of the philosopher. These discrepances are of a nature to be considerably augmented by the differently constituted atmospheres through which the rays have to travel before reaching the observer.

Observations made any day of the year, looking directly at the sun, with the aid of powerfully polarizing telescopes, exhibit no trace of colorization. The inflamed substances then, which defines the circumference of the sun, is gaseous. We can generalize this conclusion, since, through the agency of rotation, the different points of the surface of the sun come in succession to form the circumference. This experiment removes out of the domain of simple hypothesis the theory we have previously indicated concerning the constitution of the solar photosphere. These results, let it be loudly proclaimed, are entirely due to the united efforts of the observers of the 17th and 18th centuries, and also in a certain measure to those of our cotemporary astronomers. And, here, let me make a remark, which, when endeavoring to determine the physical constitution of the stars, we shall have occasion to apply. If the material of the solar photosphere were liquid, if the rays emitted from its margin were polarized, the two images furnished by the polarizing telescope would not only be colored, but they would be different in different parts of the circumference. Is the highest point of one of these images red, the point diametrically opposite will be red also. But the two extremities of the horizontal diameter will each exhibit a green tint, and so on. If, then, one succeeds in concentrating to a single point, the rays emitted from all parts of the sun's limb, even after their decomposition in the polarizing telescope, the mixture will be white.

The constitution of the sun, as I have just established it, may equally well serve to explain how, on the surface of the orb, there exist some spots not black but luminous. These have been called faculæ, others of much smaller dimensions and generally round, have been called lucules. These latter cause the surface of the sun to appear spotted. It is a singular fact; but I may trace the origin of the discovery of the faculæ and lucules, to an administrative visit to a shop of novelties on the Boulevards. "I have to complain," said the master of the establishment, "of the Gas Company; it ought to direct on my goods the broad side of the bat-wing burner, whilst, by the carelessness of their servants, it is often the edge which is directed on them." "Are you certain," said one of the assistants, "that in that position the flame gives less light than in the other?" The idea, appearing ill-founded, and I would say, absurd, it was submitted to accurate experiment; and it was determined that a flame sheds upon any object as much light when it illuminates by its edge as when its broad surface was presented to it. Thence resulted the conclusion, that a gaseous incandescent surface of a determined extent is more luminous when seen obliquely than under perpendicular incidence. Consequently, if, like our atmosphere, when dappled with clouds, the solar surface presents undulations, the parts of these undulations which are presented perpendicularly to the observer, must appear comparatively dim, and the inclined portion must appear more brilliant; and hence every conic cavity must appear a lucule. It is no longer necessary in accounting for these appearances, to suppose that there exists on the sun millions of fires more incandescent than the rest of the disc, or millions of points distinguishing themselves from the neighboring regions by a greater accumulation of luminous matter.

After having proved that the sun is composed of a dark central body, of a cloudy-reflecting atmosphere, and of a photosphere, we should naturally ask if there is nothing besides. If the photosphere terminates abruptly and without being surrounded by a gaseous atmosphere, less luminous in itself, or feebly refracting? Generally, this third atmosphere would disappear in the ocean of light with which the sun always appears surrounded, and which proceeds from the reflection of its own rays upon the particles of which the terrestrial atmosphere is composed. A means of removing this doubt presented itself; it was selecting the moment, when, during a total eclipse, the moon completely obscures the sun. Almost at the moment when the last rays emanating from the margin of the radiant orb, disappeared under the opaque screen formed by the moon, the atmosphere, in the region which is projected between the moon, the earth, and the neighboring parts, ceased to be illuminated. In all our researches upon solar eclipses, innumerable unexpected appearances invariably present themselves; thus the observers were not a little surprised when, after the disappearance of the last direct rays of the sun behind the margin of the moon, and after the light reflected by the surrounding terrestrial atmosphere had also disappeared, to see rose-shaped prominences from two to three minutes in height, dart, as it were, from the circumference of our satellite. Each astronomer, following the usual bent of his ideas, arrived at an independent opinion regarding the causes of these appearances. Some attributed them to the mountains of the moon ; but this hypothesis would not bear a moment's examination. Others wished to discover in them certain effects of diffraction, or of refraction. But the touch-stone of all theories is calculation; and uncertainty the most indefinite must follow, in reference to their application to the remarkable phenomena specified, those, namely, of which we have just been speaking. Explanations, giving neither an exact account of the height, the form, the color, nor the fixity of a phenomenon, ought to have no place in science. Let us come to the idea, much extolled for a short time, that the protuberances were solar mountains, whose summits extend beyond the photosphere covered by the moon at the moment of observation. Following the most moderate computations, the elevation above the solar disc of one of these summits, would have been 19,000 leagues. I am well aware that no argument because based on the vastness of this height, should lead to the rejection of the hypothesis, but it may be much shaken by remarking that these pretended mountains exhibit considerable portions beyond the perpendicular, which, consequently in virtue of the solar attraction must have fallen down.

Let us now take a rapid glance at the hypothesis, according to which the protuberances would be assimilated to solar clouds floating in a gaseous atmosphere. Here we find no principle of natural philosophy to prevent our admitting the existence of cloudy masses from 70,000 to 90,000 miles in length, with their outlines serrated, and assuming the most distorted forms, only in further pursuing this hypothesis, one could not fail to be astonished that no solar cloud had ever been seen entirely separate from the circumference of the moon. It is towards this determination, the subject otherwise eluding us, that the researches of astronomers should be directed. A mountain being incapable of sustaining itself without a base, the fortuitous observation of a prominence, separated in appearance from the margin of the moon, and, consequently, from the real margin of the solar photosphere, should be sufficient utterly to overthrow the hypothesis of solar mountains. Such an observation has really been made. M. Kutochi who observed the eclipse of July 8th, 1850, writes:—"the slender and redish striated appearance which was found near the northern prominence seemed to be completely detached from the margin of the moon." In the eclipse of the 28th of July, 1851, Messrs. Mauvais and Soujon, of Dantzic, and the celebrated foreign astronomers who had repaired to the different parts of Norway and the north of Germany, saw in all the selected stations without exception, a spot uniformly red, and separated from the limb of the moon. These observations put a definite termination to the explanations of the protuberances, founded on the supposition that there existed in the sun, mountains whose summits would reach considerably above the photosphere. When it shall be clearly demonstrated that these luminous phenomena cannot be the effect of the inflexions which the solar rays might experience in passing near the rough parts which fringe the circumference of the moon; when it shall be demonstrated that

13

these rosy tints cannot be assimulated to simple optical appearances, and have, in truth, a real existence, that they are not real solar clouds, it will then be necessary to add a new atmosphere to the two of which we have spoken; for these clouds cannot be sustained *in vaccuo*. The existence of a third atmosphere is moreover established by phenomena of quite another nature, namely, by the comparative intensity of the border and the centre of the sun, and also in some respects by the zodiacal light, so perceptible in our climate during the equinoxes.

TRUE PLACE OF THE SUN IN THE UNIVERSE.

In addition to the remarks contained in the foregoing article on the physical constitution of the sun, M. Arago submitted the following observations on the true place of the sun in the universe.

Archelaus, who lived in the year 448, B. C., was the last philosopher of the Ionian Sect; he said, regarding the sun, — "It is a star, only it surpasses in size all other stars." The conjecture, for what is not based upon any measurement, or any observation, deserves no other name, was certainly very bold and very beautiful. Let us pass over an interval of more than two thousand years, and we shall find the relation of the sun and the stars established by the labors of the moderns, upon a basis which defies all criticism. During nearly a century and a half, astronomers endeavored to determine the distance between the stars and the earth; the repeated failures with which their researches were attended, seemed to prove that the problem was insolvable. But what obstacles will not genius, united to perseverance, overcome? We have discovered within a very few years the distance which separates us from the nearest stars. This distance is about 206,000 times the distance of the sun from the earth, more than 206,000 times 95,000,000 of miles. The product of 206,000 by 95,000,000, would be too much above the numbers we are in the habit of considering, to warrant its annunciation. This product will still more strike the imagination, when I refer to the rapidity with which light travels. Alpha, in the constellation of the Centaur, is the star nearest to the earth, if it be allowable to apply the word near to such distances as those of which I am about to speak. The light of Alpha, of the Centaur, takes more than three years to reach us, so that were the star annihilated, we should still see it for three years after its destruction. Recall to your recollection that light travels at the rate of 192,000 miles in a second; that the day is composed of 86,400 seconds, and the year of 365 days, and you will feel as thunderstruck before the immensity of these numbers. Furnished with these data, let us transport the sun to the place of this, the nearest star, and the vast circular disc, which in the morning rises majestically above the horizon, and in the evening occupies a considerable time in descending entirely below the same line, would have dimensions almost imperceptible, even with the aid of the most powerful telescopes, and its brilliancy would range among the stars of the third magnitude, you will thus see what has become of the conjecture of Archelaus. One may perhaps feel humiliated by a result which reduces so far our position in the material world; but consider that man has succeeded in extracting every thing from his own resources, whereby he is elevated to the highest rank in the world of thought.

We would remark that in the recent works of complete astral catalogues, we shall find that the number of stars visible to the naked eye in a single hemisphere, namely the northern, is less than three thousand. A certain result, and one, which notwithstanding will strike with astonishment, on account of its smallness, those who have only vaguely examined the sky on a beautiful winter night. The character of this astonishment will change, if we proceed to the telescopic stars. Carrying the enumeration to the stars of the fourteenth magnitude, the last that are seen by our powerful telescopes, we shall find by an estimate which will furnish us the minor limit, a number superior to 40,000,000, (40,000,000 of suns!!) and the distance from the farthest of them is such that the light would take from three to four thousand years to traverse it. We are then, fully authorized to say, that the luminous rays, — those rapid couriers, — bring us, if I may so express it, the very ancient history of these distant worlds. A photometric experiment, of which the first indications exist in the Cosmotheoros of Huygens, an experiment resumed by Wollaston a short time before his death, teaches us that 20,000 of stars the same size as Sirius, the most brilliant of the firmament, would need to be agglomerated to shed upon our globe a light equal to that of the sun. On reflecting upon the well-known fact, that some of the double stars, are of very different and dissimilar colors, our thoughts naturally turn to the inhabitants of the obscure and revolving planetary bodies which apparently circulate around these suns; and we would remark, not without real anxiety for the works, the paintings, of the artists of these distant worlds, that to a day lightened by a red light, succeeds not a night but a day, equally brilliant, but illuminated only by a green light.

But abandoning these speculations, however worthy they may be of admiration, we shall come back to the chief question, which I have proposed to treat in this account, to try, if possible, to establish a connection between the physical nature of the sun and of the stars. We have succeeded by the help of the polarizing telescope in determining the nature of the substance which composes the solar photosphere, because by reason of the great apparent diameter of the orb, we have been able to observe separately the different points of its circumference. If the sun were removed from us to a distance where its diameter would appear as small to us as that of the stars, this method would be inapplicable, the colored rays proceeding from the different points of the circumference would then be intimately mixed, and, we have said already, their mixture would be white. It appears, then, that we must not apply to stars of imperceptible dimensions, the process which so satisfactorily conducted us to the result in regard to the sun. There are, however, some of these stars, which supply us with the means of investigation. I allude to the changing stars. Astronomers have remarked some stars whose brilliancy varies considerably; there are even some which, in a very few hours, pass from the second to the fourth magnitude; and there are others in which the changes in intensity are much more decided. These stars, quite visible at certain epochs, totally disappear, to reappear in periods longer, or shorter, and subject to slight irregularities. Two explanations of these curious phenomena present themselves to the mind; the one consists in supposing that the star is not equally luminous on all parts of its surface, and that it experiences a rotatory movement upon itself; thus it is brilliant when the luminous part is turned towards us, and dark when the obscure portion arrives at the same point. According to the other hypothesis, an opaque, and, in itself non-luminous satellite, circulates round the star, and eclipses it periodically. In accordance with one or the other of these suppositions, the light which is exhibited some time before the disappearance, or before the reappearance of the star has not issued from all points of the circumference. Hence, there can be no doubt of the complete neutralization of the tints of which we have just spoken.

If a changing star, when examined by a polarizing telescope remains perfectly white in all its phases, we may rest assured that its light emanates from a substance similar to our clouds, or our inflamed gas. Now, such is the result of the few observations that have been hitherto made, and which will be highly useful to complete. This means of investigation demands more care, but succeeds equally well, when applied to those stars which experience only a partial variation in their brilliancy. The conclusion to which these observations conduct us, and which we may, I think, without scruple generalize, may be announced in these terms; our sun is a star, and its physical constitution is identical with that of the millions of stars with which the firmament is strewed.

DESCRIPTION OF A NEW EYE-PIECE FOR THE SUN, WITH REMARKS ON SOLAR SPOTS.

The following is a report of some remarks recently made at the London Astronomical Society, accompanied with the exhibition of a new solar eye-piece, by the Rev. W. R. Dawes. The principal peculiarity of this eye-piece consists in a metallic slide, with perforations of different sizes, which crosses the eye-tube at right angles, just at the focus of the object-glass. There are contrivances, which can easily be imagined, for rapid manipulation, and though the slide is of course greatly heated when the sun is viewed, the conduction is cut off by interposing a plate of ivory. The perforations vary in diameter from 0.5 to 0.0075 of an inch; and, with a small field, single lenses are preferred to complicated eye-pieces. Mr. Dawes finds that, in general, apertures which exceed 0.3 inch cannot be safely used for a long time under a hot sun. Where the usual proportions are retained between the aperture and focal length of an object-glass (seldom exceeding 1 to 16 in large telescopes,) a focal diaphragm of 0.3 inch transmits a portion of the sun's image, the size and heat of which is nearly equivalent to that of the whole image of the sun in a refractor of thirty-two inches focal length, and of two inches aperture. This may usually be employed without injury to the dark glasses, and the field is quite large enough for sweeping over the sun's disc in searching for spots or other phenomena. In careful scrutinies, the suitable aperture must be employed. In some very large spots, the nuclei alone may thus be examined, without any disturbance frem the bright surface. "By this mode of observation I have ascertained the existence of a stratum of comparatively faint luminosity, which, as far as I know, has not been previously noticed. For this I would propose the appellation of the cloudy stratum. Its appearance gives the impression of considerable depth below the second luminous stratum which forms the shallow, or penumbra, usually seen round the nucleus of a spot; and from all the examinations I have hitherto made, it seems to me probable that it is not self-luminous, but of such a nature as to absorb a vast quantity of light, and reflect very little. Its faint illumination is rarely uniform, presenting rather a mottled or cloudy surface; and occasionally some small patches are very decidedly more luminous than the rest, though still incomparably less bright than even the stratum forming the penumbra; from which it also differs essentially in being destitute of the striated or ridged appearance so frequently presented in that stratum. In all spots of considerable size, and in many small ones, a black opening is perceivable in the cloudy stratum. In no instance have I perceived any light in these openings which exceeded the illumination of the earth's atmosphere by the sun's rays. It is obvious that any degree of light inferior to this cannot be rendered visible by any contrivance we can employ; just as the red projections from the sun's border cannot be seen except when the solar illumination of our atmosphere is nearly extinguished by the intervention of the moon. In order to obtain a measure of this illumination of the atmosphere, and to ascertain the limit which it sets to our researches, I have usually directed the telescope, with a very small field, to the sky close to the sun's edge, using the lightest shade of darkening glass which my eye could comfortably bear. Then, using the same shade, the telescope is directed with the smallest diaphragm to the dark part of a large spot. In this way the cloudy stratum will in general become visible, frequently occupying by far the greater part of what has been hitherto considered the nucleus of the spot, and imagined to be, in fact, the body of the sun itself. A portion of it, however, will commonly be found to appear perfectly black, whence we may conclude that, if luminous at all, it is less so than our own atmosphere when illuminated by the direct rays of the sun. To this black part only the appellation of nucleus appears to be strictly applicable. A remarkable instance of rotatory motion was observed in a spot which was sketched on January 17 and January 23. The rotation was not of the smaller round the larger portion. The whole spot had rotated round the small black nucleus." On examining the surface of the sun carefully, using a very small field, Mr. Dawes is persuaded that "the apparent rapid fluctuation of the porous structure is not real, but the effect of disturbance in our own atmosphere." Mr. Dawes states his conviction o the superiority of large apertures with high powers in viewing the sun which this reduction of the field makes easy. The faculæ, too, ar seen far better with large apertures, especially when the power is no proportionally high. "These are best seen near the east and wes edges of the sun's disc, where they give the impression of narrov ridges, whose sides are there presented to view. They usually li nearly in the direction of a circle of latitude on the sun's surface, and are rarely high enough to be seen as actual projections from his limb. On one occasion, however, the 22d of January last, I had an opportunity of observing a satisfactory confirmation of the idea that they are ridges, or heapings up of the luminous matter; and as the requisite circumstances are extremely rare, I will advert more particularly to the observation. A large bright streak, or facula, was observed to run, as usual, nearly parallel to the sun's edge for some distance, and very near it; and then to turn rather abruptly towards the edge and pass over it. The limb was at times very well defined; and when it was most sharp and steady, the bright streak was seen to project slightly beyond the smooth outline of the limb, in the manner of a mountain ridge nearly parallel to the sun's equator." This eye-piece was applied to Mr. Lassell's 20 foot reflector last September, and the sun was examined with the whole of the 24 inch mirror. The eye-piece did not become more than sensibly warm after two hours' exposure to a bright sun. Mr. Dawes points out the utility of this contrivance in examining the surface of the moon, in observing occultations of small stars, and the eclipses of Jupiter's satellites, and in observing or detecting the faint satellites of planets. By such means, too, Venus and Mercury may be more pleasantly observed when near the sun; and, as the author remarks, "to the practised observer such applications will readily occur," and need not be here insisted on.

ON THE FORM OF IMAGES PRODUCED BY LENSES AND MIRRORS OF DIFFERENT SIZES.

A PAPER on the above subject was read before the British Association by Sir David Brewster, the object of which was to show, that the photographic portraits taken with cameras with large object-glasses or large mirrors must necessarily be distorted and hideous, as in fact it is notorious they are; and that hence all persons engaged in this new and most important art should receive with gratitude any scientifi discovery which promised to correct so serious a defect — which by some has been attributed to the imperfection of the lenses employed, — by others to the unsteadiness of the sitter who is having his portrai taken, — by others, again, to the constraint of features and limb unde which he submits to the operation; but it is by all admitted and deplored. If we consider that the pupil of the human eye is only about 2-10ths of an inch in diameter, it is obvious that the image formed by the eye of those solid objects placed in front of it, and by which we are accustomed to see them, to judge of them, and to recog nize them, cannot embrace any of the rays of light which come from those parts of the object which lie in such positions towards the sides, top, bottom, or hinder parts as cannot pass in straight lines to an aperture of the size of the pupil, — in fact, unless it agree almost exactly with the exact perspective form of the object, the pupil being the point of sight. If, then, an object be placed before a lens, the part of the lens towards its centre of the size of the pupil is capable of forming a correct image of that object, consisting of rays coming from precisely the same parts of it as an eye would receive were its pupil in the same position. But all the parts of the lens or mirror of the same size which lie around and at a distance from this portion of it, would receive rays coming from parts of the solid object which the true eye could not receive, and which must therefore form as many unnatural images as there were such parts; and the photographic picture which embraces and confounds into one hideous mass all these, any one of which by itself would be correct, must in the very nature of things give a most confused and displeasing representation of the object. Sir David illustrated and proved these assertions by a diagram of a lens with a simple solid form, a cylinder topped by a cone behind, placed in front of the lens, pointing out the parts which alone could be embraced in a correct perspective view of it, and what parts the large lens or mirror would moreover receive and transmit rays from, to be jumbled in the photographic picture with that which would alone give a correct idea of the object as seen. He showed from the now familiar illustration afforded by the binocular stereoscope, how very dissimilar were the pictures of the same object received by small lenses placed as near as the two pupils of the human eye; images so distinct that a child could readily distinguish them; and yet multitudes of such images were all received and jumbled together in those photographic pictures where lenses or mirrors of that or larger — say three or four inches — aperture were used. "The photographer, therefore," said Sir David Brewster, "who has a genuine interest in the perfection of his art will, by accelerating the photographic processes with the aid of more sensitive materials, be able to make use of lenses of very small aperture, and thus place his art in a higher position than that which it has yet attained. The photographer, on the contrary, whose interests bribe him to forswear even the truths of science, will continue to deform the youth and beauty that may in ignorance repair to his studio, adding scowls and wrinkles to the noble forms of manhood, and giving to a fresh and vigorous age the aspects of departing or departed life." He then produced an exact diagram of photographic images of a simple object produced by Mr. Buckle of Peterborough. The acting diameter of the lens was $3\frac{1}{8}$ inches; and by using it with all covered, except a central space of 2-10ths of an inch diameter, and then along with this space exposing circular spaces of the same size towards the outer circumference of the aperture, the effect of the combination of the marginal pictures was most distinctly exhibited and demonstrated, by halos extending round the true image, and the sharp cross lines ruled on the object and shown in the image with the small lens, but all confused in that with the surrounding apertures.

ON THE OPTICAL PROPERTIES OF A RECENTLY DISCOVERED SALT OF QUININE.

The above is the title of a paper read before the British Association, Belfast, by Prof. Stokes. The salt referred to is stated by Dr. Herapath, to be easily formed by dissolving bi-sulphate of quinine in warm acetic acid, adding a few drops of a solution of iodine in alcohol, and allowing the liquid to cool; when the salt crystallizes in thin scales, reflecting (while immersed in the fluid,) a green light with a metallic lustre. When taken out of the fluid the crystals are yellowish green by reflected light, with a metallic aspect. The following observations were made with small crystals formed in this manner: — The crystals possess in an eminent degree the property of polarizing light, so that Dr. Herapath proposed to employ them instead of tourmalines, for which they would form an admirable substitute, could they be obtained in sufficient size. They appear to belong to the prismatic system; at any rate, they are symmetrical (so far as relates to their optical properties and to the directions of their lateral faces,) with respect to two rectangular planes perpendicular to the scales. These planes will here be called respectively the principal plane of the length, and the principal plane of the breadth, the crystals being usually longest in the direction of the former plane. When the crystals are viewed by light directly transmitted, which is either polarized before incidence or analyzed after transmission, so as to retain only light polarized in one of the principal planes, it is found that with respect to light polarized in the principal plane of the length the crystals are transparent and nearly colorless, — at least when they are as thin as those which are usually formed by the method above mentioned But with respect to light polarized in the principal plane of the breadth, the thicker crystals are perfectly black, the thinner ones only transmitting light, which is of a deep red color. When the crystals are examined by light reflected at the smallest angle with which the observation is practicable, and the reflected light is analyzed, so as to retain, — first, light polarized in the principal plane of the length, and secondly, light polarized in the other principal plane, — it is found that in the first case the crystals have a vitreous lustre, and the reflected light is colorless, while in the second case the light is yellowish green, and the crystals have a metallic lustre. When the plane of incidence is the principal plane of the length, and the angle of incidence is increased from 0° to 90°, the part of the reflected pencil which is polarized in the plane of incidence undergoes no remarkable change, except perhaps that the lustre becomes somewhat metallic. When the part which is polarized in a plane perpendicular to the former is examined, it is found that the crystals have angle of polarization, the reflected light never vanishing, but only changing its color, passing from yellowish green, which it was at first, to a deep steel blue, which color it assumes at a considerable angle of incidence. When the light reflected in the principal plane of the breadth is examined in a similar manner, the pencil which is polarized in the plane of incidence undergoes no remarkable change, continuing to have the appearance of being reflected from a metal, while the other or colorless pencil vanishes at a certain angle and afterwards reappears, so that in this plane the crystals have a polarizing angle. If, then, for distinction's sake, we call the two pencils which the crystals, as belonging to a doubly refracting medium, transmit independently of each other, ordinary and extraordinary, the former being that which is transmitted with little loss, we may say, speaking approximatively, that the medium is transparent with respect to the ordinary ray, and opaque with respect to the extraordinary; while as regards reflection, the crystals have the properties of a transparent medium or of a metal according as the refracted ray is the ordinary or the extraordinary. If common light merely be used, both refracted pencils are produced, and the corresponding reflected pencils are mixed together; but by analyzing the reflected light, by means of a Nicol's prism, the reflected pencils may be viewed separately, — at least when the observations are confined to the principal planes. The crystals are no doubt biaxal, and the pencils here called ordinary and extraordinary are those which in the language of theory correspond to different sheets of the wave surface. The reflecting properties of the crystals may be embraced in one view, by regarding the medium as not only doubly refracting and doubly absorbing, but doubly metallic. The metallicity, so to speak, of the medium of course alters continuously with the point of the wave surface to which the pencil considered belongs, and doubtless is not mathematically null even for the ordinary ray. If the reflection be really of a metallic nature, it ought to produce a relative change in the phases of vibration of light polarized in and perpendicularly to the plane of incidence. This conclusion the author has verified by means of the effect produced on the rings of calcareous spar. Since the crystals were too small for individual examination in this experiment, the observation was made with a mass of scales deposited on a flat black surface, and arranged at random as regards the azimuth of their principal planes. The direction of the change is the same as in the case of a metal, and accordingly the reverse of that which is observed in total internal reflection. In the case of the extraordinary pencil the crystals are least opaque with respect to red light, and accordingly they are less metallic with respect to red light than to light of higher refrangibility. This is shown by the green color of the reflected light when the crystals are immersed in fluid; so that the reflection which they exhibit as a transparent medium is in a good measure destroyed. The author has examined the crystals for a change of refrangibility, and found that they do not exhibit it. Safflower red, which possesses metallic optical properties, does change the refrangibility of a portion of the incident light; but the yellowish green light which this substance reflects is really due to its metallicity, and not to the change of refrangibility, for the light emitted from the latter cause is red, besides which it is totally different in other respects from regularly reflected light. In conclusion, the author observed that the general fact of the reflection of colored polarized pencils had been discovered by Sir David Brewster in the case of chrysammate of potash; and in a subsequent communication he had noticed in the case of other crystals the difference of effect depending upon the azimuth of the plane of incidence. Accordingly, the object of the present communication was merely to point out the intimate connection which exists (at least in the case of the salt of quinine,) between the colored reflection, the double absorption, and the metallic properties of the medium.

Specimens of Sensitive Media were exhibited by Prof. Stokes. These were: — A crystal of green fluor spar, which, by the development of blue light within it, changed its color; — the solution of the common bi-sulphate of quinine in acidulated water, which, by its action on the invisible rays developed blue light; and the solution of the green coloring matter of leaves in alcohol, which by a similar action became blood red.

PROF. STOKES' RESEARCHES ON LIGHT.

The researches of Prof. Stokes took their origin from an unexplained phenomenon discovered by Sir John Herschel, and communicated by him to the Royal Society in 1845. A solution of sulphate of quinine examined by transmitted light, and held between the eye and the light, or between the eye and a white object, appears almost as transparent and colorless as water; but when viewed in certain aspects and under certain incidences of light, exhibits an extremely vivid and beautiful celestial blue color. This color was shown by Sir John Herschel to result from the action of the strata which the light first penetrates on entering the liquid; and the dispersion of light producing it was named by him epipolic dispersion, from the circumstance that it takes place near the surface by which the light enters. A beam of light having passed through the solution was to all appearance the same as before its entrance; nevertheless, it was found to have undergone some mysterious modification,—for an epipolized beam of light—meaning thereby a beam which had once been transmitted through a quiniferous solution, and had experienced its dispersive action—is incapable of further epipolic dispersion. In speculating on the possible nature of epipolized light, Prof. Stokes was led to conclude that it could only be light which had been deprived of certain invisible rays which in the process of dispersion had changed their refrangibility and had thereby become visible. The truth of this supposition, novel and surprising as it at first appeared, has been confirmed by a series of simple and perfectly decisive experiments; showing that it is in fact the chemical rays of the spectrum, more refrangible than the violet, and invisible in themselves, which produce the blue superficial light in the quiniferous solution. Prof. Stokes has traced this principle through a great range of analogous phenomena, including those noticed by Sir David Brewster in his papers on "Internal Dispersion;" and has distinguished between "cases of false internal dispersion," or "opalescence," in which the luminous rays are simply reflected from fine particles held in mechanical solution in the medium, and those of "true internal dispersion," or "fluorescence," as it is termed by Prof. Stokes. By suitable methods of observation the change of refrangibility was detected, as produced not only by transparent fluids and solids, but also by opaque substances; and the class of media exhibiting "fluorescence" was found to be very large, consisting chiefly of organic substances, but comprehending, though more rarely, some mineral bodies. The direct application of the fact, as we now understand it, to many highly interesting and important purposes, is obvious almost on the first announcement. The facility with which the highly refrangible invisible rays of the spectrum may be rendered visible by being passed through a solution of sulphate of quinine or other sensitive medium, affords peculiar advantages for the study of those rays; the fixed lines of the invisible part of the solar spectrum may now be exhibited to our view at pleasure. The constancy with which a particular mode of changing the refrangibility of light attaches to a particular substance, exhibiting itself independently of the admixture of other substances, supplies a new method of analysis for organic compounds which may prove valuable in organic chemistry.

DOVE'S THEORY OF LUSTRE.

Sir David Brewster, at the British Association, explained the theory of Dove respecting the origin of lustre, which was, that the lustre of bodies and particularly the metallic lustre arose from the light coming from the one stratum of the superficial particles of bodies interfering on the eye with the light coming from other and deeper strata,—the regular symmetrical arrangement of the particles in these bodies producing effects somewhat analogous to that of mother-of-pearl. But the opinion which Sir David himself seemed to incline to, was, that since we know from the phenomena of very thin metallic leaves that lights of very different colors are transmitted through strata of different kinds of matter and of different thicknesses, and since from the different refrangibility of lights of these colors, the same lens will not bring them to a focus at the same distance,—metallic lustre was caused by the effort used to accommodate the eye to the distinct vision of these colors.

ART OF SEEING THE INTERIOR OF THE EYE BY THE EYE ITSELF.

The following paragraph has recently been published in several journals, relative to a discovery said to have been made by M. Andraud, an eminent French engineer.

"Some attention has been excited by the alleged discovery, by a French engineer of some celebrity named Andraud, of some means of seeing the air. If, says he, you take a piece of card, colored black, of the size of the eye, and pierce with a fine needle a hole in the middle, you will, on looking through that hole at a clear sky or a lighted lamp, see a multitude of molecules floating about; which molecules constitute the air. We shall see whether the theory will obtain the sanction of the Academy of Sciences, to which it has been submitted."

An ingenious writer in the New Orleans Delta, who has given this subject much attention, has published the following communication. The atomic globules which were rendered visible to M. Andraud, by means of the perforated card, are *not ærial* molecules. I have been, for some months past, familiar with this interesting experiment. The beautiful globules seen by means of the hole in the card are the atomic colorless globes which constitute the crystalline fluid *within the eye.* M. Andraud supposes they are *external* and in the air, when the truth is they are *internal* and within the chamber of the eye.

The experiment may be tried, and the fact verified by any person, in the following manner: Take a thick visiting-card and black it with ink, or a piece of pasteboard opaque enough to forbid the transmission of light through it, and perforate the center with a pin-hole. Place the card between the eye and a candle-flame, or a globe-lamp, and not more than two inches from the eye, and the same distance from the light; but this distance will vary according to the convexity or flatness of the seer's eye, who must adjust it till he finds his focus. Instead of seeing the flame of the candle, the beholder now discerns a circular disc the size of the iris of the eye. This disc is bright and planet-like, and is crossed by innumerable lines like the fibres visible on the surface of a magnified rose-leaf. It *appears to be beyond the eye*, between the card and the light; and it is this illusion which deceived M. Andraud, and led him to suppose that he saw a portion of the atmosphere magnified. But this visible disc is, in fact, a spherical section of the fluidal crystalline lens within the chamber of the eye, strongly illumined by the concentrated pencil of light, passing from the candle into it through the minute hole in the card; and the veined appearance of its surface is the reticulated *materia* of the ordinarily transparent coat of the cornea rendered visible. The chamber of the eye thus lighted up by the intense line of light passing into it through the minute orifice, (which acts as a strongly magnifying lens,) there is conveyed to the optic nerve an image (exactly the size of the pupil through which the ray passes) of a circular section of the crystalline fluid, with its atomic particles intensely magnified. The spectacle is one of surpassing wonder and beauty. Myriads of illuminated molecules distinctly appear in tremulous motion in the bright fluid; some of them are simple globes, others are encircled by two or more concentric rings like exquisite miniatures of the planet Saturn, as seen through a telescope. Some of them are transparent, like infinitely small soap bubbles, and float about as lightly, while others are of the white color of pearls.

By contracting the eye, or by gently moving the head from side to side, these beautiful millions of globular atoms are made to undulate within the chamber of the eye, and change places, some ascending and others descending; while others thrown nearer the focus of the light, dart across the disc like shooting stars in a lesser firmanent; while others revolve about each other in orbits of infinite diversity. The experiment is a highly interesting as well as a philosophical one, and will well recompense whoever attempts it. It will require some practice in a tyro to adjust the card to the proper focus, so as to obtain the clearest disc; but any one who knows how to use a microscope will easily discover when the card is in focus. If the flame of the candle is seen through it it is out of focus, and it must be advanced or drawn back until a round planet-like shape is discernible. This planet-like shape, which will appear crossed by a net-work, is the cornea coating of the eye magnified. The pupil of the eye must now be expanded, as when one examines closely a very minute object, when the atomic world of globules that compose the crystalline fluid will be discerned behind the net-work surface of the cornea; and the steadier one gazes, the clearer is this wonderful and beautiful spectacle perceived in all its surprising variety of form, beauty, and motion.

A better medium than the card proposed by M. Andraud I have used in making this experiment. It is a small lens, (the eye-piece of a broken spy-glass,) with an inch and a half focus. This held to a solar lamp or candle, at six feet distance, or turned towards the full moon, (which is better still,) the chamber of the eye is far more intensely illumined than by means of the perforated card. The lens of ordinary magnifying spectacles will serve equally as well as the eye-piece named, by covering the surface with opaque paper, having in the center a clear space to transmit the light throughout into the pupil of the eye.

A writer in the National Intelligencer remarks upon the above described experiment as follows: The best manner of detecting the globules is with a lens; though the perforated hole shows an interesting spectacle. The iris of the eye is also superbly magnified and rendered beautifully visible with two lenses, a small and a large one, placed five feet apart; the larger one directed to the moon or a lamp, and looking at it with the smaller (inch focus) placed close to the eye. Indeed, the experiments may be varied so as to produce the finest effects, at once novel and beautiful. Next to a telescopic view of the heavens, I know nothing in science so interesting and at the same time so simple as this "seeing the interior of the eye" with the eye itself.

HARMONY OF COLOR IN DRESS.

A CORRESPONDENT of the London Art Journal, in treating upon the subject of dress, says that "the optical effect of dark and black dresses is to make the figure appear smaller, hence it is a suitable color for stout persons; black shoes diminish the apparent size of the feet. On the contrary white and light-colored dresses make persons appear larger. Large patterns make the figure look shorter, longitudinal stripes, if not too wide, add to the height of the figure, horizontal stripes have a contrary effect, and are very ungraceful. Incongruity may be frequently observed in the adoption of colors without reference to their accordance with the complexion of the wearer, as a light blue bonnet and flowers surrounding a sallow countenance, or a pink opposed to glowing red; a pale complexion associated with a canary or lemon-yellow, or one of delicate red and white rendered almost colorless by the vicinity of a deep red. If the lady with the sallow complexion had worn a transparent white bonnet; or if the lady with the glowing red complexion had lowered it by means of a bonnet of deeper red color; if the pale lady had improved the cadaverous hue of her countenance by surrounding it with pale green, which, by contrast, would have suffused it with a delicate pink hue; or had the face of delicate red and white been arrayed in a light blue, or light green, or in a transparent white bonnet, with blue or pink flowers on the inside—how different and how much more agreeable would have been the impression of the spectator! In general the broken and semi-neutral colors are productive of an excellent effect in dress. They may be enlivened by a little positive color, but the contrasting color should bear but a small proportion to the mass of principal color. A blue bonnet and dress may be contrasted with an orange colored shawl, but the blue to contrast the orange must be of a very deep tone; a pink bonnet may be worn with a green dress, but the hue of each should be carefully assorted according to their exact contrast. Colored shawls are instances in which a great variety of colors may be arranged with harmonious and rich effect. It is always necessary that if one part of the dress be highly ornamented or consist of various colors, a portion should be plain, to give repose to the eye. The French manufacturers pay great attention to this subject, and the good effects of this study are visible in the textile fabrics which are so highly valued."

THE PSEUDOSCOPE.

A NEW instrument, contrived by Mr. Wheatstone, of London, for producing the conversion of the relief of any solid to which it is directed, is called the Pseudoscope, as it conveys to the mind false perceptions of all external objects. It consists of two reflecting prisms, placed on a frame, with adjustments, so that, when applied to the eyes, each eye may separately see the reflected image of the projection which usually falls on that eye. This is not the case when the reflection of an object is seen in a mirror; for then, not only are the projections separately reflected, but they are also transposed from one eye to the other, and therefore the conversion of relief does not take place. The pseudoscope being directed to an object, and adjusted so that the object shall appear of its proper size and at its usual distance, the distances of all other objects are inverted; all nearer objects appear more distant, and all more distant objects nearer. The conversion of relief of an object consists in the transposition of the distances of the points which compose it. With the pseudoscope we have a glance, as it were, into another visible world, in which external objects and our internal perceptions have no longer their habitual relations with each other. Among the remarkable illusions it occasions, the following are mentioned :—The inside of a tea-cup appears a solid convex body; the effect is more striking if there are painted figures within the cup. A china vase, ornamented with colored flowers in relief, appears to be a vertical section of the interior of the vase, with painted hollow impressions of the flowers. A small terrestrial globe appears a concave hemisphere; when the globe is turned on its axis, the appearance and disappearance of different portions of the map on its concave surface has a very singular effect. A bust regarded in front becomes a deep hollow mask; when regarded *en profile*, the appearance is equally striking. A framed picture hung against a wall appears as if imbedded in a cavity made in the wall. An object placed before the wall of a room, appears behind the wall, and as if an aperture of the proper dimensions had been made to allow it to be seen; if the object be illuminated by a candle, its shadow appears as far before the object as it actually is behind it.

BINOCULAR MICROSCOPE.

THE following notice of a new form of microscope, is taken from the New Orleans Medical Register. "At a meeting of the Medical Society, Oct. 1852, Prof. J. L. Riddell called the attention of the society to an instrument of his own invention and manufacture, which promises to be of incalculable advantage in microscopic researches, especially in the prosecution of microscopic anatomy and physiology.

"He remarked that he last year contrived, and had lately constructed and used, a combination of glass prisms, to render both eyes serviceable in microscopic observation. The plan is essentially as follows: Behind the objective, and as near thereto as practicable, the light is equally divided, and bent at right angles and made to travel in opposite directions, by means of two rectangular prisms, which are in contact by their edges, that are somewhat ground away. The reflected rays are received at a proper distance for binocular vision upon two other rectangular prisms, and again bent at right angles, being thus either completely inverted, for an inverted microscope, or restored to their original direction. These outer prisms may be cemented to the inner, by means of Canada balsam; or left free to admit of adjustment to suit different observers. Prisms of other form, with due arrangement, may be substituted.

"This method proves, according to Prof. Riddell's testimony, equally applicable to every grade of good lenses, from Spencer's best sixteenth, to a common three-inch magnifier, with or without oculars or erecting eye-pieces, and with a great enhancement of penetrating and defining power. It gives the observer perfectly correct views, in length, breadth and *depth*, whatever power he may employ; objects are seen holding their true relative positions, and wearing their real shapes. In looking at solid bodies, however, depressions sometimes appear as elevations, and *vice versa*, forming a curious illusion; for instance, a metal spherule may appear like a glass ball silvered on the under side, and the margin of a wafer may seem to ascend from the water into the air.

With this instrument the microscopic dissecting knife can be exactly guided. The watchmaker and artist can work under the binocular eye-glass with certainty and satisfaction. In looking at microscopic animal tissues, the single eye may perhaps behold a confused amorphous, or nebulous mass, which the pair of eyes instantly shape into delicate superimposed membranes, with intervening spaces, the thickness of which can be correctly estimated. Blood corpuscles, usually seen as flat discs, loom out as oblate spheroids. Prof. R. asserted, in short, that the whole microscopic world could thus be exhibited in a new light, acquiring a ten-fold greater interest, displaying in every phase, a perfection of beauty and symmetry indescribable."

GIGANTIC TELESCOPE.

A NEW and gigantic telescope, rivalling that constructed by Lord Rosse, is now erecting upon Wandsworth Common, by Mr. Gravatt, for the Rev. Mr. Craig. It consists of a plain tower, with a long tube slung at its side. The tower, consisting of brick, is 64 feet in height, 15 feet in diameter. Every precaution has been taken in the construction of this building, to prevent the slightest vibration; but, if any disappointment in this respect should arise, additional weight can be obtained by loading the several floors, and the most perfect steadiness will be thus insured. By the side of this sustaining tower hangs the telescope. The length of the main tube, which is shaped somewhat like a cigar, is 76 feet; but with an eye-piece at the narrow end, and a dew-cap at the other, the total length in use will be 85 feet. The design of the dew-cap is to prevent obscuration by the condensation of moisture which takes place during the night, when the instrument is most in use. Its exterior is of bright metal, the interior is painted black. The focal distance will vary from 76 to 85 feet. The tube at its greatest circumference measures 13 feet, and this part is about 24 feet from the object-glass. The determination of this point was the result of repeated experiments and minute and careful calculations. It was essential to the object in view that there should not be the slightest vibration in the instrument. Mr. Gravatt, reasoning from analogy, applied the principle of harmonic progression to the perfecting of an instrument for extending the range of vision, and thus aiding astronomic research. By his improvements, the vibration at one end of the tube is neutralized by that at the other, and the result is, that the utmost steadiness and precision are attained. The ironwork of the tube was manufactured by Messrs. Rennie, under the direction of Mr. Gravatt. The object-glasses are also of English construction, and throw a curious light on the manner in which an enlightened commercial policy has reacted upon and promoted the advancement of science. Up to a recent period, the flint glass for achromatic telescopes was entirely of foreign manufacture. Since the reduction in the duty, great improvements have been made in this department. The making of the large flint glass was intrusted to Mr. Chance, of Birmingham, who at first hesitated to manufacture one larger than 9 inches in diameter. On being urged, however, by Mr. Craig, he succeeded in producing one of 24 inches; perfectly clear, and homogeneous in structure. Besides this, there is a second of plate glass of the same dimensions, cast by the Thames Plate Glass Company. The tube rests upon a light wooden framework, with iron wheels attached, and is fitted to a circular iron railway at a distance of 52 feet from the centre of the tower. The chain by which it is lowered is capable of sustaining a weight of 13 tons, though the weight of the tube is only 3. Notwithstanding the immense size of the instrument, the machinery is such that it can move either in azimuth, or up to an altitude of 80°, with as much ease and rapidity as an ordinary telescope, and, from the nature of the mechanical arrangements, with far greater certainty as to results. The slightest force applied to the wheel on the iron rail, causes the instrument to move horizontally round the central tower, while a wheel at the right hand of the observer enables him to elevate or depress the object-glass with the greatest precision and facility. With respect to the magnifying power of this novel instrument, it is only necessary to state that, though the focus is not so sharp as it will be shortly, it has already separated the nebulæ in the same way as Lord Rosse's. It has also separated some of the double stars in the Great Bear, and shown distinctly a clear distance of 50° or 60° between them, with several other stars occupying the intervening space. Ordinary readers will better understand the extraordinasy magnifying power of the telescope, when we inform them that by it a quarter-inch letter can be read at the distance of half a mile.

The London Observer furnishes the following additional particulars relative to the power of this new instrument; it says: — "It has been already ascertained, that, as a measuring instrument, or for penetrating space, its powers are unapproachable by all other instruments. It separates minute points of light so distinctly, that its qualifications as a discovering telescope must be extremely valuable. It resolves the milky way, not simply into beautiful and brilliant star-dust, to use the language of astronomers, but subdivides this 'dust' into regular constellations, showing counterparts of the Orion, the Great Bear, and the other brilliant galaxies of our system, adorned, in addition, with the most varied and gorgeous colors. The lenses are so perfectly achromatic, that the planet Saturn appears of milk-like whiteness; and, as regards this planet, a good deal of scientific interest has been recently attached to it, in consequence of the distinguished American astronomer, Bond, of the Cambridge Observatory, Massachusetts, having stated he believed he saw a third ring or belt round the planet. Professor Challis brought the Northumberland telescope at Cambridge to bear upon it, but failed in discovering it. Lord Rosse's gigantic telescope was also employed upon it in vain; and it became a matter of great interest to the astronomical world, to ascertain whether there was a third ring or not; and this question has been solved by the Craig telescope; the third ring, of a clear, brilliant gray color, having been distinctly seen. This is owing to the great quantity of light which the Wandsworth telescope brings to the eye of the observer from this planet, giving a bright appearance to what, in an instrument of less power, would have been completely invisible.

"Some idea of its powers may be formed from the fact, that it magnifies the light of the moon 40,000 times; and in coarse objects, like the outlines of the lunar mountains and the craters, the whole of these rays may be allowed to pass at once to the focal point, as they do not in such objects confuse it in any appreciable degree. In the Craig telescope, the moon is a most magnificent object, and perfectly colorless, enabling the beholder to trace the outlines of the various mountain ranges with such vivid distinctness as to make us long for fine clear weather, in order to bring the whole powers of this marvellous instrument upon our satellite. It is positively asserted that of a favorable evening, if there was a building or object of the size of Westminster Abbey in the moon, the whole of its parts and proportions would be distinctly revealed. As an illustration of its space-penetrating powers, and the manner in which it grasps in the light, it may be stated, that soon after it was erected it was directed to a test object, a minute speck of light in one of the constellations, which is not to be seen at all times by the most excellent instruments, though guided by first rate observers, and in profound darkness. The Craig telescope at once discovered that this test object was not a minute speck of light, but a brilliant double star. As soon as it is finally adjusted, Mr. Craig proposes to direct the instrument to the planet Venus, to examine it minutely, in the hope that he may be able to settle the question of whether she has a satellite or not. We need not say what an advantage the solution of this fact would be to science.

"But wonderful as are the effects of this telescope, it is not yet perfect, and it has been found that a part of one of the lenses is too flat by about the five-thousandth part of an inch! To many it may appear incredible that the five-thousandth part of an inch can be estimable so as to be appreciable and measured; but the indistinctness of a portion of the image revealed the fact. The rays of light which fall upon that part of the lens go beyond the focal length, and render the object indistinct, and confuse the image. This portion of the lens has to be "stopped out" when extraordinary accuracy of definition is required; as, for instance, in observing so fine a point as the third ring of Saturn; and, as the aperture is so large, the absence of this small portion of the rays is not important, the quantity of light being so great. It was at first feared that the attempt to correct this defect might produce the inconvenience of over correcting it, and produce an error on the other side; but Mr. Gravatt has devised a plan by which the lens, which was polished in the first instance by four workmen, may now be repolished by machinery upon such accurate mathematical principles as will prevent the possibility of error. The machinery is somewhat similar to that by which the reflector of Lord Rosse's gigantic telescope was polished, with the difference, that, the reflector being concave, and the Craig lenses convex, the machinery will act reversely."

The Observer states the following additional facts of an interesting character, relative to the improvements made by the two scientific gentlemen above named, the benefits of which will perhaps be even more widely extended than those resulting from the single instrument already perfected. "Not the least of the benefits which Mr. Craig has conferred upon astronomical science, is the practical demonstration of the fact, that achromatic telescopes of this vast size and extraordinary range, may be constructed at a comparatively small cost, thus doing away with the necessity for the more expensive and elaborate arrangements required for the great reflecting telescopes. The simple and effective mechanism devised by Mr. Gravatt is another illustration of the advance we have made in the mechanical arts, and fully justifies the soundness of the judgment evinced by Mr. Craig in his selection of an engineer."

TRAVELLER'S CAMERA.

Mr. Fox Talbot publishes the following description of a portable photographic apparatus arranged by him, and called "The Traveller's Camera."

He says: I first mount the camera itself upon a board of its own breadth, but two or three inches longer than it. I then make a kind of table, or support, beneath the surface of which are sunk or concealed three troughs, which are retained in fixed positions. One of these is intended to hold a solution of nitrate of silver; the second, either a solution of gallic acid, or sulphate of iron; and the third, water. The usual paper holder is dispensed with, but instead of it there is a simple frame, to which a sheet of paper or a pane of glass can be attached from behind, and taken away again, while the frame remains in the camera. The upper part of the frame carries a long handle, passing through the lid of the camera, which may either stand upright, or, if it be jointed, it can be folded down on the camera. When the camera is placed on its table, or support, it can move upon it in one direction only, backward and forward, being confined to that motion by two parallel strips of wood, upon which are placed certain marks corresponding to a mark upon the camera, indicating that when either of these marks are brought into union, then the paper holding frame of the camera is in a vertical line over the centre of one of the troughs. Now, when the photographer sets out of a morning upon his excursion, he carries with him two boxes, one containing the plates of glass (or the sheets of iodized paper) he intends to use, which of course may be freely exposed to light, not being in a sensitive state; and the other box to hold the pictures which he expects to make. When arrived at the scene of action, the *modus* *operandi* is this: having first filled the troughs with their respective liquids, the camera is placed upon its table or support, and this again upon a stand which is usually required to give it a due elevation from the ground. The camera is pointed at the object, and a sheet of ground glass is placed in the frame from behind, to obtain the focus, and is then removed, and a sheet of prepared iodized paper, or a plate of iodized glass (which of course must not be at all sensitive) is put in its place. A door is then shut at the back of the camera, which places the prepared paper of glass in the dark. The camera is then moved on its support to the mark indicating the trough of nitrate of silver. The object-glass of the camera is then closed. The operator then takes hold of the frame by its handle, and pushes it down into the trough below, which he is enabled to do by reason of a narrow slit in the bottom of the camera, which allows a passage. He then draws it up again immediately. He then opens the object-glass of the camera, and after a due time closes it again. He then moves the camera on its support to the mark indicating gallic acid, or sulphate of iron. He then, as before, pushes the frame down and lifts it up again, either immediately or after a due length of time. He then, in a similar way, drops the frame into and out of the trough of water. He then opens the door at the back of the camera, and takes out and examines the picture he has obtained, which for that purpose he may freely expose to the light. If not satisfied with it, he tries again, correcting his process by his first experience. But if he is satisfied with his picture, he deposits it in his box. It is not yet quite finished, but the finishing process is deferred without inconvenience until after his return in the evening. In practice, I find that this simple arrangement works delightfully, and I should be glad to be allowed to name it the *Traveller's Camera*."

ON THE SOLAR AGENCY PRODUCING CHEMICAL CHANGE.

From Mr. Hunt's late work on Photography, we copy the following passage relative to the solar agency, which produces the chemical change.

"The operation of the antagonistic forces of light is somewhat remarkably shown over different regions of the earth. Advancing from our own lands towards the tropics, it is found that the difficulties of obtaining pictures by the solar influences increase; and, under the action of the glowing light of equatorial climes, a much longer period is required for impressing a photograph, than is occupied in the process either in London or Paris. It has been stated by Dr. Draper, that in his progress from New York to the Southern States, he found the space protected from chemical change by the yellow rays regularly increasing. The same result is apparent in the differences between the spring and summer. Usually in April and March photographs are more readily obtained, than in June and July. It is worthy of notice, that the morning sun, between the hours of eight and twelve, produces much better effects than can be obtained after the hour of noon; this was observed at a very early period by Daguerre. For drawings by application, this is but slightly, if at all, felt, but with the camera it is of some consequence to attend to this fact. We are not yet in a position to record more than the fact — the cause of the difference is not yet determined; probably it may be found to exist in a greater absorptive action of the atmosphere, caused by the elevation of aqueous vapor from the earth. But the experiments of M. Malaguti seem to imply the contrary, this philosopher having found that the chemical rays permeate water more readily than they do air; some experiments of my own, however, are not in accordance with M. Malaguti's results. In the neighborhood of large towns it might be accounted for by the circumstance of the air becoming, during the day, more and more impregnated with coal smoke, &c., which offers very powerful interruption to the free passage of the chemical rays. This will, however, scarcely account for the same interference being found to exist in the open country, some miles from any town. Until our meteorological observers adopt a system of registering the variations of light and actinic power by means of some well devised instrument, we cannot expect to arrive at any very definite results."

IMPROVEMENTS IN PHOTOGRAPHY.

PHOTOGRAPHY has made rapid progress during the last two years, especially in the mode of operating on paper and glass. To M. Niepce must be accorded the merit of having contributed to the perfecting of this art, by his beautiful discovery of the process of albumen on glass. Proofs have been obtained by this means, which, for beauty of design, clearness and fineness of detail, leave nothing to be desired. There are, however, serious inconveniences attendant upon this process. The length of exposure in the camera necessary for obtaining an image, has hitherto compelled us to limit its application to landscapes and architecture, and renounce its employment in portraiture. These difficulties have at last been overcome by Mr. Bingham, of London, who substitutes a layer of collodion instead of the albumen of M. Niepce. This process, it is stated, rivals in beauty the albumenized plate, and even surpasses the daguerreotype in sensibility to light. The manner of operating with collodion resembles, in many respects, the albumen process, and no operator accustomed to the manipulations of the albumen on glass, can fail to succeed with collodion. The details of the process are described at length by Mr. Bingham, in the Comptes Rendus of May, 1852, and in the London Chemist for July, 1852.

Photographs on Glass. — According to a process described by M. Pucker, in the *Archiv der Pharm.* lxix., a thin film of iodide of sulphur is formed upon plate glass, by covering the glass, which must be perfectly clean, with a very thin coating of sulphur, and then impregnating this for a few seconds with the vapor of iodine. The glass plate is then placed in the camera, where at the same time the vapor of some quicksilver in an iron cup in the bottom of the camera, acts upon the iodide of sulphur with which it is coated, and it receives the photographic image within a minute. The glass plate, when taken out of the camera, only exhibits a trace of the picture, but this immediately comes out on exposure to the action of the vapor of bromine. If the picture be now held over alcohol, and some of the same liquid be poured upon it, it will be fixed.

The glass plates must be breathed upon and well rubbed with a soft linen rag several times before use. They are coated with sulphur by burning sulphur sticks, made on purpose, in a proper tube, and holding the plates over it at a distance of about three inches. These sulphur sticks are prepared by dipping pieces of rush pith into a melted mixture of sulphur and mastic, with which they become incrusted. For use, these sulphur sticks, which are about the size of a lucifer match, are stuck on a brass needle, introduced into the middle of a glass tube, and kindled, so that the vapor of the sulphur may come in contact with the glass plate held over it.

These glass plates are so sensitive, that the coating of iodide of sulphur becomes instantly changed on exposure to direct sunlight, and give a Moser's image within five minutes when laid in a book. The figures thus obtained are most easily read by candlelight. In daylight, the blue letters can be recognized on the yellow ground only by looking through the plate towards the middle of the window, or towards a sheet of paper fastened in that place, the sulphur not having been removed either by vapor of bromine, or by alcohol.

If a glass plate, covered with a solution of gum and exposed to the vapor of iodized sulphur, be placed in the camera, a positive picture, with all its details, is obtained, the outlines of which can be laid bare by an etching point capable of scratching the glass. If a glass plate, so marked, be rubbed in with printing ink, the outlines will be filled, and the ink will remain in them when the glass is freed from the coating of gum by means of water. The picture is then easily transferred to paper, which is to be laid on the plate and rubbed over with a paper-knife.

Improvements in preparing photographic paper.—M. Legray, in a recent communication to the French Academy, describes a new method of preparing photographic paper, which he claims to possess superior qualities. The substance first used in the preparation of the paper, is virgin wax, which is kept at a temperature of 100° Centigrade, in a large, flat vessel, and the paper is immersed therein until completely saturated with the wax. The sheet of paper is then withdrawn, and laid between several pieces of blotting paper, over which a moderately heated iron is passed, which causes the blotting paper to absorb the superfluous wax. If the paper is properly prepared, there will be no gloss whatever on its surface, and it will be perfectly transparent.

The waxed paper is then immersed in a warm solution, composed as follows:—

1,000	parts of	rice water,
40	" "	sugar of milk,
15	" "	iodide of potassium,
0.80	" "	cyanide of potassium,
0.50	" "	fluoride of potassium.

The sheet of paper should be laid in this solution for half an hour, and it may then be withdrawn, and hung up to dry.

The paper is then immersed in a clear solution of aceto-nitrate of silver, which is thus formed: —

300	parts of	distilled water,
20	" "	acetate of silver.
24	" "	crystallizable acetic acid,
5	" "	animal charcoal.

The animal charcoal serves to render the paper more susceptible to receive impressions, and decolorizes the solutions when they have been previously used. The paper should remain three minutes in this solution, and in order to insure contact with the liquid, the two sides of the sheet should be rubbed over with a brush. The paper is then washed several times with distilled water, and well dried between pieces of blotting paper. Paper thus prepared may be taken immediately into the dark chamber, and it is not necessary to subject the image to the action of gallic acid on its removal from the camera; this may be deferred till the evening, or even the next day, or the day following.

The paper may be kept in a dark place for more than a fortnight, without undergoing any alteration; and in this respect offers greater advantages than any of the photographic papers hitherto known. The solution of gallic acid is composed of one part of gallic acid, half part (0.5) of nitrate of silver, and 200 parts distilled water. The image is fixed, as usual, by the hyposulphite of soda.

Whipple's Chrystalotype. — The following is the outline of a process discovered by Mr. J. A. Whipple, of Boston, for the production of a picture on paper, to which the name chrystalotype has been given. A glass plate is first prepared with a sensitive coating, and on this the picture is taken. As in all such pictures, when prepared after Talbot's process on paper, the light objects are here represented the darkest, and the dark ones the lightest. A black man with a white hat becomes a white man with a black one. The lights in this glass picture are transparent. The shades are opaque. In the preparation of this plate, we presume, is Mr. Whipple's invention. Now, take this plate, place under it a sheet of paper prepared with one of the photographic solutions, and let the sun strike through. The light parts of the plate are copied dark, and *vice versa.* Of course, the black man gets a black face again, and a white hat.

The pictures taken by this process upon paper are of marvellous delicacy and finish, and surpass anything of the kind we have heretofore examined.

DAGUERREOTYPES WITHOUT MERCURY.

M. Natterer, of Vienna, has discovered a process for obtaining proofs on iodized plates with the chloride of sulphur, without the use of mercury. A plate of silver is iodized in the usual manner, and then placed on the top of a vessel 6 or 8 inches high, having at the bottom, in a small cup, a few drops of chloride of sulphur; it should remain exposed to the action of the vapor until the sombre yellow color is changed to a red, after which it is brought to a focus in the camera, where it is left for a time, depending upon the luminous strength of the focus of the objective. (With the objectives of Voigtlander, not less than ten seconds and not more than two minutes.) The plate is then taken out and examined in the camera by the light of a candle. It often occurs that no trace of the image is as yet perceptible, but if the plate is heated by placing over a spirit lamp the unprepared side, or if left for some time in the dark, or, lastly, if exposed only for a few seconds to a weak dimmed light, the positive picture then appears with all its shades. Of these three modes of bringing out the image, the second is superior to the others.

ENGRAVED PHOTOGRAPHS.

The idea of the prospective advantages of bringing the photographic process into immediate connection with the engraver's art, and the probable chance of fitting it for the part of the engraver's draftsman, in actually pencilling out the lines for the wood engraver, the etching needle or the burin, has been often discussed. The London Practical Mechanic's Magazine for May, contains two wood engravings, engraved from photographic designs taken upon a collodion film, which was subsequently transferred to wood. The design of the picture was thus, as it were, pencilled upon the block by the action of light. This result has been accomplished by Mr. Urie, of London, in the following manner: The picture is first obtained upon a collodion film upon glass in the usual manner. The film is then carefully detached, and laid upon the prepared wooden block. The engraver then engraves through the film, as if he were treating an actual drawing upon the wood surface. It is obvious that the whole process, more especially the transfer of the pictorial film from its original foundation to the block, is a matter involving extreme nicety of manipulation. The operator proceeds by floating off the film in water, by placing the glass plate horizontally therein, and with the picture upwards, assisting the dislodgment of the film, when necessary by a slight mechanical action. Then, the wood block, having its surface previously prepared with the white of an egg and lamp-black,—the darkening being necessary to throw out the picture from its translucent ground — the film is carefully laid upon the block; the white of an egg having sufficiently adhesive power to hold it firmly down. At first, the very obvious difficulty of the peeling off, or disintegration of the film, opposed the efforts of the engraver in his subsequent treatment of the block, but this brittleness has been overcome by a slight wash of varnish. Engravings produced in this way are light-drawn pictures indeed. In his execution of them, the engraver is freed from the mannerisms, or imperfections of the artist, or mechanical draftsman, escaping on the one hand the dangers of the lack of "life," or the missing of expression; and on the other avoiding all inconvenience from chance, error, or neglect.

Since the above was laid before the public, the process has been still further improved, by taking the photographic picture directly upon the wooden surface to be engraved. This is best effected by drying on a coating of lamp-black and white of egg, and varnishing this over with a coat of pure white of egg, before laying on the collodion. After collodionizing the wood, it is dipped into nitrate of silver and placed at once in the camera, the picture being subsequently developed, by dipping in sulphate of iron, and nitric acid, washing in pure water, and finally fixing with hyposulphite of soda. To preserve the picture a final coat of mastic varnish is laid on.

GAUDIN ON ENGRAVING FROM DAGUERREOTYPES.

DAGUERREOTYPES combine all the necessary conditions for engraving by means of acids, being composed of an unchangeable coating deposited upon a sheet of silver that several chemical agents easily corrode. By this means, the parts protected correspond to the lights, and those corroded, to the shades — precisely as the picture requires, and as is the case with aqua fortis engravings; moreover, the impressions taken upon paper would be in their right position. But practice is far from realizing the promises of theory. The reason of this want of success arises primarily from the extreme delicacy of the dotted parts which form the half-tints, and again, from the deficiency of depth in shades of any extent. In fact, an engraving fit for taking impressions is composed of deep furrows, produced, either directly, by the cutting of the graver, or indirectly, by the interstices of the grain formed on the plate, or by the scraping of the point, as in etching. The shades are owing to the vast number of these irregularities on the same spot, while the biting of the acid on a daguerreotype may plough deep without leaving any irregularities necessary to retain the ink for the impression. For example, if there happen to be in the daguerreotype open windows, forming shades of some extent, the acid will make a hollow of the same extent, but the bottom of it will be smooth, and the ink will scarcely adhere. M. Donne was the first who thought of engraving daguerreotypes. His first attempts were very remarkable, and no one doubted their ultimate success. He employed a very simple and expeditious process. Over a daguerreotype taken on a double-silvered plate and carefully washed with hyposulphite of soda and afterwards finished with distilled water, he poured a mixture composed of three parts of pure nitric acid and four of distilled water, having first covered the edges of the plate with a thick coat of engravers' wax, so as to make a flat disc of it. In the course of a short time there was a lively effervesence owing to the disengagement of nitrous gas during the disappearance of the silver. As soon as he judged the engraving deep enough he washed the plate well in water. By this means he obtained very delicate engravings, from which as many as forty copies could be taken; they were, however, deficient in vigor, and had a gray tint, almost uniform.

Attempts have been since made to take copies by the battery, placing the daguerreotype in an acid, or metalliferous bath communicating with the carbon pole of a cell of Bunsen's battery, which is the pole of oxidation or departure. There were produced engravings of a high finish, but of a texture that might be called impalpable, and from which copies could not be taken by a copper-plate press. To remedy this defect, M. Fizeau thought of covering an engraving which had undergone the first biting process, with an oily substance that would fill up the smallest cavities and leave untouched the prominent parts, which he cut out with the greatest care; in this state it was gilded by means of the battery, and then stripped of its oily coating by a suitable dissolvent. After this operation, the part already bitten was strongly acted upon by the nitric acid, which left untouched all the parts that had been gilt. By means of this improvement, M. Fizeau succeeded in obtaining a few engravings, possessing a certain vigor, of casts illuminated by the sun. Delicate views subjected to the same operation have always been far inferior to photographs on paper. The increasing progress of these latter, have led to the neglect of engraving daguerreotypes; indeed, the small number of indifferent copies that can be taken, is a great obstacle to this mode of employment. It might be remedied by taking pictures on hardened steel silvered by the battery. I silvered a sheet of hardened steel, by rubbing it with a solution of chloride of silver dissolved in the hyposulphite of soda. The daguerreotype was successful, but not the engraving, from deficiency, no doubt, of the silvering. With the resources at present offered by the battery, it is certain that the copying of engravings in a similar manner would be much increased. There would be required however great manual strength; it would be a very delicate operation, which could be executed only with a diamond graver. No attempts have been made, that I know of, to copy daguerreotypes by means of lithography, yet the art might, notwithstanding, furnish all the required vigor, for the shades depend in lithography only on the chemical nature of the surface, and not at all on its confirmation. I propose, however, to do this;—Cover a piece of silk, waxed, of the size of the engraving to be lithographed, with an exceedingly thin coating of lithographic ink dissolved in alcohol. On this waxed silk take by pressure a copy of the daguerreotype merely washed with hyposulphite of soda and rinsed with distilled water. With the waxed silk alone, the operation has succeeded very well; it is a precedent of flattering promise. If the coating of lithographic ink is exceedingly thin, the catching property of the waxed silk will be only increased, and the taking of the impression will be easier. The taking of the impression having been successful is a great step toward completion; all that remains to be done, is to transfer it on the lithographic stone. For this purpose the stone should be finely polished with wafer and pumice stone; then the waxed silk covered with a few sheets of unsized paper, is pressed down tightly with a screw, but not too much. For greater success, the stone is warmed, and the whole left in the press for several hours, to give the lithographic ink time to react upon the stone. It is evident, wherever the photogenic coating covers the silk the lithographic ink cannot act upon the stone, and besides, its dryness will prevent it from sticking, so that when the silk is taken off, the stone will be clean wherever it touched. There remains nothing else to be done but to submit the stone to a slight acidulation with a large quantity of gum arabic. Actually, the result of taking the copy will be quite different from what it would be with the plate engraved by means of acids. Every portion of silver uncovered, and represented on the waxed silk by a continued coating of lithographic ink, will produce on the stone an oleaginous place of the same extent, which will give the shading. It is for the purpose of not erring in the other extreme, that the waxed silk should be covered with an *infinitely fine* coating of lithographic ink, to prevent its destruction, which might blur the lights and shades.

FIXATION OF COLORED PHOTOGRAPHS.

M. NIEPCE DE SAINT VICTOR laid before the Paris Academy of Sciences, at the sitting of the 8th of November, daguerreotypes upon which he had succeeded in fixing, in a manner more or less permanent, colors by the camera obscura. M. Niepce states, that the production of all the colors is practicable, and he is actively engaged in endeavoring to arrive at a convenient method of preparing the plates. "I have begun," he says, "by reproducing in the dark chamber colored engravings, then artificial and natural flowers, and lastly dead nature — a doll, dressed in stuffs of different colors, and always with gold and silver lace. I have obtained all the colors; and, what is still more extraordinary and more curious is, that the gold and the silver are depicted with their metallic lustre, and that rock-crystal, alabaster, and porcelain, are represented with the lustre which is natural to them. In producing the images of precious stones and of glass we observe a curious peculiarity. We have placed before the lens a deep green, which has given a yellow image instead of a green one; whilst a clear green glass placed by the side of the other is perfectly reproduced in color." The greatest difficulty is that of obtaining many colors at a time; it is, however, possible, and M. Niepce has frequently obtained this result. He has observed, that bright colors are produced much more vividly and much quicker than dark colors:—that is to say, that the nearer the colors approach to white the more easily are they produced, and the more closely they approach to black the greater is the difficulty of reproducing them. Of all others, the most difficult to be obtained is the deep green of leaves; the light green leaves are, however, reproduced very easily. After sundry other remarks, of no peculiar moment, M. Niepce de Saint-Victor informs us, that the colors are rendered very much more vivid by the action of ammonia, and at the same time this volatile alkali appears to fix the colors with much permanence. These results bring much more near than hitherto the desideratum of producing photographs in their natural colors. The results are produced upon plates of silver which have been acted upon by chloride of copper, or some other combination of chlorine.

M. Niepce stated a curious fact, namely, that the colors become more rapidly effaced by the light in the mornings than in the afternoons. In connexion with this subject, it may be mentioned that there have been presented to the Academy a number of lithographic designs on sheets of gutta-percha, pressed as thin as ordinary letter paper.

The following remarks upon the above announcement are taken from the Paris Journal, "Cosmos."

Formerly, for fixing the colors, M. Niepce de St. Victor operated by means of contact, that is to say, he placed on the chlorided plate the painted image that he wished to copy. The colors were outward; the luminous rays in passing through them were in their turn colored, and shaded the plate by exercising on it their photogenic action. It is therefore certain that hitherto, M. Niepce had operated only on flat objects—by means of contact, and not at a distance—without the aid of a camera.

These conditions for success appeared so essential for the production of colors, that very skilful practitioners doubted obtaining any thing more. Indeed, we have been told that M. Regnault had challenged M. Niepce ever to succeed in obtaining the colored image of a boquet of flowers. The challenge was accepted, and much has been accomplished. M. Niepce took a bouquet of hollyhocks with its leaves, flowers and buds; he filled up the empty parts with vine leaves, suspended the bouquet in the air, directed his camera towards it, received its image on the chlorided plate, and before half an hour had passed, the buds and flowers—red, rose-color and yellow, &c., had painted themselves with their various shades quite discernible, and we have seen, ourselves, these encouraging proofs. The leaves alone, particularly the vine leaves, of a dark green, remained refractory; their forms were depicted black. This negative result will not astonish any one, for every one knows that the photogenic action of green rays is almost nothing; it is not however entirely so, and every thing leads us to hope that success will be obtained in overcoming this difficulty. Before operating with a bouquet, M. Niepce had operated with figures, with a colored bust of the Prince President, and had obtained proofs really perfect, in the camera, with the perfect outline that flat pictures did not give.

The reason of M. Regnault's imagining that it would be fruitless to copy the natural colors of bodies, such as flowers, for example, was this; he considered them too much weakened, or diluted with white—that the prominent influence of the white light would destroy the tint, and create an unconquerable uniformity. Mr. Niepce, however, is able to prove by a number of very curious experiments, that, far from being injurious, the influence of the white light is very useful, and that it assists considerably in copying colors.

The Hilotype.—It will be remembered, that some two years since, it was asserted that a discovery had been made by the Rev. Mr. Hill, of Westkill, N. Y., by which the images of objects in all their natural colors could be copied photographically from nature in a few seconds. The failure of Mr. Hill to substantiate his assertions by the exhibition of results, has caused the whole subject to be discredited, and the announced discovery has generally been considered as fabulous.* Within the past year, however, testimonials have been published by various artists, who have seen the pictures taken by Mr. Hill, which renders it certain that something has been accomplished. The course pursued by Mr. Hill in relation to the discovery is a most singular one, and forms a striking contrast to the open and manly conduct of M. Niepce in regard to the same subject. Mr. Hill appears to be actuated by pecuniary motives, rather than by a true scientific spirit. The honor of the discovery, in any event, will now undoubtedly be awarded to M. Niepce. Had a different course been pursued it might have belonged to Mr. Hill and his country.—*Editor.*

NIEPCE'S SECOND MEMOIR ON HELIOCHROME.

In the Annual of Scientific Discovery for 1852, pp. 126–131, we published a memoir submitted to the French Academy by M. Niepce, on the subject of Heliochrome, or the production of colored photographic pictures. The following is a second memoir on the same subject, subsequently read to the Academy, by the same author, and containing some additional details respecting his extraordinary and interesting investigations. The memoir is copied from Humphries' Daguerrean Journal, for which it was translated : — My later experiments have proved to me that these phenomena of coloring by light only held good according to the proportion of chlorine or chloride of which the baths were composed in which I prepared my silver plates. It is known from the experiments of M. E. Becquerel that chlorine water impresses the silver plate by a simple immersion so as to render it susceptible of copying afterwards, by means of the light, the colors of the solar spectrum: but there will be produced one or another predominant color, according to the quantity of chlorine that the water serving to prepare the silver plate may contain. For example, I produce the yellow ray by the feeblest quantity of chlorine, and the red and orange by water completely saturated with chlorine, or I add to some liquid chlorine a salt of copper, and even perchloride of iron. The former of these substances gives much liveliness to the colors, for they are very feeble when the chlorine is employed alone. Many chlorides have no influence on the silver

* See Annual of Scientific Discovery, 1852, p 131.

plate, such as the chlorides of sodium, aluminum, magnesium, &c., but if there be added to their solution a salt of copper, they become fit for giving an impression on the plate of silver, and producing colors, those colors predominating, at the will of the operator, according to the quantity of the chloride added to the salt of copper; the proportions of the salt of copper vary according to the chlorides employed. This result is the more remarkable because the salts of copper employed without a chloride exercise no influence, and this influence varies according to the quantity of chlorine or chloride put into the bath with a quantity of salt of copper remaining the same. In like manner, by varying the proportions of the salt of copper, with a given quantity of chlorine or chloride, remaining the same, the effects can be changed; but in this case the results will be similar to those of the former; however, it is preferable to take 100 grammes of sulphate of copper, with 400 parts of water, and add variable proportions of chlorine or chloride, according to the color required. To obtain all the colors at once, there must be taken the proportion of chlorine or chloride corresponding to the yellow and green rays, and in this case there will be several colors by allowing the plate to become suitably prepared in the bath; that is to say, the bath ought always to be at a temperature of 10° Centigrade, at the least, and the plate should be immersed in it for about five minutes. The thickness of the coating laid on, as well as the absorption of the bath, causes a difference in the effect; it is therefore very essential to operate always in the same condition if the same results are desired. (The mixture of the chloride with the salt of copper should be made cold, or at least at a moderate temperature.)

When several colors are obtained on the plate they are much less vivid than when only one predominant color is required. This is the reason that it is so difficult to obtain several colors at once, of great intensity, particularly with white grounds, and to copy the dark parts at the same time. I mentioned that the feeblest quantity of chlorine or chloride furnished yellows; but to have indigo and very bright violet, there will be no yellow. The red, alone, is always produced, because this color is caused by the heat of 100° Centigrade, to which the plate has been first of all exposed before any action of the light; however, with yellows, the red is very feeble. The finest reds are obtained with a large quantity of chlorine or chloride, except with the acid chlorides, such as those of zinc and tin, and hydrochloric acid, which furnish very good results when they are mixed with a salt of copper in suitable proportion; but if in excess, there will be produced only a violet color. In this case the ground of the picture is very clear, and the lines very pure. With the neutral chlorides, when united to a salt of copper, it happens that, if in excess, they produce very bright colors, particularly the reds and those of an orange tint, but the ground of the plate is always dark; this is the case particularly with the perchloride of iron. If a mixture is made of one part of chloride of iron with four of a salt of copper in 300 parts of water, all the colors will be obtained, with white grounds, but they are not very bright. If a mixture is made of 100 parts of chloride of magnesium with 50 parts of sulphate of copper, all the colors will be copied, and they will be brighter than the preceding, but the ground will always be dark or pink.

I shall now speak of the experiments that I have made on colored flames, and on the relations of the color of these flames with the colors that are developed on the silver plate prepared with the bodies that give colors to these same flames.

It has been observed that chlorine alone gave to a silver plate the property of being differently colored when exposed to the influence of the light. It was therefore of importance, according to my idea, to dye with it alone flames of all the colors, which I did by means of the following experiments. If there is placed in pure alcohol a small quantity of pure hydro-chloric acid, there will be obtained on burning it, at first a yellow flame; then, if there be gradually added new hydro-chloric acid, by shaking the liquor in a capsule, there will be successively obtained flames of all the colors of the spectrum, beginning from the yellow ray to the violet, which will be produced by the greatest quantity of hydro-chloric acid that can be placed in the alcohol without extinguishing it; only I premise that the flames are not very brilliant. They will be rather more so if there be substituted for the hydro-chloric acid a chloric ether, or Holland gin, and preferably, the chlorides of carbon, particularly the sesqui-chloride, which has given me colored flames from the yellow ray to the violet; but I have not been able to obtain red and orange-colored flame. That arises probably because the heat was not sufficiently strong, or because I did not employ sufficient chloride. The proto-chloride of carbon has given me flames of a rather great intensity of color, by exposing it on a sheet of platinum, or by saturating a stout match of asbestos, heated by the flame of an eolipile lamp. I have by this means obtained violet flames of a deepish tinge, but nothing further. This arises, no doubt, from the great volatility of the proto-chloride of carbon, which does not allow of maintaining it at a sufficiently high temperature to produce red and orange rays, as can be done with the chloride of copper. It resists, however, much better the action of fire than the sesqui-chloride of carbon, which, being treated in the same manner, immediately volatilizes, producing only a yellow flame.

Having formed a chloride of silver with nitrate of silver and chloride of magnesium, which, having been previously well washed, was afterwards exposed to the flame of the eolipile lamp, there was produced a fine yellow flame. But to obtain flames of all the colors of the spectrum, with a great depth of color, a chloride of copper must be formed, by mixing hydro-chloric acid (or a chloride whose base does not give coloring to flame) with a salt of copper, or preferably, by adding one of these two things to the per-chloride of copper. Colored flames of all the rays of the spectrum can be by this means obtained, either by varying the proportion of chlorine or chloride, or by varying the temperature, and the results will be the same. If, for example, there is placed in pure alcohol a salt of copper, to which hydro-chloric acid is gradually added, there will be produced at first a yellow flame, and all the other colors as far as violet will be successively obtained. If, instead of a salt of copper, there be taken some neutral per-chloride of copper, there will be produced at first a yellow flame, and afterwards a green; but there will be no blue flame, except by adding hydro-chloric acid, and by increasing the quantity of the above acid the violet will be attained; at last, a red flame will be produced by the largest quantity that can be added without extinguishing the alcohol. Now, if I take some neutral deutochloride of copper, (dry) and expose it on a sheet of platinum to the flame of a spirit lamp, — the alcohol quite pure, — I shall produce successively colored flames from the yellow to the red, which latter is produced by the strongest heat that I can obtain. But, having thought that with a higher temperature I could perhaps obtain an orange colored flame, I made use of a Gaudin lamp with a current of oxygen, and by that means obtained on a sheet of platinum, not only a red flame, but a very fine orange colored flame, from the high temperature that I was able to obtain — a result that I had foreseen. (A strong eolipile lamp may be used for this experiment.)

If I take the same deutochloride of copper and throw it into a very fierce fire, such as one composed of pit coal and wood, there will be produced, almost simultaneously, flames of all the colors of the spectrum, according to the strength of the fire: and if only indigo, violet, red, and orange colored flames are required to be produced, we have only to add to the per-chloride of copper some hydro-chloric acid, or some chloride of magnesium, in a rather large quantity. In this case there will be produced jets of red flame in certain parts of the fire, which will be as bright as those produced by strontium; but in this last case, there will be scarcely any green flames, and still less yellow. These two latter will be only produced towards the end of combustion, or in the less heated parts of the fire; and if there is a sufficiently powerful heat, there will be produced an orange colored flame. It is evident that to obtain in a fire flames of all the colors of the spectrum, it is necessary to take a chloride of copper which contains only the quantity of chlorine suitable for producing only a green flame by burning some alcohol, and I will observe that this ray becomes the middle of the solar spectrum, and that it is the same in producing all the colors by light; for it will be recollected that I have said that there should be taken in this case the quantity of chlorine or chloride that preferably produced the yellow and green rays. Then all the colors will be produced, according to the luminous strength of each ray, as the variation of heat produces flames of different colors. The intensity of the heat may be (as has been seen,) recruited by a greater or smaller quantity of chlorine; and with the same quantity of chlorine, the heat may produce the yellow flame, being the minimum, and the orange, the maximum. In like manner it is observable that the smallest quantity of chlorine produces the yellow ray by the light, and the greatest quantity the orange ray; or in other words, with a given quantity of chlorine, the light will develop all the colors, according to the intensity of the luminous rays.

To sum up, the chlorine, alone, produces only flames of a weak color compared with those produced by a chloride of copper; and it is the same with the helio-chromatic colors, that is to say, those produced by the light on a sensitive plate. It is therefore very remarkable that the same relations exist between colored flames and images colored by the light, since, according to the quantity of chlorine that I place in my bath to prepare a silver plate, I obtain one or the other predominant color. The others will be scarcely observable; only one, or at the most, two, will have any strength. I have found only two metals that afford flames of different colors when combined with chlorine; they are copper and nickel. This last, however, gives colors by no means vivid, compared with those of copper. I have not been able to get a change of color from the chloride of strontium, the chloride of sodium, the bi-chloride of potassium and uranium, or bromic acid, by increasing the quantity of chloride or the intensity of the heat. It may be said that this theory on the obtaining of colored images by the light differs from that which I gave in my first memoir; yet it is clear that the basis is still the same, and that what I attributed to the color given to the flame by the base of the chloride added to the substance in combustion, was true only in regard to the quantity of chlorine or chloride that I employed to form the bath in which I prepared the silver plate.

COLORS MOST FREQUENTLY HIT DURING BATTLE.

It would appear, from numerous observations, that soldiers are hit during battle according to the color of their dress, in the following order: — Red is the most fatal color; the least fatal, Austrian grey. The proportions are, Red 12; Rifle Green 7; Brown 6; Austrian Bluish-Grey 5. — *Jameson's Journal.*

ACCOUNT OF A ROCK CRYSTAL LENS AND DECOMPOSED GLASS FOUND IN NINEVAH.

Sir David Brewster at the last meeting of the British Association, said that he had to bring before the meeting, an object of so incredible a nature that nothing short of the strongest evidence was necessary to render the statement at all probable: — it was no less than the finding in the treasure house at Ninevah of a rock crystal lens, where it had for centuries lain entombed in the ruins of that once magnificent city. It was found in company with several bronzes and other objects of value. He had examined the lens with the greatest care and taken its several measurements. It was not entirely circular in its aperture, being 1 6-10ths inches in its longer diameter and 1 4-10ths inches in its shorter. Its general form was that of a planoconcave lens, the plane side having been formed of one of the original faces of the six-sided crystal of quartz, as he had ascertained by its action on polarized light, — this was badly polished and scratched. The convex face of the lens had not been ground in a dish-shaped tool in the manner in which lenses are now formed, but was shaped on a lapidary's wheel, or in some such manner. Hence it was unequally thick, but its extreme thickness was 2-10ths of an inch, its focal length being 4½ inches. It had twelve remains of cavities which had originally contained liquids or condensed gases; but ten of those had been opened probably in the rough handling which it received in the act of being ground; most of them therefore had discharged their gaseous contents. Sir David concluded by assigning reasons why this could not be looked on as an ornament, but a true optical lens.

Sir David then exhibited specimens of the decomposed glass found in the same ruins. The surface of this was covered with iridescent spots more brilliant in their colors than Peacock copper ore. Sir David stated that he had several years since explained how this process of decomposition proceeded, on the occasion of having found a piece of decomposed glass at St. Leonard's. It had contained manganese, which had separated from the silex of the glass, at central spots round which circles of most minute crystals of true quartz had arranged themselves; bounded by irregular jagged circles of manganese, these being arranged in several concentric rings. When this process reached a certain depth in the glass it spread off laterally, dividing the glass into very thin layers, and new centres seemed to form at certain distances, and thus the process extended.

RECENT INVESTIGATIONS ON HEAT.

The theory of Heat has made great advances within the last ten years. Mr. Joule has by his experiments confirmed and illustrated the views demonstrated about the end of the last century by Davy and Rumford regarding the nature of heat, which are now beginning to find general acceptance. He has determined with much accuracy the numerical relation between quantities of heat and of mechanical work. He has pointed out the true principles upon which the mechanical value of any chemical change is to be estimated, and by very careful experiments he has arrived at numerical expressions for the mechanical equivalents in some of the most important cases of chemical action, in galvanic batteries, and in combustion. These researches appear to be laying the ground work for the ultimate formation of a *Mechanical Theory of Chemistry*, by ascertaining experimentally the mechanical equivalents expressed in absolute motive force of the thermic, electric, and magnetic forces. Mathematical developments of the theories of heat and electro-dynamics, in accordance with these principles, are given in various papers by MM. Helmholz, Rankine, Clausius, and Thompson, published principally within the last two years.

Mr. Hopkins, F. R. S., is at present engaged in investigating the possible influence of high pressure on the temperature at which substances in a state of fusion solidify — an inquiry which was shown by Mr. H., in a report recently presented to the British Association, to have an important bearing on the questions of the original and present state of the interior of the earth. It is well known that the temperature of the earth increases as we descend, and it has been calculated that at the rate at which the increase takes place in such depths as are accessible to us, the heat at a depth of 80 or 100 miles would be such as to fuse most of the materials which form the solid crust of the globe. On the hypothesis of original fluidity, and assuming that the rate of increase known to us by observation continues farther down, and is not counter-balanced by a considerable increase in the temperature of fusion occasioned by pressure, the present state of the earth would be that of a solid crust of 80 or 100 miles in thickness enveloping a fluid nucleus. Mr. Hopkins considers this state to be inconsistent with the observed amount of the precession of the equinoxes, and infers that if the temperature of fusion be not increased considerably by pressure, the hypothesis of internal high temperature being due to primitive heat cannot be correct; whilst, on the other hand, if the temperature of fusion be considerably heightened by pressure, he considers the conclusion to be unavoidable, that the earth must be solid at the centre.

Mr. Hopkins is assisted in these experiments, which are carried on at Manchester, by the well-known engineering knowledge of Mr. Fairbairn, and the equally well-known experimental skill of Mr. Joule. The principal difficulties attending the experiments with substances of low temperatures of fusion have been overcome, and strong hopes are entertained of success with substances of more difficult fusibility. The pressures employed are from three to four tons to eight and ten tons on the square inch The latter is probably equal to the pressure at several miles beneath the earth's surface.

HEAT OF THE SUN.

M. Secchi, of Rome, has made a series of photometric experiments on the disc of the sun, by means of a thermo-electric pile. He has found that the heat of the borders of the disc is nearly half that of the centre, which confirms, as regards radiation of heat, what was already known for light and chemical action. But he observed further, that the heat was not the same at all points equi-distant from the centre; and that the place of maximum temperature was 3′ above the centre; the isothermal curves were a species of parabola. The sun's surface differs in temperature not only because of the absorption due to its atmosphere, but also from certain inherent differences in the surface itself. But M. Secchi also remarks that at the time of the observations, the 20th, 21st, and 23d of March, the solar equator was raised about 2.6′ above the centre, and hence the inferior part of the disc presented the south pole of the sun, while the north pole was concealed; and, moreover, the ascertained point of its greatest heat lies in the equator. The conclusion therefore follows that the equatorial regions of the sun are hotter than the polar. M. Secchi's observations did not extend to the spots of the sun; yet in a few trials they were found to produce a sensible diminution of temperature. He says that the prevalence of the spots about the equatorial region corresponds well with the view that this part is the hottest in the sun.

NEW MODE OF MEASURING HIGH TEMPERATURES.

The pyrometers of Wedgewood and Daniell, have both been found inapplicable to measure readily the high temperatures of furnaces and melted metals, as they are not easily obtained. A very ingenious method of doing this, and within the means of every one, has been proposed by Mr. John Wilson. According to his plan, a given weight of platinum is exposed for a few minutes to the fire, the temperature of which is required to be measured, and then plunged into water of a determined weight and temperature. The number of degrees of heat, measured by a small thermometer in the liquid, thus communicated by the heated platinum to the liquid, becomes the index to the actual temperature of the fire.

In practice, the quantity of water by weight may be just double that of the platinum, and the amount of heat indicated in this case for each degree that the temperature of the water is raised, is readily found by direct experiment, and when once found, we have the constant value of 1° of this pyrometer. The weight of water being to that of the platinum as 2 to 1, each degree will equal $31\frac{1}{4}$° Fahr.

To obtain accurate results, one must allow for the heat absorbed by—

1st. The mercury of the thermometer in the water.
2d. The glass bulb and stem of the thermometer.
3d. The vessel containing the water.
4th. The heat retained by the piece of platinum.

The portion of total heat absorbed by the several bodies compared to the portion received by the water will be in proportion to their several weights and the specific heat of each compared with water. If the platinum weigh 1,000 grains, the tinned iron vessel, 3 inches diameter and 2 inches deep, 658 grains, the mercury in the thermometer 200 grains, and the glass bulb and stem immersed 35 grains, then, since the platinum compared with an equal weight of water will only have to absorb 1-32 part of the actual heat that water will, in order that both may exhibit the same temperature, iron only 1-9, mercury 1-30, and glass 1-6, the correction is thus obtained:

								Equivalent grains of water.
Platinum	1,000	grains	×	1-32	specific	heat	=	31
Iron	658	"	×	1-9	"	"	=	73
Mercury	200	"	×	1-30	"	"	=	7
Glass	35	"	×	1-6	"	"	=	6
Total,								117

Therefore, the effect of these bodies is equivalent to the addition of 117 grains to the 2,000 grains of water, and 1-17 must be added as a correction to all temperatures obtained by the instrument; in other words, the value of a degree will be increased from 31¼° to 33° Fahr. A piece of fire clay may be substituted for the platinum, and a direct experiment, either with this, or the platinum, will give the value of a degree. The author found that a piece of Stourbridge clay, 200 grains weight, plunged in melted silver, and then into the tinned vessel containing 2,000 grains of water, raised the temperature of the water 41°.

Now if 1,890° Fahr., the melting point of silver, be divided by 41°, we obtain 56° as the equivalent to 1° of this pyrometer.

In measuring temperature by means of platinum, it must not be plunged into melted metals, as it readily alloys even with melted lead, it must be put in the fire, or the clay employed instead.

In practice it will be found best to determine at once the value of a degree in the manner we have described, viz: by submitting the piece of metal, or clay, to some heat already known, and then observing how much the temperature of the water is raised; always employing the same vessel, and using the same thermometer.—*Brewster's Journal.*

MELLONI ON DEW.

We copy the following observations on dew, from the recently published memoir of M. Melloni.

Dew is not an immediate effect of the cooling produced by the nocturnal radiation of vegetables on the vapor of the atmosphere, as most treatises on physics and meteorology assume, but the result of a series of actions and reactions between the cold due to the radiation of plants, and the cold transmitted to the surrounding air. The grass is cooled but little below the temperature of the air, but it very quickly communicates to it a portion of the acquired cold; and since the difference of temperature between the radiating body and the surrounding medium is independent of the absolute value of the prevailing temperature, the grass surrounded by a colder air still further lowers its temperature, and communicates a new degree of cold to the air, which reacts in its turn, on the grass, and compels it to acquire a temperature still lower, and so on in succession. Meanwhile the medium loses its state of equilibrium, and acquires a sort of vertical circulation, in consequence of the descending motion of the portions condensed by the cold of the upper foliage, and the ascending motion of the portions which have touched the surface of the earth. Now, the gradual cooling and the contact of the soil evidently tend to augment the humidity of the stratum, and thus bring it by degrees towards the point of saturation. Then, the feeble degree of cold produced directly by the radiation of bodies, suffices to condense the vapor contained in the air which surrounds them; and since the causes which give rise to the circulating movement, and to the humidity of the air, continue through the whole of the night, the quantity of water deposited on the leaves increases indefinitely.

The greatest part of the nocturnal cooling is due to the development of the leaves, which present to the sky an immense number of thin bodies having large surfaces, and almost completely isolated; this is the reason why the dews are so feeble in winter, and less copious in the nights of the early parts of spring, than in the long nights of autumn. Dew is more abundant in autumn, because the days being then warmer than in spring, and the vapor increasing more rapidly than the temperature, the same degree of cold (such as the invariable depression of the temperature of plants below that of the atmosphere) condenses a greater quantity of vapor. The slightest breath of wind disturbs the circulation of the lower stratum, and necessarily diminishes the accumulation of dew. A strong wind impedes the formation, by bringing fresh supplies of heat, and especially by renewing incessantly the stratum of air comprised between the summit of the plants and the surface of the earth, and thus taking away from it the possibility of gradually acquiring that high degree of humidity necessary to the precipitation of the vapor, by reason of the small degree of cold which the plants contract with regard to the surrounding medium.

The differences of the quantity of dew on different substances all arise, either from their difference of emissive power, or from the diversity of their situation, with regard to the heavenly vault, or from the hygrometric condition of the surrounding space, or from the greater or less obstacles which retard the descent of the air, and thus more or less favor its frigorific reaction; or lastly, from the proximity of the soil, which permits the return of the air on the radiating substances, and gives rise to that aerial circulation, whence results the gradual cooling and successive augmentation of humidity in the lower stratum of the atmosphere.

Copiousness of Dew in Tropical Countries. — Laying aside everything depending on the alternations of the seasons in our temperate climates, and on the differences of vegetation in countries situated in the same latitude, it is easy to convince ourselves, that the greatest difference between the temperature of the day and that of the night, will occur under the torrid zone, and that there also, the dews will, in general, be more abundant than in any other part of the globe. In fact, in cold and temperate countries, the two principal elements of nocturnal radiation proceed (so to speak) in opposite directions; since the night is long when the earth is destitute of vegetation, and short when the plants are richly clothed with foliage. But, under the equator, vegetation never fails — the night is always long, and almost entirely without twilight; and in the neighboring countries forming the torrid zone, properly so called, when the night time slightly exceeds the period of daylight, the rain falls in torrents, and plants are more richly clothed with leaves, than at any other season of the year. The greatest difference, then, between the temperature of the days and that of calm, clear nights, will occur in the equatorial regions, a short time after the rainy season; and as there will then prevail in the atmosphere a high degree of humidity, the dew itself will be very abundant at this season. On the other hand, since the torrid zone possesses the highest known atmospheric temperature, the nocturnal cooling ought to precipitate there a larger quantity of water than in any other country, by reason of the divergence above mentioned between the progression of the vapor and that of the temperature. In fact, the dews are so copious in the equatorial regions, that Humboldt does not hesitate to compare their effects with those of rain itself.

Want of Dew in Polynesia. — A curious fact, and one not much known, which seems at first sight to contradict what we have been saying, is the extreme feebleness, or absolute non-existence of dew, in that extensive assemblage of small islands in the torrid zone, generally fertile, and more or less rich in plants, which geographers have denominated Polynesia. But with little attention it will be seen that this apparent anomaly affords one of the most striking confirmations of the truth of the theoretical views unfolded in this memoir. In fact, whatever may be the humidity of these small islands, scattered here and there in the vast ocean, and their tendency to the cooling produced by the long nights and the luxurious vegetation, the small extent of their territories renders the atmospheric column superincumbent on each of them easily permeable even to its centre by the air of the surrounding sea. This invasion is, moveover, favored by the trade winds which prevail constantly in those latitudes. Now, we know that the air in the midst of vast seas preserves a nearly uniform temperature. The stratum of air cooled by the contact of the soil, will then be warmed by mixing with the air which is constantly reaching it from the sea, and the difference between the temperatures of the day and night being extremely small, dew can scarcely be formed at all, or at any rate, in very small quantity.

Perfectly analogous causes prevent the formation of dew on ships which traverse the vast solitudes of the ocean. But what is truly singular, is the appearance of the phenomena, on board these same ships, on arriving afterwards in the neighborhood of *terra firma*. Thus the navigators who proceed from the Straits of Sunda, to the Coromandel Coast, know that they are near the end of their voyage when they perceive the ropes, sails, and other objects placed on the deck, become moistened with dew during the night. The reason of this strange phenomena will be readily seen, if we start from the fact, (well established by experience,) that in the equatorial regions, the sea air preserves not only a nearly constant temperature by day and night, but also an hygrometric state, considerably removed from the point of saturation; and that the reverse is the case with regard to the air on land, which, in the day-time, is drier than the air of the sea, but which, in the night, may readily acquire in countries sufficiently abounding in water, or near enough to the coast, a much greater humidity, in consequence of the frigorific actions and reactions of which we have before spoken. Now, the land wind, which always blows by night on the borders of tropical countries, when the sky is clear, transports the humid air to a certain distance out at sea. Then, the feeble degree of cold acquired by substances freely exposed on the deck, totally unable as it is to condense the vapor of the sea atmosphere, is nevertheless sufficient for that of the air which has been in nocturnal contact with the soil.

Dew becomes more abundant as we approach the equator. — We conclude that dew, feeble or non-existent towards the poles, by reason of the extreme brevity of the summer nights, becomee more and more abundant as we approach the equator; that, notwithstanding the general course of the phenomena is very much modified by the extent, the nature, and the position of the land, according as it is more or less surrounded by the sea, more or less covered by mountains, lakes, meadows, marshes, and running streams. The borders of Egypt, of the Red Sea, of the Persian Gulf, of Chili, and of Bengal, are celebrated for the richness of their dews; the deserts of Central Africa, and the interior provinces of Bahia, Brazil, and Persia, by the almost total absence of this nocturnal phenomenon.

The appearance of dew may serve in certain cases to make known the proximity of a mass of water concealed from the eye of the observer. — Thus, the dew which is almost completely wanting in certain sterile valleys traversed by the Euphrates, becomes of sufficient intensity to form visible drops of waters, whilst at a distance of some miles from the borders of this river, concealed by the land. And Mr. Denham says, that independently of the suffocating heat, and of the intense cold that he endured during the night, in his memorable journey across the Sahara, he also suffered from the extreme dryness of the air, until he reached a certain distance from Lake Tchad, where, though there was not the slightest appearance of water on any part of the horizon, the dews began to appear, feeble at first, then more and more copious, and so abundant on arriving near the banks of this great African lake, that the clothes of those persons who remained some time outside the tents were completely soaked with it.

With regard to the intense cold experienced by Denham, during the night in the desert, it is occasioned (in my opinion) neither by the extreme clearness of the sky, nor by an excess of cutaneous perspiration, but from the great nocturnal calm of this desolate region, which allows the soil to act strongly on the air, and to receive, with equal force, the reaction of that fluid. Observe, first, that a dry, flat, monotonous, horizontal, and uniformly extended country, like this immense plain of Northern Africa, presents no cause capable of disturbing, during the night, the equilibrium of the air; so that this must remain in a state of absolute rest some time after the setting of the sun; the soil of the desert being, moreover, composed of dry, sandy earths, of bad conducting quality, can receive from the interior but a very poor compensation in exchange for the heat it has lost. The solid body radiating by night towards space and the surrounding medium, will therefore be unmoving and isolated, and thus be in highly favorable conditions for reacting with energy on each other, and considerably lowering their temperature.

Another phenomenon resulting from the combination of the two frigorific actions, successively excited in the radiating body, and the medium which envelopes it, is the congealation of water, produced artificially in Bengal, during the calm and clear nights. And it is also in consequence of these same frigorific actions that the buds of plants, and the shallow waters of ditches and ponds, scattered here and there over the country, often freeze during the calm, clear nights of spring, whilst the thermometer marks several degrees higher than the freezing point.

ON THE CAUSES OF THE EXCESS OF THE MEAN TEMPERATURE OF RIVERS ABOVE THAT OF THE ATMOSPHERE.

Mr. Rankine, at the Belfast meeting of the British Association, stated: M. Renou having for four years observed the temperature of the river Loire, at Vendome, as compared with that of the atmosphere, has found that the mean temperature of the river invariably exceeds that of the air, by an amount varying from $1\frac{1}{3}°$ to 3° Centigrade, and averaging 2.24° Centigrade, and a similar result has been deduced from observations made by M. Valin on the Loire at Tours. M. Renou and M. Babinet account for this fact by the re-radiation from the bed of the river of solar heat previously absorbed by it. Mr. Rankine thinks this supposition inadequate to account for the facts; because the excess of temperature of the river over the air was considerably above its mean amount in November, and very near its maximum in December; and because the mean diurnal variation of temperature of the river was much less than that of the air. He considers that friction is more probably the principal cause of this elevation of temperature; for if water descends in a uniform channel, with a uniform velocity, from a higher level to a lower, the whole power due to its descent is expended in overcoming friction; that is to say, is converted into heat, as the experiments of Mr. Joule have proved. This must cause an elevation of temperature, which will go on until the loss of heat by radiation, conduction, and evaporation, balances the gain by friction, and at this point the temperature of the river will remain stationary.

ON THE REFRACTION OF SOUND.

The unequal rapidity of the propagation of sound in different mediums, enables us to show the refraction of the sonorous undulations when it passes from one medium to another. The existence of such a refraction, though placed beyond doubt by the theoretical researches of Poisson and Green, was never shown by direct experiment before the investigations of M. Sondhauss. Upon examining the action of a lens upon sonorous waves, M. Sondhauss verified the existence of this refraction. As solid lenses were not suitable for the experiment, he was led to prepare gaseous ones, by filling a membranous envelope in the form of a sphere, or lenticular shaped, with gas. At first he prepared a globe of gold-beater's skin, about one foot diameter, filled with carbonic acid; this globe was suspended about one foot distance from a common watch; on placing the ear upon the opposite side it was found that a focus existed where the intensity of the sound was much more remarkable than elsewhere, but he was not able to obtain definite results.

In a second experiment the globe of gold-beater's skin was replaced by a lens, made of very thin letter paper, it answered no better, and the author abandoned, for a time, his researches. The discovery of collodion, (a solution of gun cotton in ether, which leaves in evaporation a very thin, strong, and transparent pellicle, which can be readily separated from the surface on which it is deposited,) determined him to undertake new experiments. On cutting from a very large globe of collodion, two equal segments which were fixed at their bases upon an iron hoop, he fashioned a sort of lens; or, rather, it was made for him by M. Mullen, of Breslau, so that the interior could be filled with any gas. The iron ring was 307 millimeters in diameter, and 61 millimeters in width; one of the two segments of collodion had a height of 60 millimeters when the apparatus was filled with gas, the other 57.5 millimeters.

The experiment was made by placing a watch at a certain distance from the lens in the direction of its axis, and observing on the other side the place where the tick was heard with the greatest intensity. It was easy to perceive the tick very distinctly, when the ear was placed in the axis, though it was scarcely perceptible when it was removed. In another experiment the ear being located in a position for hearing plainly, the lens was removed, the ticking ceased entirely; upon replacing the lens it was again heard distinctly.

To prevent illusion, the eyes of the observer were closed in such a manner as not to perceive when the lens was removed or replaced. In fine, it was observed that the point where the ticking ceased to be perceptable in the direction of the axis of the lens became more and more distant as the watch was brought nearer, though it was impossible to assign with precision the point where the intensity was a maximum, and consequently to verify the formulæ relative to the foci of lenses.

These experiments were not only made by M. Sondhauss, but by other persons accustomed to observe; MM. Bunsen, Kuchof, and others, who obtained the same results. Besides, to remove all doubts, M. Sondhauss sought to verify these results, without the aid of the ear, which he accomplished in the following manner: — Instead of the watch the sonorous body employed, was the mouth piece of a flute or flageolet, and the vibrations of the air through the lens were observed by means of a membrane stretched at the end of a kind of acoustic cornet. The undulations arriving at the opening, were thrown upon the membrane and were rendered apparent by the movement of a small quantity of fine sand sprinkled upon its surface. In this way the phenomena were observed very distinctly.

He was able, in short, by means of the lens of carbonic acid, to make an experiment analagous to that of the conjugate mirrors. Two persons placed on opposite sides of the lens, were enabled to hold a conversation in a low whisper, which those standing about could not hear.

MONOCLAVE OR UNI-TOUCH.

Such is the name of a very ingenious but complicated instrument invented by Mr. Acklin. Its object is to enable any person to play on the piano, organ or accordion by making a band of paper pass, with a velocity regulated by the time of the tune, across the instrument. This paper is pierced with holes corresponding to the notes, and is prepared by means of a peculiar machine, by simply playing the tune once on the piano. The inventor indicates many other useful applications of this instrument: that it may be worked with the foot, so that a good player may play on two pianos at the same time.

UNIVERSAL MUSICAL LANGUAGE AND ACOUSTIC TELEGRAPHING.

A system of universal musical language and acoustic telegraphing has recently been brought forward by M. Sudre in France and England. The principle of the universal language is the expression of ideas by the seven musical notes, do, re, mi, fa, sol, la, si, played on any instrument, or spoken, or written, or indicated by signs. By representing the notes on parts of the fingers, the deaf and dumb can communicate by the same method. Since the time of Leibnitz, who proposed the adoption of universal characters to be used for all sciences, as algebraic notation is for mathematics, the subject has received much notice from learned men. Previous to that, George Dalgairns, a Scotchman, and Bishop Wilkins, one of the originators of the Royal Society, had proposed a philosophical language. But the difficulties of the scheme have hitherto proved insurmountable. M. Sudre's ingenious and pleasant system has obtained high encomium in France, the author having received the crown and medal of the Athenæum of Arts in Paris at the annual meeting in 1845, a commission of the French Institute having also reported favorably of it. M. Sudre represents that two or three months study is sufficient for any one of ordinary ability to have perfect command of the language. The acoustic telegraph is an invention likely to prove of more practical and immediate importance, and has been recommended by special commissions in France, named by the ministers both of War and of Marine. Three sounds, sol, do, sol, are alone used, and with these, either by bugle, drum, or cannon, every signal can be perfectly conveyed. The same notes, represented by three lights, white, red, and green, form a system of night signals superior to any hitherto used.

HUMAN VOICES IMITATING MUSICAL INSTRUMENTS.

A band of singers calling themselves Organophonics have lately made their appearance in London. A critic thus speaks of them:— "The novel announcement of an orchestral performance without instruments drew a considerable audience to this theatre last night. Many, doubtless, went incredulous as to the possibility of so instructing the human voice — flexible as it is — as to imitate, with proximate fidelity, a variety of wind and stringed instruments in harmonious concert; and such persons were not disappointed. It seems that nature will only submit to a certain amount of torture, beyond which she vindicates her rights. This was very much the case last night with the 'Organophonic Band' — a company of twelve German performers, who, without any mechanical aid, executed, by voice, several pieces of music, some of them of no small difficulty. A person, who only heard and did not see what was going on, would certainly say that he listened to music, and to the music of well known instruments, but of such tender stop and weak volume, that he would remark that they were instruments that had lost their wind — in fact, instruments in the last stage of consumption. That these new visitants are ingenious and surprising, that they must have undergone considerable and laborious training, in order to give such wonderful intonation and modulation to the human organ, is an acknowledgement to which they are justly entitled; but as is the case with almost all exhibitions of this kind, from which action and variety are absent, they are not calculated to afford an evening of sustained and continuous amusement.

"The 'Huntsman's Chorus,' from 'Der Freischutz,' with an echo, in imitation of the musical box, was, perhaps, the best executed piece in the entire programme, the echo being wonderfully true. A solo imitative of the piccoli, was likewise admirably done, full of energy and action but necessarily deficient in the sharp piercing tones of that instrument. Both of these performances were encored, though there was a very just and considerate feeling against repetitions from the evident effort and strain which these displays occasioned to the performers. Polkas, marches, waltzes, fantasias were all executed with equal facility, and there seems scarcely an instrument, from the cymbal and drum to the Scotch bagpipes, which they are not capable of imitating with more are less fidelity and exactness. Some of them can imitate three or four instruments almost without a pause."

NEW WIND GUAGE.

Mr. W. C. Buchanan, C. E., of Glasgow, has designed an improved anemometer, or wind guage, the object of which is to remove as far as possible friction from the working parts, by the weight of the vane and tube to which it is attached being removed from the axis on which they turn by means of a float which bears up that weight, and that the axis be reduced to about one-quarter inch in thickness, the under one working at the foot of the apparatus, and the upper one in a hole in the centre of strong iron supports, crossing each other at right angles, and allowing room for the vane to traverse without touching them, the axis to work loosely both above and below. The vessel containing the float to be placed betwixt the vane and the index apparatus, and filled with water or oil. The wind passing down the tube acts upon an inverted vessel in water, and this vessel carries a rod with a pencil, which marks the force of the wind on a cylinder which is moved by clock-work. There is another cylinder which is moved by a connection with a wheel in the upright tube, which gives the direction of the wind; so that the time, force, and direction of the wind are given by the instrument.

HYDROBAROMETER.

A NEW instrument with the above name has been constructed by M. Walferdin, of Paris, for ascertaining the depth and temperature of the sea. M. Walferdin shows that the bulb of an ordinary thermometer, formed by being blown on the extremity of a tube, is compressible between the finger and thumb so far as to cause the mercury to ascend appreciably, and thät consequently the ordinary arrangement for ascertaining the temperature at depths is faulty. At the artesian well of Grennelle, before the jetting of the waters, six *maxima* thermometers ("thermometers a maxima a deversement" of M. Walferdin) protected from pressure and sunk to a depth of 505 meters, indicated as the mean temperature 26° 43 C. A seventh thermometer at the same time was sunk, unprotected from the pressure, and it indicated 39° 50 C. A pressure of 50.5 atmospheres had thus increased the result by 13.07°, equivalent as the arbitrary scale of the instrument to $\frac{1}{4}$° an atmosphere. This experiment was performed by Arago and M. Walferdin.

It hence follows that a *minima* thermometer, protected from the action of pressure, will indicate the true temperature of depth; while a *maxima* inverting thermometer exposed to the pressure, and sunk with the other, may indicate the pressure of the sea. Such is the principle upon which M. Walferdin constructs his new instrument which he calls a *hydrobarometer*.

The best means of avoiding the effects of pressure on a thermometer, according to careful trials, is by enclosing the instrument in tubes of glass, more or less thick according to the pressure they will have to endure, and hermetically sealing the tubes.

MEAN DENSITY OF THE EARTH.

REICH has published the results of a second series of experiments on the mean density of the earth, undertaken principally with a view of determining the cause of the difference between his own previous results and those of Baily. (It will be remembered that Cavendish found 5.48, Reich 5.45, Baily 5.66.) Three series of experiments, making in all 70 single determinations, were made. The first gave as mean 5.5712 with a probable error of 0.0113, the second gave 5.6173 with a probable error of 0.0181, the third gave 5.5910 with a probable error of 0.0149. The general result of these three series is 5.5832 with a probable error of 0.0149. The third series was made with a bifilar suspension wire, but the results did not correspond better than those obtained by the single wire. To determine whether magnetic or diamagnetic action interfered with the results, two series of experiments were made, one with a magnetic sphere of iron, the other with a diamagnetic sphere of bismuth. The sphere of iron gave 5.6887 with a probable error of 0.0312; the sphere of bismuth gave 5.5266 with a probable error of 0.0402. It would appear probable that the magnetism of the iron exerted some influence, but none could be attributed reasonably to the diamagnetism of the bismuth. — *Pogg. Ann.*, lxxxv.

ON THE RE-CONCENTRATION OF THE MECHANICAL ENERGY OF THE UNIVERSE.

A CURIOUS paper on this subject was read before the British Association by Mr. Rankine, in which he stated that it has long been conjectured, and is now being established by experiment, that all forms of physical energy, whether visible motion, heat, light, magnetism, electricity, chemical action, or other forms not yet understood, are mutually convertible: that the total amount of physical energy in the universe is unchangeable, and varies merely its condition and locality, by conversion from one form to another, or by transference from one portion of matter to another. Prof. W. Thomson has pointed out, that in the present condition of the known world there is a preponderating tendency to the conversion of all the other forms of energy into heat, and to the equable diffusion of all heat; a tendency which seems to lead towards the cessation of all phenomena, except stellar motions. The author of the present paper points out that all heat tends ultimately to assume the radiant form; and that, if the medium which surrounds the stars and transmits radiation between them be supposed to have bounds encircling the visible world, beyond which is empty space, then at these bounds the radiant heat will be totally reflected, and will ultimately be re-concentrated into foci; at one of which if an extinct star arrives, it will be resolved into its elements, and a store of energy re-produced.

EFFECT OF THE EARTH'S ROTATION ON LOCOMOTION.

MR. CLARKE in the London Mechanic's Magazine calls attention to the remarkable influence of the earth's rotation on locomotion. It is well known that as the earth revolves on its axis once in twenty-four hours, from west to east, the velocity of any point on its surface is greater nearer the equator and less farther from it in the ratio of the cosine of the latitude. Mr. Clarke says: — "Some rather important conclusions in relation to railway travelling arise out of the view now taken. The difference between the rotative velocity of the earth in surface motion at London and at Liverpool is about twenty-eight miles per hour; and this amount of lateral movement is to be gained or lost, as respects the locomotive in each journey, according to the direction we are travelling in from one place to the other; and in proportion to the speed will be the pressure against the side of the rails, which, at a high velocity, will give the engine a tendency to climb the right hand rail in each direction. Could the journey be performed in two hours between London and Liverpool, this lateral movement of rotative velocity of the locomotive would have to be increased or diminished at the rate of nearly one-quarter of a mile per minute, and that entirely by side pressure on the rail, which if not sufficient to cause the engine to leave the line, would be quite sufficient to produce violent and dangerous oscillation. It may be observed, in conclusion, that as the cause above alluded to will be inoperative while we travel along the parallels of latitude, it clearly follows that a higher degree of speed may he attained with safety on a railway running east and west, than on one which runs north and south."

VISIBLE ROTATION OF THE EARTH.

M. FOUCAULT, the originator of the ingenious pendulum experiment, for affording ocular proof of the rotation of the earth upon its axis, has recently presented to the French Academy an account of another method for establishing his theory, which is reported in the Journal des Debats for October, 1852. M. Foucault says: —

"Nobody now questions the apparent deviation of the pendulum, and few hesitate to regard that deviation as a demonstration of the earth's rotation. But, when we try to explain the experiment, difficulties arise in the minds of many persons who cannot comprehend how it is that the plane of oscillation is said to be fixed. Since the point of attachment travels with the earth's surface, since a line drawn perpendicularly to the horizon of the place of operation must change its inclination in space every moment, how can the plane of oscillation remain fixed, or even preserve its original direction? Here is the stumbling-block of all who, without taking into account the decomposition of the movements of rotation, confidently advance into the domain of mechanical science, relying only on the illuminations of common sense. The error of such persons arises from their taking as an absolute fact that fixity of the plane of oscillation which is only a fact relatively to the vertical line of the place of operation.

"But if in the experiment we substitute for the plane of vibration of the pendulum, the plane of rotation of a body freely suspended by its centre of gravity, we rid ourselves of this embarrassing relative fixity of plane, and have only to consider a plane physically defined, which really enjoys an absolute fixity of direction. If, at the moment of putting it in rotation, the axis of this body points to a given star in the sky, then during the whole time of the rotation the axis will continue to point towards the same point of the firmament, and this in virtue of the inertia of matter; or, for this simple reason, that it is unable to displace itself, or, so to speak, incapable of *un-east-ering* itself alone. If, then, we select a star, or if we fix upon one of those points in the heavens which seem to have the swiftest movement, the axis of rotation of our freely suspended body, when attentively examined, will be seen to share the same apparent displacement, and so will give a manifest sign of the movement of the earth. To obtain this effect in the highest perfection, we should give to our axis of rotation a perpendicular direction, and we should be very careful not to select the pole-star as our point of direction; for, as that star has no apparent motion, one instrument would 'refuse to exhibit.' To verify the earth's rotation by the aid of such an instrument is equally possible at the poles and at the equator. The only necessary condition to this experiment is, that we shall support the revolving body by its centre of gravity, without imposing upon it any bond attaching it to the earth, so that it shall be as it were more free than a planet, a kind of isolated little globe lost in space and disengaged from all perturbatory action.

"But who, we may ask, will undertake to furnish us with the means of fulfilling this solitary condition? The question might have gone unanswered, had not that incomparable artificer, M. Froment, come to our rescue. 'Mount,' we said to him, 'mount upon a steel axis a crown of bronze, in such wise that it may turn swiftly within a circle, which shall rest, by means of blades of steel, upon a second exterior circle; which again shall be itself suspended in the air, by means of a thread, without torsion. Arm the whole system with screw-balance weights, in order to secure a perfect equilibrium; and then, if the earth really does turn, we shall see it with our microscopes.' After eight months of steady application, M. Froment has furnished us with an instrument so perfect that the massive pieces which compose it move upon each other at the faintest breath. This admirable mobility, however, disappears as soon as the bronze crown begins to revolve; for then, in virtue of the fixity of the plane of rotation, the whole system consolidates itself with surprising force. When in this condition, the revolving body ceases to take part in the earth's diurnal motion; and, although the steel axis, in consequence of its shortness, seems to preserve its primary direction relatively to terrestrial objects, we have only to bring the microscope to bear upon it, in order to discover an apparent uniform and continuous movement, which causes it to follow exactly the movement of the celestial sphere. Thus, with a deviation of a new kind, we obtain a new proof of the earth's rotation; and this with an instrument of no great size, and easy of transportation, — an instrument, too, which offers us an image of the continuous movement of the globe itself. In the case of the pendulum, you have before you only the progressive displacement of an ideal plane, more or less well defined by the curve described by an oscillating mass. But, in our new instrument, you have material masses really withdrawn from the influence of the diurnal motion, and which return under the general law only in consequence of the decay in the velocity of the moving body."

M. Foucault now goes on to describe another set of experiments which may be made with this new instrument, the result of which is to make apparent in bodies revolving on the surface of the earth what he calls "a force of orientation," a power, that is, of "taking their bearings," as we may say. These experiments are carried on by sup-pressing the play of one or the other of the articulations, which leave the crown or circular plate of bronze at liberty to move around its centre of gravity. If we stop the play of the blades which represent the horizontal diameter, about which one of the concentric circles moves, the axis of the revolving body is brought down into the horizontal plane, where it may "take its bearings," in the manner of the ordinary declination compass. Supported by the vertical suspension, the body, turning swiftly, shows itself to be solicited by a directing force, which tends to recall its axis into the plane of the meridian, the plane of the pole-star, of the midday sun, of the axis of the earth. And when it has reached its position of equilibrium, the body turns, like the earth, from west to east. Thus we may almost find our meridian without lifting a glance to the heavens. If, on the contrary, we check the suspending thread, we restore the blades to their function, and permit the axis of the revolving body to incline only in some vertical plane arbitrarily chosen. We launch it into motion, and watch the effect. Soon the axis inclines in one direction or in the other; and, when it takes a definite position, we find that the axis points to the poles of the earth, and thus we discover the inclination of the axis of the earth. These facts can be seen without the microscope. After mentioning as a means of verification inherent in the instrument, the artificial acceleration of the compounding efficacy of movement communicated to the instrument through its base by the earth, whereby the phenomena of "orientation" are exaggerated without being altered, M. Foucault goes on to express the general principle, that, when a force, or system of forces, acting upon a revolving body tends to produce a new rotation not parallel to the first, the resulting effect is a progressive displacement of the axis of primary rotation, which directs itself towards the axis of new rotation by a path which tends to make them parallel. "By this principle," he says, "we may equally well explain the precession of the equinoxes, and the pirouettes of a *teetotum* on a parlor table. We account thus for the singular reactions we experience when we agitate with the hand a swiftly revolving body. We may foresee in the motion of a railway train along a curved line, a cause of dislodgement added to the centrifugal force, and which tends to spin off all the wheels driven by so rapid a rotatory motion. We discover, that contrary to the received opinion, the whirligig which, with the help of a mirror, has been thought to furnish an artificial horizon, does not tend exactly towards the vertical position, but leans northward or southward, according as it turns to the right, or left; and that always on a perfectly horizontal surface it must advance slowly to the east, so that really to demonstrate experimentally the motion of the earth, we shall soon only have to choose among a thousand ways of doing so. Meanwhile, thus much is acquired, viz: the apparent deviation of the plane of rotation, and the phenomenon of orientation, which reveal the direction of the earth's axis. As all these facts depend on the earth's rotation, we propose to give this new instrument which has served to establish them, the name *gyroscope*." — *To-Day.*

CHEMICAL SCIENCE.

CHEMICAL COMBINATIONS.

Dr. T. Wood, at the British Association stated, in a paper on the above subject, that he conceived that there was a mutual dependence or relation between the space and the matter which compose a body, such relation causing the distance between the particles to be definite; that, therefore, if the nature of the matter changes, the distance between its particles must also change; that, if two bodies be mixed or brought together, at insensible distances, as in solution, they are no longer two but one body,—and, as they were dissimilar previously to being mixed, the one body they form must be dissimilar from either separately, and so the distance between the particles must be different. It must also be less; for, if greater, the bodies could be brought nearer at sensible than insensible distances, and so could not form one body at all, which is contrary to our supposition. But, as every molecular movement is accompanied by its opposite, this lessening of distance between combining particles is attended with expansion among others, and this expansion is the heat.

MOLECULAR PECULIARITIES OF CERTAIN BODIES.

Dr. Tyndall, at the British Association, Belfast, stated, that drawn by former researches to the contemplation of molecular action, he had commenced a series of inquiries on this subject, the first fruits of which were here laid before the meeting. Organic substances naturally suggest themselves as likely to afford instructive examples of molecular action; for here nature, to attain her especial ends, has arranged her materials in a peculiar manner, which arrangement makes itself manifest when the substance is made the vehicle of a force. Wood was first examined; cubes were cut from a number of trees, four faces of each cube being parallel to the fibre, and consequently two perpendicular to it. Further, two opposite faces were parallel to the ligneous layers and two perpendicular to them. The problem to which Dr. Tyndall addressed himself was as follows: If a source of heat of definite measurable amount be brought close up to the face of the cube required the quantity transmitted through the mass of the cube to the opposite face in a minute of time. This quantity will of course depend upon conductive power of the wood in the given direction. To measure it, a new instrument has been devised by Dr. Tyndall, whose indications are capable of extreme accuracy. This instrument has very little in common with Fourier's thermometer of contact. It is applied to ascertain the velocity of the transmission of heat through either solids or liquids. The mass to be examined is reduced to the cubical form, and the instrument enables us to bring a source of heat of a strictly measurable character against one face of the cube, and to determine the relative quantity transmitted to the opposite face in a given time. By means of this instrument — which the Doctor minutely described — the author examined the conductivity of various bodies. Fifty-seven different kinds of wood have been examined by means of this instrument; the heat travels with a maximum velocity along the fibre, but its flux is not the same in all directions perpendicular to the fibre; it travels with greater speed across the ligneous layers than along them. The complete law of action may be expressed as follows: At all points situate in the centre of growth, wood possesses three unequal axes of calorific conduction, which are at right angles to each other. The first and greatest axis is parallel to the fibre; the second and intermediate axis is perpendicular to the fibre, and also perpendicular to the ligneous layers; while the third and least axis is perpendicular to the fibre and parallel to the layers. Dr. Tyndall further shows that in this single substance there are four systems of axes coinciding with each other. The axes of elasticity, established by Savart, and the axes of calorific conduction, of fluid permeability and of cohesion, established by himself. Wood, in fact, furnishes us with one of the most instructive examples of the influence of molecular aggregation with which we are acquainted. Among crystalline bodies, rock crystal or fine silica is the best conductor. While wood at the end of a minute causes only a deflection of 10° or 12°, a cube of silica of the same size produces a deflection of 90°. This fact accounts for the steadiness of temperature in one-set districts, and the extremes of heat and cold presented by day and night on such sandy wastes as Sahara. The sand, which is for the most part silica, speedily drinks in the noon-day heat, and loses it by night just as speedily. Muscular tissue is an extremely bad conductor; and to this, in a great measure, the constancy of temperature of the human body in various zones is to be attributed. To this fact also Sir Charles Blagden and Chantrey owed their safety in exposing their bodies to a high temperature; owing to the almost impervious character of the tissues of the body the irritation produced was confined to the surface.

ON THE ATOMIC WEIGHTS OF PLATINUM AND BARIUM.

At the British Association, Dr. Andrews read a paper on the above subject. No determination of the atomic weight of platinum having been made since the recent revision of atomic weights, and the number adopted by chemists for that metal resting on the authority of a single experiment of Berzelius, the author considered it of importance on practical as well as theoretical grounds to institute some new experiments on the subject. The salt of platinum selected was the double chloride of potassium and platinum; which, after being dried in vacuo, at a temperature of 105° Centigrade, was decomposed by digestion with metallic zinc and a small quantity of water, the action being assisted by the application of heat towards the end of the process. After the complete precipitation of the platinum and the formation of chloride of zinc from the decomposition of the double salt, the excess of zinc was removed by the addition, first, of acetic, and subsequently, of nitric acid. The precipitated platinum was then removed by means of a small and carefully washed filter, and the amount of chlorine in the solution of chloride of zinc ascertained by Gay Lussac's process, which has been of late so successfully applied by Pelouze to the determination of several other âtomic weights. The double chloride of potassium and platinum was found to retain 55-10,000ths of its weight of moisture, even when dried at a temperature considerably superior to the boiling point of water. In three experiments performed by this process, the numbers obtained were 98.93, 98.84, and 99.06; the mean number 98.94 expresses, therefore, the atomic weight of platinum. For the atomic weight of barium, the author obtained from two closely accordant experiments the number 68.789; and concluded with some general observations as to the importance of a systematic series of experiments to settle, if possible, definitively whether the law of Prout, that the atomic weights of all bodies are multiples of that of hydrogen, be universally true. He concluded by reading an interesting extract from a letter which he had received from Baron Liebig. "It is not certain that Prout's law may not be true for oxyen, nitrogen, and carbon, without its being necessary to assume, as a consequence, that other bodies behave similarly, — that is, that their atomic weight must be exactly multiples by whole numbers of the atomic weight of hydrogen. The law is certainly not true of all bodies, but it may be true of certain groups, whose members, in respect to atomic weight, stand in a simple numerical relation to each other. The atomic weights of silicium, cobalt, strontium, tin, arsenic, and lead, are in the same ratio as the numbers, 1 : 2 : 3 : 4 : 5 : 7. We do not see the necessity of this relation, but only the possibility. Why should fractional numbers only occur, and not whole numbers also? I consider these relations only as facts : the law of the numbers themselves is quite unknown to us, — as unknown as the absolute weights of the atoms."

EARLY EGYPTIAN CHEMISTRY.

The following facts elicited by the recent unrollment of a mummy at Bristol, England, were communicated to the Philosophical Magazine, by Dr. Herapath. He says, "on three of the bandages were hieroglyphical characters of a dark color, as well defined as if written with a modern pen; where the marking fluid had flowed more copiously than the characters required, the texture of the cloth had become decomposed and small holes had resulted. I have no doubt that the bandages were genuine, and had not been disturbed or unfolded: the color of the marks were so similar to those of the present "marking ink," that I was induced to try if they were produced by silver. With the blowpipe I immediately obtained a button of that metal; the fibre of the linen I proved by the microscope, and by chemical re-agents, to be linen; it is therefore certain that the ancient Egyptians were acquainted with the means of dissolving silver, and of applying it as a permanent ink; but what was their solvent? I know of none that would act on the metal and decompose flax fibre but nitric acid, which we have been told was unknown until discovered by the alchemists in the thirteenth century, which was about 2200 years after the date of this mummy, according as its superscription was read.

The yellow color of the fine linen cloths which had not been stained by the embalming materials, I found to be the natural coloring matter of the flax; they therefore did not, if we judge from this specimen, practise bleaching. There were, in some of the bandages near the selvage, some twenty or thirty blue threads; these were dyed by indigo, but the tint was not so deep nor so equal as the work of the modern dyers; the color had been given it in the skein.

"One of the outer bandages was of a reddish color, which dye I found to be vegetable, but could not individualize it; Mr. T. J. Herapath, analyzed it for tin and alumina, but could not find any. The face and internal surfaces of the orbits, had been painted white, which pigment I ascertained to be finely powdered chalk."

CHEMICAL ACTION OF LIGHT.

The following account of experiments on the chemical action of light have been published by J. W. Slater in the Chemical Gazette, Sept., 1852. They were undertaken chiefly in order to examine the law proposed by Grothuss, that substances are most readily de-colorized by rays of light of a color complementary to their own. The solutions used for isolating the different rays were, bichromate of potash for yellow, mixed chlorides of copper and iron for green, ammonio-sulphate of copper for blue, sulphuric tincture of roses for red, and water with a little nitric acid for white. The vessels containing these solutions stood on a shelf about 12 feet from the ground, and had free sunshine through the day. In the first place, five test tubes containing a strong solution of permanganate of potash were placed respectively in the five rays. The order of decomposition was blue, red, white, green, yellow. The two first were nearly colorless on the third day, and on the seventh, when opened and tested, contained no manganese in solution. The white and green were not entirely decomposed till the twenty-second day, and the yellow after eight weeks still contained much permanganic acid. In order to determine what was the effect of free contact with the atmosphere upon actinic decompositions, two tubes containing solution of permanganate, the one sealed, the other open, were fixed in phials of the ammonio-sulphate of copper, and cemented to the necks so as to prevent the escape of ammoniacal fumes. In about eight hours the solution in the sealed tube had become colorless, whilst the other retained a deep red tinge. Peroxide of mercury exposed to blue light in a sealed tube was much blackened in four days, whilst a similar portion in an open tube was not affected. Periodide of mercury (prepared by trituration) in sealed tubes and dry, gave the following order of action — blue, red, white, green, yellow, the action of the two latter rays being hardly perceptible, and possibly due to small portions of blue and red light which had not been absorbed by the solutions. In unsealed vessels the action was rather less rapid. Covered with water, the iodide was not affected by any of the rays. This salt is far more stable than is generally asserted. The sample used in these experiments had been kept for ten years in diffused light without any alteration, and even in the blue ray an exposure of several weeks was required to produce any great effect. Periodide obtained by precipitation seemed rather less stable.

Iodide of starch, perfectly dry, gave the following order: Blue, red, white, yellow, green. The decomposition under the two latter rays was very slow and imperfect. When moist, the iodide was bleached far more rapidly than when dry; more rapidly also in open than in closed tubes. Perchloride of mercury was acted on as follows: — Blue, red, white, green. The yellow ray caused no perceptible formation of protochloride. This substance, under the blue ray, gives false results if not perfectly screened from ammoniacal vapors. Peroxide of mercury gave blue, red, (considerable,) white, green, yellow, (very slight.) Alcoholic tincture of the green coloring matter of leaves was decomposed very rapidly, and almost simultaneously in all the rays; apparent order, white, red, yellow, green, blue. Alcoholic sulphocyanide of iron gave — white, blue, yellow, green, red. To determine whether the actinic decomposition of solutions was in any way influenced by their degree of concentration, seven sealed phials were placed in white light, each containing 40 parts by measure of concentrated aqueous solution of perchloride of mercury. To No. 2 had been previously added 20 volumes of distilled water; No. 3, 40 pts.; No. 4, 80 pts.; No. 5, 120 pts.; No. 6, 160 pts.; No. 7, 330 pts. The decomposition was most rapid in No. 6, then Nos. 5 and 4. The statement that the blue ray deprives salts of their water of crystallization, could not be verified with oxalate of ammonia and ferrocyanide of potassium. Weighed portions of these salts, placed respectively under blue, white and green glasses, were found at the end of a month to have suffered no change in weight. It has been observed by Hunt, that a solution of bichromate of potash gives a greenish yellow precipitate with sulphate of copper in the sunshine. This was found to take place almost equally in all the rays, whether in sealed or open vessels, though a little earlier in the former. The action was found more rapid and more complete in dilute than in concentrated solutions. The latter, after having ceased to deposit, give a further amount of precipitate if diluted. There is a considerable effervescence in the liquid, caused by the escape of oxygen gas. The precipitate is at first of a greenish yellow, but becomes a yellowish brown when dry, and shrinks greatly in bulk. Solutions of sulphate of copper and of bichromate, exposed to the sun, and then mixed in the dark, give the same precipitate; but if prepared in the dark, no perceptible precipitate is obtained, even on long standing. If the mixture is boiled, however, a precipitate appears. If the precipitate formed by the action of the sun is removed and the liquid boiled, a precipitate appears of a redder shade, probably identical with Bensch's chromate of copper. I have not as yet obtained a quantity sufficient for analysis, either of this or of the former precipitate. Whether the electric and hygrometric conditions of the atmosphere exert any influence upon actinic decompositions, I have not been able to determine with certainty.

ON THE APPLICATION OF CERTAIN OPTICAL PHENOMENA TO CHEMISTRY.

Prof. Stokes at the British Association stated that he had found in experimenting on prismatic fringes, and the dark lines of the spectrum, that by the interposition of small portions of chemical substances in solution, and in other cases, as by the beads formed by the blowpipe, optical means would discover the presence of many bodies by their power upon light. Arguing upon the advantage of this auxiliary power to the chemist, he pointed out the facility with which trials could be made. The salts of per-oxide of uranium, for instance, has a property of showing dark lines in a certain portion of the spectrum, and on one occasion he discovered on a blowpipe bead the lines that were usually associated with the presence of uranium; in that instance he had no reason to expect it could be present, and upon careful attention he found that he had used a platina wire that had been employed with experiments where uranium had been present; and a minute quantity must have remained attached to the wire, and thus become evident. He took a single case of difficulty and where doubt still remained, to call the attention of chemists to the value of optical research where ordinary tests did not avail. He found that manganesic acid in solution had a certain power over light, giving dark bands. There was a class of crimson solutions of manganese which some chemists supposed the per-oxide in solution, and others a different oxide; but Mr. Pearsall, had shown the probability that manganesic acid was present: this was a fair case, and accordingly by optical means he decided that manganesic acid was not present. He had considered the effects of acids and bases, but sulphuric acid and potassa made no difference if added to manganesic acid. He considered this a fair case, when no test had been devised to settle the point. Prof.

Stokes showed the effect of cobalt, uranium, solution of chlorophylle, sulphate of quinia, and other substances, and gave this verbal statement of the application of optical researches to abridge chemical labor.

PHOSPHORESCENCE OF BODIES.

Prof. Draper, of New York, has communicated to the Philosophical Magazine, a paper of experimental researches, "On the Phosphoresence of Bodies," whence we obtain the following general conclusions: —

1st. That the methods employed in these experiments are not sufficiently delicate to detect any increase of the dimensions of a phosphorescent while it is in a glowing state.

2d. No structural change can be discovered by resorting to polarized light; but there is reason to believe, from the change of color which certain bodies exhibit when the quality of shining is communicated to them, and from the manner that vapors condense on their surfaces, that such has actually taken place.

3d. That phosphorescence is attended with a minute rise of temperature.

4th. That it is not necessarily connected with any electrical disturbance.

On comparing these conclusions, it is obvious, that if the third be correct, there must necessarily be a change of volume; and that the reason the dilatation is not discovered by direct experiment, is owing to the insufficiency of the means employed.

The general definition given of phosphorescence is, that it is the extrication of light without heat, (Gmelin.) But these results show that such definition is essentially incorrect; for, if the experiment be made with due care, a rise of temperature can be detected, though its absolute amount may be very small.

With respect to the absolute quantity of light emitted by phosphori, Prof. Draper, from an experiment several times repeated, concludes that the intrinsic brilliancy of phosphori is very small; a fine specimen of chlorophane, at its maximum of brightness, yielding a light three thousand times less intense than the flame of a very small oil lamp.

From certain experiments and considerations it is to be inferred, that there is an intimate connection between temperature and phosphorescence, which may be conveniently expressed in the following terms: —

The quantity of light a substance can retain is inversely as its temperature.

Again, this principle leads to the conclusion, that the quantity of light that a body can receive is directly as the intensity and quantity of light to which it has been exposed.

In conclusion, Prof. Draper is led to believe, that all the facts of phosphorescence can be fully explained on the principles of the communication of vibratory motion through the ether; that, as upon that theory, an incandescent body, maintained at incandescence, would eventually compel a cold body in its presence to come up to its own temperature, by making its particles execute movements like those of its own, — so the sunshine, or the flash of an electric spark, compels a vibratory movement in the bodies on which its rays fall; that these movements are interfered with by cohesion in the case of solids, but that they are instantly established and almost as instantly cease in the case of gases and liquids; that reducing the cohesion of a solid, by raising its temperature, permits a resumption of the movement; and that the condition of opacity, either melantic or otherwise, is a bar to the whole phenomenon.

SULPHATE OF IODO-QUININE.

In March last, Dr. Herapath announced the discovery of a beautiful crystalline compound, possessing the optical properties of the tourmaline, and even in a superior degree to this mineral. It also, at certain angles of rotation, would act as selenite, viz., depolarize a ray.

This remarkable body was procured in the following way: — About 10 grains of di-sulphate of quinine (ordinary sulphate of quinine) were dissolved in half a fluid ounce of pure acetic acid, and gently warmed; a spirituous solution of iodine was then cautiously added, a few drops at a time; the whole again gently heated to dissolve the cinnamon-brown precipitate first produced, and the mixture set aside for several hours to crystallize. When these crystals were examined by reflected light, they were found to possess a brilliant emerald-green color, similar to murexide, or the fragments of the elytra of cantharides; but by transmitted light, they were almost colorless and transparent, having a slight olive-green tint only. The forms of these crystals are very various; prismatic plates, parallelopipeds, rhomboidal parallelograms, and hexagonal plates very perfect; but by very careful manipulation and slow crystallization, the author obtained large compound plates composed of many flat prisms, joined edge to edge, and all in the same plane; by which means he was enabled to produce crystals large enough to furnish his microscope with artificial tourmalines, and to perform all the experiments usually exhibited by the polarizing microscope. Upon submitting this substance to chemical analysis, he discovered the fact of its being a compound of iodine, sulphuric acid, and quinine; many experiments prove that all these constituents are absolutely essential to its production, and the removal of either will destroy the compound. These crystals are exceedingly small and delicate, requiring considerable magnifying to show their remarkable optical character. When placed upon the selenite stage, or a thin film of mica, in a beam of polarized light under the microscope, they exhibit the most vivid and beautiful colors. Even without any polarizing apparatus, they serve very well to demonstrate the phenomena of polarization, for when two of the crystals are crossed, at right angles, an intense blackness is produced where they are superimposed; if, however, they overlap, in the direction of their long diameters the light passes through unaltered; when again, a third crystal happens between `two others, at an angle of 45°, it depolarizes the light and appears colored, like a plate of selenite between two tourmaline plates; the color depending upon the thickness. When the solution of disulphate of quinine is strong, and heated so that no precipitate occurs in adding the tincture of iodine, the crystals are formed as soon as the liquid cools, like a bright green film on the surface, and glittering like so many spangles; a few may be removed cautiously with as little of the fluid as possible by means of a loop of thread, and deposited on a glass plate, and if any liquid remains on the plate it must be cautiously removed by touching it with the corner of a bit of bibulous paper; being well dried, the glass may be cautiously warmed, for the crystals dissolve at a low heat, and a small drop of Canada balsam placed upon them, and the thin glass cover in the usual way of mounting microscopic objects. Or a drop of the hot solution may be placed on a cold glass slip and as soon as the crystals have formed sufficiently, the thin glass cover applied so as to exclude bubbles of air, and the edges sealed with the gold size, or other cement.

When the crystals are placed upon a glass slide in an excess of the mother liquid, tufts of radiating sulphate of quinidine are formed below them, these when placed in a beam of polarized light with a film of selenite or mica intervening, furnish a most gorgeous exhibition of colors, varying as the polarizer is turned on its axis, and unsurpassed by anything we have ever witnessed.

By very careful manipulation Dr. Herapath has succeeded in obtaining the crystals sufficiently large to answer instead of the tourmaline plates and Nicols' prism; these are, however, exceeding rare at present, indeed the largest the Dr. has yet produced is only one-fourth of an inch in diameter. Upon submitting these artificial plates to micrometrical measurement, it was found that those which possessed sufficient thickness to adhere together in clusters, and to raise themselves upon their edges so as to exhibit their thickness, were none of them more than 1-300th of an inch, many of them 1-600th or 1-900th of an inch only; but even these were much thicker than any of the broad, thin plates, so readily broken, some of which were successfully mounted; these could not have been more than 1-1000th of an inch; and when it is recollected, that tourmalines, as sold for optical purposes, are generally from 1-100th to 1-50th of an inch, it is at once apparent that this newly discovered salt of the vegetable alkaloid quinine, is the most powerful substance known as a polarizing crystal.

DETECTION OF SODA BY POLARIZED LIGHT.

The double chloride of potassium and platinum, crystallizing in regular octahedrons, exercises, when placed in a dark field of the polariscope, no depolarizing action; and the same remark applies to the bichloride of platinum, in consequence probably of its imperfect crystallization; on the other hand, the chloride of sodium and platinum in thin crystalline plates, is remarkable for its depolarizing power; and a trace of this salt, which is invisible to the naked eye, may be at once detected by the brilliant display of prismatic colors which it exhibits under the action of polarized light. This property may be applied to the detection of soda in the following way:—The other bases having been removed by the ordinary methods, and the alkalies converted into chlorides, a drop of the solution is placed on a glass slide, and a very small quantity of a dilute solution of the bichloride of platinum added, avoiding, as far as possible, an excess of that re-agent. The drop is then evaporated by a gentle heat till it begins to crystallize, and afterwards placed in the field of a microscope furnished with a good polarizing apparatus. On turning the analyser till the field becomes perfectly dark, and excluding carefully the entrance of light laterally, the crystals remain invisible if either potash, or no alkali whatever, be present, while the presence of the slightest trace of soda is at once indicated by the depolarizing action of its platinum compound. With a drop of solution of chloride of sodium weighing 0.0015 grm. and containing 1-10,000th of its weight of chloride of sodium, a very distinct effect was obtained. The quantity of soda thus detected was only 1-13,000,000th of a gramme, or about 1-1,000,000th of a grain.

ELECTRO-CHEMICAL RESEARCHES ON THE PROPERTIES OF ELECTRIFIED BODIES.

Fremy and Becquerel contributed the following paper to the Comptes Rendus, March, 1852.

For several years the attention of chemists and physicists had been directed to the very remarkable modifications which certain bodies present when submitted to the action of a very moderate temperature. We know that, under this influence, sulphur and phosphorus acquire new properties. We propose to investigage whether electricity, like heat, can change the physical and chemical properties of different bodies. We must examine, in the first place, into the singular effects presented by oxygen in various circumstances, and referred to the formation of what has been called *ozone;* this body appears to be produced in all cases in which oxygen is submitted to the influence of electricity. Without wishing to cast doubt upon the sagacity of those who have examined into the properties of ozone, it cannot be denied that there still exists great uncertainty in the minds of chemists and philosophers as to the interpretation of the phenomena observed; we have therefore thought it was important to submit these phenomena to new experiments.

After going over all the experiments made on ozone, mentioning in particular the important researches of Schonbein, Marignac, and De la Rive, we have examined, first, the oxidizing properties of the oxygen procured by the decomposition of water by the galvanic pile; the result of these researches is that the pile cannot be employed to determine the nature of ozone, because the active principle is found only in very small proportion, in the oxygen of the pile. We have, therefore, been obliged to study successively all the methods that can be employed to electrify oxygen. The arc which is formed upon the interruption of the voltaic circuit does not appear to modify the oxygen in the same manner as the ordinary spark, because the elevation of temperature which accompanies it probably destroys that which the electricity might produce; but according to our observations, this arc may determine the combination of gases among themselves, acting thus as spongy platinum and as electricity; under its influence we have combined nitrogen and oxygen directly, to form nitric acid, nitrogen and hydrogen and ammonia, and sulphurous acid and oxygen to form anhydrous sulphuric acid.

Pure oxygen, enclosed in glass tubes, together with a band of starched and iodized paper, was electrified by means of a series of sparks striking the outer surface of the tube; the paper began to become blue after the passage of a few sparks. This colorization depends on electrization of the oxygen, and not on the decomposition of the iodide; for no effect takes place when the iodide is placed in hydrogen, and operated on. This fact, is so much the more remarkable, as the oxygen is electrified without the intervention of metallic wires, and consequently without the presence of particles transported by the electric spark. Oxygen, prepared by the most different modes, acquires a very distinct odor, and strongly marked oxidizing properties when it is subjected to the influence of electricity; these properties are manifested by oxygen as pure as it is possible to obtain. The oxygen thus electrified loses its oxidizing properties when exposed to iodide of potassium, but regains its odor and chemical activity when again electrified; this experiment may be repeated indefinitely on the same gas.

All these facts show that the oxidizing power of electrified oxygen is not due to the presence of a foreign body contained in the gas; when pure and dry oxygen is enclosed in a series of glass tubes and subjected to the action of electric sparks, if after a time we break the extremities of these tubes to ascertain the volume of gas that has become immediately absorbable by alkaline iodide, we shall find that during several hours the modification increases in proportion to the time of electrization, and that afterwards it appears to diminish, probably because the spark destroys that which at first it produces.

The difficulties presented in the preceding experiment induced us to study the deportment of electrified oxygen with certain absorbing bodies, capable of immediately seizing the modified oxygen and of withdrawing this gas from the decomposing action of an excess of electricity; we, therefore, passed a series of electric sparks into small eudiometric tubes full of moist oxygen, and placed either over mercury, or a solution of iodide of potassium, or containing in their interior a moistened leaf of silver; we then saw the oxygen become absorbed in a regular manner by the action of the electric spark, aud in many experiments obtained a complete absorption. Lastly, to get rid of all doubts about the particular activity imparted to oxygen by the electric spark, we wished to verify the preceding experiments in closed tubes. We, therefore, introduced into tubes filled with pure oxygen some iodide of potassium and moistened silver. We submitted these tubes for several days to the action of electricity; the spark, which, during the first days was very brilliant, became paler and paler, and at last almost invisible. At this moment on breaking the tubes, under water, we saw this liquid rush into their interior and fill them completely, thus showing that a vacuum had been produced, and consequently that the oxygen had become completely absorbable without heat, by the silver and iodide of potassium. We must add, that to render these experiments decisive, we had previously ascertained — 1st, that pure water, the surface of glass and the platinum wires conducting the sparks, could not absorb oxygen; 2d, that water is not necessary to develope the activity of oxygen, but to cause the active oxygen to react upon metals or iodide of potassium; 3d, that the electric spark does not decompose the iodide of potassium. We think, therefore, that we have shown, by rigorous experiments, that oxygen under the influence of electricity, can become completely absorbable in the cold by iodide of potassium and several metals, such as mercury and silver. These facts confirm the researches of Schonbein and others, and show that electricity, in acting upon oxygen, developes properties in it which did not exist before its influence; we propose, therefore, simply to give the name *electrified oxygen* to the gas, which having been submitted to the action of electricity acquires a particular state of chemical activity, and to abandon the name ozone, which expresses the idea of the transformation of the oxygen into a new body.

OBSERVATIONS RELATIVE TO THE ELECTRO-CHEMICAL PROPERTIES OF HYDROGEN.

The following paper was lately read before the French Academy of Science: —

It is known that when two sheets of platinum have been previously placed in contact, one with hydrogen gas and the other with oxygen, and are immersed in water mixed with sulphuric acid, they constitute, momentarily, a voltaic pair — the sheet covered with hydrogen serving as the zinc side of an ordinary pair. By arranging on the conducting liquid two tubes, half filled, one with hydrogen the other with oxygen, and immersing the sheets of platinum partly in the liquid and partly in one of the gases, the pair gives out electricity until there is no more gas in the tubes. By uniting several pairs, there is formed what has been called a gas battery; it is worthy of notice that in this battery, when a circuit is closed, the gases contained in the tubes of each pair diminish in volume, the hydrogen twice as rapidly as the oxygen, so that the re-composition of water is effected in each element. Many eminent philosophers — Faraday among others — have directed their attention to this subject, and their experiments prove that the probable cause of the disengagement of electricity is the combination of the oxygen dissolved in the liquid with the hydrogen adhering to the platinum by the intervention of this metal. The oxygen adhering to the second sheet is therefore only opposed to the polarization that would be produced by carrying over this sheet, the hydrogen that procedes from the decomposition of the conducting liquid. Therefore the platinum, like other solid bodies employed under some circumstances, instead of this metal, is only the medium that determines the combination of the gases, and permits the circulation of electricity. It appears from this that the nature of the conducting liquids, must have an influence on the development of electricity, and the new results that are found mentioned in that part of the treatise of M. Edmond Becquerel, which speaks of the action of hydrogen on the chloride of gold as well as in that entitled "electric current developed," confirm the truth of this assertion. The following experiment is corroborative of the first: — If a tube of very small diameter, filled with hydrogen gas be placed in a vessel containing a concentrated solution of chloride of gold, at the end of a few days the temperature not having sensibly varied, the level of the chloride of gold, inside the tube will be very little different from what it was at first. Then introduce a piece of platinum wire, one part in the gas and the other part with its extremity, immersed in the chloride of gold; the gas is seen slowly to diminish in volume, and even at the end of a certain time to disappear completely, when the platinum wire rises to the top, but at the same time as the hydrogen gas disappeared, gold is precipitated in the metallic state on that part of the platinum wire immersed in the chloride. It is to be observed that the liquid does not contain, in solution, any platinum, therefore it is not acted upon by the neutral chloride of gold, at least as far as analysis proves; moreover, the exterior air is not an agent in the manifestation of the phenomenon, since it is produced likewise in close vessels. To be able to judge of the different results obtained, M. Becquerel gives the following conclusions: —

1st. Platinum wire that does not reduce a neutral solution of chloride of gold, may acquire this property when the solution is placed in contact with hydrogen gas, and the wire immersed partly in the gas and partly in the solution; gold is precipitated in the metallic state on that part of the wire immersed in the liquid, and the gas is absorbed while the deposit is going on.

2d. This action is manifested equally in close vessels not exposed to atmospheric influence. As the liquid, after the reaction, does not contain any platinum in the solution, it results that the metal undergoes no alteration — that it only serves as a conductor, and it acts only by its pressure. These experiments appear to prove that in this circumstance there is produced between a liquid and a gas (the chloride of gold and hydrogen,) when platinum is present, an action of the same kind as between oxygen and hydrogen, under the influence of the same metal.

3d. A piece of wire, with a sheet of gold under the same conditions, does not furnish any noticable effect.

4th. A voltaic pair may be formed with a single liquid, two sheets of platinum and one gas (hydrogen,) but this latter to be in contact with one of the sheets and the liquid; by uniting several pairs there is then a gas battery composed of a single gas, one metal and one liquid. Hitherto it had been laid down as a law, that with the platinum and acid solution, two gases (oxygen and hydrogen) were necessary to obtain this result; only the elements of the battery formed with the chloride of gold, have a feebler intensity of action than the usual gas pairs.

5th. The solution of chloride of gold, chemically pure, may therefore be considered definitively as superseding the acid solution and oxygen in the gas battery. The remarkable effects that are manifested in this circumstance should not be confounded with those that would be produced by certain gaseous solutions or liquids, such as nitric acid absorbing hydrogen at the ordinary temperature, without the appliance of platinum.

ON THE SPHEROIDAL STATE OF BODIES.

At a lecture before the Royal Institution, England, M. Boutigny remarked that the simple phenomena of the subject would seem to have necessarily attracted attention from the most ancient times, and endeavoring to discover some record of the fact, he had found the possible expression of it in the Wisdom of Solomon, xix. 20:— "The fire had power in the water, forgetting his own virtue; and the water forgat his own quenching nature." Eller and Leidenfrost, however, about the middle of the last century, first truly observed the simple phenomena; but nothing had since been done, either to increase our knowledge of the singular facts, or to suggest an explanatory theory concerning them. M. Boutigny then exhibited the experiments which he had recently made. He placed some nitrate of ammonia, which is inflammable at a very low temperature, upon a capsule of platina, greatly heated, but it assumed the spheroidal condition without ignition. On removing the lamp, however, and when the substance was cooled down to the ordinary temperature, it ignited. The beautiful violet colored vapor of iodine was produced also in the same manner, as also distilled water, which passed into steam as soon as the metal disc was sufficiently cooled. He then proceeded, by experiment, to show how the fact as relates to water, readily explains the occasional bursting of steam boilers, when, by the cooling of the boiler after the introduction of water into it when overheated, the contents are immediately and violently converted into steam.

The singular fact of the universal decrease of temperature in the liquid, when in a spheroidal state, was then adverted to. Numerous experiments had proved it. This phenomenon has given a result wholly unforeseen, and most remarkable. The chemist knows that liquid anhydrous sulphurous acid boils at a very low temperature. M. Boutigny, in submitting this acid to similar conditions in a slightly humid atmosphere, the acid first took an opaline appearance, then lost its transparence, and finally solidified. The solid formed was ice! As a variation of this experiment, some drops of water were thrown upon the acid while in the spheroidal state, and the wâter immediately congealed. In order to demonstrate that liquids, when in this state, do not touch the surface of the metal, some concentrated nitric acid was dealt with, but it did not act upon the copper disc on which the experiment was made, until the copper was cooled. A cylinder of silver, at a white heat, was also plunged into water; it was distinctly observed for many seconds (the room being darkened) not to be affected by the surrounding medium. The lecturer then insisted that it was not alone to such physical results that we are to look on the curious phenomena he has unveiled, but to the new method of chemical analysis and synthesis which they suggest. He has thus found that some bodies, which are not decomposed at boiling heat, are so when put in a spheroidal state; while others, placed in contact under the influence of this new molecular state, produce new combinations. When wine and alcohol are in a spheroidal state, their elements are found to be in a new order; ether is decomposed, and disengages aldehyde; chloride of ethyle decomposes nitrate of silver; ammonia dissolves iodine, &c.

PREPARATION OF MAGNESIUM.

Bunsen has observed, that fused chloride of magnesium is readily decomposed by the voltaic current, so that it is possible, in a short time, by the employment of a battery of a few pairs only, to obtain a mass of metal weighing several grammes. For the preparation of the chloride, Liebig's method is recommended; particular care must be taken, however, in drying the mixture of magnesia and sal-ammoniac, to avoid the formation of a basic chloride. As a decomposing cell, Bunsen employs a porcelain crucible divided into two parts by a diaphragm reaching to half the depth of the crucible. In this manner the chlorine set free at one electrode is prevented from again combining with the magnesium deposited upon the other. The electrodes used are of carbon, in the form in which it is prepared for Bunsen's battery; into the surface of the negative pole kerfs are cut to prevent the magnesium set free from floating to the surface of the fused liquid and there taking fire. To determine the quantity of magnesium formed in a given time, the author introduces a tangents-compass into the circuit, and deduces by a well known formula the relation between the chemical and the magnetic effects of the current, so that the latter being observed, the former may easily be calculated. Magnesium, as obtained by electrolysis, is upon a fresh fracture sometimes faintly crystalline in large plates, at others fine grained; in the first case, it is silver-white and very brilliant, in the last more bluish gray and without lustre. Its hardness is nearly that of calc-spar. It fuses at a moderate heat; in dry air it is wholly unchangeable, and does not lose its lustre; in moist air it soon becomes covered with a coating of magnesia. Heated to whiteness in the air, it takes fire and burns with an intense white light; the evolution of light by combustion in oxygen is of unusual intensity — about 500 times that of a wax candle. The metal decomposes pure cold water very slowly, acidulated water rapidly. Thrown upon aqueous muriatic acid the metal instantly ignites. Concentrated sulphuric acid dissolves it slowly; a mixture of nitric and sulphuric acids has no action in the cold. The density of magnesium was found to be 1.7430 at 5° Centigrade. Calculated from this, the atomic volume of magnesium is 86, or exactly double that of nickel. The metal, as obtained by electrolysis, may easily be filed, bored, sawed, or somewhat flattened by hammering, but is hardly more ductile than zinc, at ordinary temperatures. The magnesium obtained by means of potassium, contains a small quantity of that metal, and is ductile; that reduced by electrolysis, almost always contains traces of aluminum and silicon. — *Ann. der Chemie und Pharmacie*, lxxxii. 137.

TITANIUM AND ZIRCONIUM IN MINERAL WATERS.

Dr. Mazade, of Valence, states that he has detected in the mineral waters of Neyrac, France, both titanium and zirconia. He had previously announced his having found in the same waters, molybdenum, tin, tungsten, tantalum, cerium, yttrium, glucinium, nickel, and cobalt. — *L'Institut, No.* 964.

ON THE PASSIVE STATE OF METEORIC IRON.

Wohler states, that he has observed the curious fact, that the greater portion of the meteoric iron he has had an opportunity of examining, is in the so called passive state, that is to say, it does not reduce the copper from a solution of the neutral sulphate of copper, but remains bright and uncoppered therein. But if touched in the solution with a piece of common iron, the reduction of the copper commences immediately upon the meteoric iron. It also becomes active instantaneously on the addition of a drop of acid to the solution of copper; but if the reduced copper be filed away, the new surface is again passive. I convinced myself by experiments on meteoric iron, which had never been in contact with nitric acid, and nevertheless was passive, that this state could not have been produced by the corrosion of the surface by the acid, for the production of the Widmannstattean figures. I thought first that this deportment might be employed as a means of distinguishing true meteoric iron; but it soon appeared that some undoubtedly genuine meteoric iron was not in this state. Seven specimens, from different parts of the world, examined, were found to be passive; six reducing, or active; and four which do not become coated with copper immediately, but on which the reduction gradually commences, after a longer or shorter contact with the cupreous solution, and usually from one point, or from the margins of the fluid.

These peculiarities appear to have no connection either with the presence of nickel, or the property of forming regular figures on corrosion. I also found that an artificially prepared alloy of iron and nickel, which on corrosion acquired a damasked surface, reduced the copper from solution in the same manner as common iron. Whether this state is proper to all meteoric iron on its reaching the earth, and, as may have happened in the case of the active kinds, have only been lost in the course of perhaps a very long period of time, and what probable opinion can be formed of these phenomena must be settled by experiments and observations of a more extended nature.—*Pogg. Ann.*

PRODUCTION OF BRITISH IRON.

Mr. Samuel Blackwell, an eminent English iron-master, estimates the gross annual production of iron in Great Britain to be upwards of 2,500,000 tons. Of this quantity, South Wales furnishes 700,000 tons; South Staffordshire, 600,000; and Scotland, 600,000. The remainder is divided among the various smaller districts. The number of furnaces in blast in England and Wales during the year 1850, was 336.

ON THE COMPOSITION OF WOOTZ, OR INDIAN STEEL.

Wootz, or Indian Steel, has for a long time been held in high estimation from the supposition that the celebrated scimitars of Damascus were made from it. A chemical examination was made of wootz in 1819, by Faraday, who came to the conclusion that the peculiar excellence of this steel depended chiefly on a small quantity of aluminum combined or alloyed with it; two separate analyses yielding 0,0128, and 0,0693 of aluminum. On the other hand, Karsten could only detect dubious traces of aluminum in wootz, and Elsner attributed the improvement in the quality of the steel produced in Faraday's experiments, not to the small quantity of foreign metals, aluminum, silver, platinum, &c., alloyed with them, but entirely to the operation of remelting, and this seems to be the practical conclusion come to at Sheffield, Eng., at the present day. The fact that the alloys produced by Faraday possessed a perfectly damasked surface, closely resembling wootz, seems to militate against the conclusions of Elsner. M. Breant attributes the damask of the Eastern blades to the crystallization of two distinct compounds of iron and carbon, and draws a distinction between the oriental damask, and that produced by alloys of steel. This is confirmed by the experiments of M. Anocoff, a Russian engineer, published a few years since in the *Annuaire des Mines de Russie.* He pretends to have produced blades so nearly emulating those of Damascus, as to allow of their being bent at a right angle, and capable of dividing a film of gauze floating in the atmosphere. Mr. Henry, of England, has recently made several analyses of wootz, and failed to detect in it the presence of alumina; he, however, found sulphur, silicon, and arsenic, in appreciable quantities.

SEPARATION OF SILVER FROM OTHER METALS.

The following is an abstract of the specification of a patent granted to Alexander Parks, of England, for improvements in the separation of silver from other metals. The invention consists—first, of certain improvements in the mode of employing zinc for the purpose of separating silver from lead. Secondly, of improvements in separating the silver from the alloy of zinc and other metals thus produced. The patentee states that he has found when lead contains 14 ozs. of silver to the ton, the most suitable proportion is 1 per cent. of zinc; thus, for each ton of lead containing 14 ozs. of silver, he uses 23 lbs. 4 ozs. of zinc; for each ton of lead containing 21 ozs., 33 lbs. 6 ozs. of zinc; and for each ton of lead containing 28 ozs. of silver, 44 lbs. 8 ozs. of zinc. The process is conducted as follows:—The lead, in the state it is received from the smelting-house, is melted in an iron pot, and heated to the temperature of melted zinc; the zinc, in a melted state, is then added, and the whole well mixed; the contents of the pot are then stirred in the usual way, with a piece of green wood, to remove any impurities; it is then cooled; the alloy of silver, zinc &c., rises to the surface, and is removed by the means of ladles pierced full of holes. A previous assay of the lead will indicate the right proportion of zinc to be employed; a larger quantity will be found necessary in cases where the lead is very impure. The lead which has thus been desilverised by means of zinc, often retains a small portion of that metal, which has the effect of rendering it brittle: this defect is remedied by the following process:—

The melted lead is run into a reverbatory furnace, and raised to a dull red heat, when the zinc rises to the surface and becomes oxydised; the furnace is then tapped and the lead run into an iron pot, when it is stirred with a piece of green wood, to remove any oxide of lead which may have formed; after which, it is ladled into moulds in the usual way. By this means, 3 tons of lead may be deprived of the zinc it contains in the course of from 2 to 2½ hours; the surface of metal exposed being from 25 to 30 square feet. The oxide of zinc remains in the furnace, whence in may be afterwards be removed.

In order to separate the silver from the other portions of the alloy the patentee proceeds as follows:—The silver is first concentrated by removing as much of the lead as possible, by placing it in an iron pot, the bottom of which is preforated with holes, the top being, at the same time, covered with a tight-fitting lid; heat is then applied, and when the metal is nearly red hot a large quantity of the lead in the alloy will escape, and thus the mass of alloy will become much reduced in size. If care be taken that the heat be not carried to too great a degree, the lead which thus escapes will be found to contain but a very minute quantity of silver. The alloy thus concentrated may next be treated by either of the following methods: First the alloy is placed in closed retorts, or muffles, and exposed slowly to a low heat, and continually stirred, by which means the metal is partly oxydised and falls down in fine powder; the heat is then increased, and when all the metals (except silver) in the alloy become completely oxydised, the whole is transferred to tanks containing dilute sulphuric or muriatic acid, which dissolves the oxides, leaving the silver in the metallic state. Secondly, the alloy is placed in suitable retorts, or distillatory apparatus, formed of Stourbridge clay, or of iron set in clay retorts and lined with powdered bone and charcoal, and by which means the zinc is distilled off in the usual way, after which the back part of the retort is tapped and the residue treated by cupellation, in the way well known.

By the process of desilvering lead, known as that of Pattinson's, many of the English lead mines which are now workable with profit, must otherwise have been abandoned. The chief ore from which lead is extracted is that known as galena, or the sulphuret of lead, furnishing from 75 to 80 parts of the metal according to purity. It usually, though not always contains silver in various proportions. Upon the quantity of silver often depends the profitable raising of the ore.—Previous to the invention of Mr. Pattinson, about 20 ounces of silver in a ton of lead were required to render the extraction of that metal worth the cost; since then as little as three or four ounces in the ton of lead will repay extraction. Now, as so many ores contain small quantities only of silver, the importance of the process is evident. In a scientific point of view it is one of much interest, as it consists in so conducting the work that portions of lead can be crystallized, by which the silver becomes excluded, in the manner in which in many crystallizing processes, foreign substances are excluded during crystallization, thus by degrees a mixed mass of silver and lead is left, extremely rich in the first metal. When this richness in silver arrives at the point desired, that metal is extracted in the usual manner by cupellation. In one of the lead works in England, in which arrangements exist by which the fumes of the furnaces are prevented from escaping, the damage to the surrounding country is obviated, and lead to the amount of 33 per cent. is obtained from the deposits or "fume."

ZINC OXIDE AS A PIGMENT.

This branch of industry has already arrived at much importance in this country through the action of the New Jersey Zinc Company, whose works are dependant upon the red zinc ore and Franklinite so long known to mineralogists. The products of this manufacture are chiefly two, the white oxide, dry or ground in oil, and of several grades of quality, and the colored pigments formed mainly by grinding the raw ore. The zinc white is made in large oven-shapen retorts of brick, around which the heat of an anthracite fire is conducted both above and below. These ovens are very low, but of large superficial area. A wide pipe of sheet iron connects each with a very large horizontal tube in which a current of air is kept moving by the revolution of a fan-wheel. This current flows first through the retorts, furnishing air to burn the zinc and means of transportation to the oxyde formed, which is delivered by the current in large cooling chambers. The charge in the ovens is one thousand pounds of crushed red zinc and Franklinite mixed with its own bulk of the dust of anthracite coal. The heat is raised to full redness and so managed as to be hottest on the upper surface of the charge. Reduction of the zinc is probably effected by the action of the hot carbon, but the metal is immediately burned by the atmospheric oxygen drawn in by the mechanical action of the blower before named. All the volatile products of this chemical action are drawn through the long tubes and partly delivered into capacious sacks of closely woven muslin suspended in well ventillated apartments. The heat retained by the oxide is not sufficient to scorch the muslin. From the proper openings in the sack the material is collected in casks. In the retorts the residue consists of undecomposed Franklinite and of metallic iron mingled with unchanged carbon. When the best results are obtained the ore yields half its weight of oxide. This oxide is never quite pure, as a small quantity of dust and foreign materials are drawn in with the current of air. Dissolved in acetic acid this residue remains on the filter and perfectly pure carbonate of zinc may be precipitated from the acetate. Chemists will regard this as an important means of procuring chemically pure zinc.

It is curious that the carbonate of zinc obtained by precipitation when mingled with oil has no "body," or does not cover the surface on which it is laid, while the anhydrous oxide obtained in the furnace process covers very well. Water added even in small quantity to the zinc oxide ground in oil, will cause the whole mass to solidify. The greater cheapness of zinc oxide, its freedom from poisonous quality, and the fact that sulphuretted hydrogen does not discolor it, are causes which must lead to the general use of this material in place of lead. The New Jersey Zinc Co. are at present manufacturing about 5,000 pounds of zinc oxide daily, from 18 furnaces or retorts, only one-half of which are usually in operation at the same time. The colored paints formed by grinding the crude ore, are sold at very cheap rates and found to possess remarkable power to prevent the oxidation of metallic iron.—*Silliman's Journal.*

ON THE PRODUCTS OF SMELTING FURNACES, AS PROOFS OF GEOLOGICAL HYPOTHESES.

A PAPER on the above subject was read before the German Scientific Association at Wiesbaden, by Prof. Leonhard, of Heidelberg, of which the following is an abstract: "For a long period of time," began the author, "no particular attention was devoted to scoriæ and slags, the secondary productions of all smelting works. As useless and unprofitable, they were thrown aside after the metal had been extracted, as the miner in his shaft gets rid of all waste and unproductive rock." He then showed how, until lately, the study of lavas themselves was neglected. The same was the case with scoriæ and slags; they are not, as was formerly supposed, "accidental combinations of several materials, nor arbitrary mixtures of earths and metallic oxides, which, however occurring again and again in this or that smelting produce, show nevertheless in a quantitative point of view the most endless varieties. The scientific foundation of a theory of the formation of scoriæ and slags is the work of Mitscherlich. The production of mineral substances by means of fire, or as the produce of high furnaces by the gradual diminution of the temperature of materials melted together in given proportions, or from vapors, attracted more and more attention. The influence of temperature on the resulting substances is most important, bringing about new combinations and new conditions out of the same material. These phenomena are most remarkable in the combination of iron and charcoal.

"Space, quiet, and freedom of motion," said the author, "are the most important conditions and necessary requisites for the particles of matter to be able to arrange themselves in regular order to produce well-formed crystals; this the chemist had taught us. All products of this kind are subject to unchangeable laws. The more gradual the reduction of the igneous fluid to a solid mass, the more favorable are the conditions of crystallization. If proportions and conditions are the same, we always see the same forms reproduced." After these words the author described the process of late chemists with regard to the melting and reduction of various rocks, and then rapidly noticed the numerous minerals and combinations of minerals found in the scoriæ and slags of smelting furnaces. "All scoriæ," he added, "have a similarity of substance and degree of *flexibility* (?) sufficient to enable the metalic particles thus obtained to sink by means of their greater specific gravity. Scoriæ have a less specific weight than the products to be gained by smelting; the latter are pure metals, or a combination of metal with charcoal, sulphur, &c.—the former consist entirely or chiefly of earths. We can thus understand how a covering of slag is formed over the melted treasure as a protection against the influence of fire and of atmosphere." After mentioning some of the principal minerals obtained from furnaces, and which are the principal ingredients of the most extensively found rocks, he observed that "in a geological point of view these products are of the greatest importance. They point out how nature has ever worked in her mysterious abodes, on a still larger scale and with an overwhelming force. These substances will open up a new field for inquiry and investigation for observation and experiments. They will play an important part in all future geological hypotheses, when we have to argue from the known to the unknown. They will fill many a gap in imperfect observations, they will explain various phenomena, explode rash assertions and imaginary assumptions. We may also hope, too, for further information on the question, whether the fundamental rocks of our planet, the form of which presumes a fluid state, were soluble in water; or whether the temperature of the earth was once so high, that the ingredients of certain rocks were in a melted state?" He concluded by mentioning that, "amongst the products of smelting furnaces there are some which have not yet been found in a natural state Some of the artificial productions, however, have been subsequently discovered in the realms of nature, and there is no reason why we may not expect, with future investigations, to find the others."

NEW TEST FOR MERCURY.

Mr. Arthur Morgan in a paper read before the Dublin Medico-chirurgical Society says, — if a strong solution of iodide of potassium be added to a minute portion of any of the salts of mercury, placed on a clean bright plate of copper, the mercury is immediately deposited in a metallic state, appearing as a silvery stain on the copper, which cannot be mistaken, as no other metal is deposited by the same means. By this method corrosive sublimate may be detected in a drop of solution unaffected either by caustic potash, or iodide of potassium. In a mixture of calomel and sugar in the proportion of one grain to two hundred, a distinct metallic stain will be obtained with one grain of the mixture, which of course contains 1-200 of a grain of calomel; in like manner, 1-400 of a grain of peroxide of mercury may be detected, although the mixture with sugar is not in the least colored by it, with preparations of mercury in the undiluted state, this process acts with remarkable accuracy, the smallest quantity of calomel in peroxide of mercury, such as would almost require a magnifying lens to perceive, placed on copper and treated with iodide of potassium, will give a distinct metallic stain.

The advantages of this test may be briefly stated as follows: — It is a delicate test inferior only to chloride of zinc and the galvanic test of zinc and gold. It is easy of application. It requires a very small portion of the substance to be examined—a matter of no small importance. Acting on the insoluble as well as the soluble salts, it obviates the intermediate process of solution. When it acts, its indications are decisive. As to its disadvantages, the only one which seems tenable is, that although it acts on minute portions, still that must be in a concentrated condition.

ON THE PREPARATION OF PURE SILVER FROM CHLORIDE OF SILVER. BY C. BRANNER.

It has long been known that pure silver for chemical purposes is best prepared by the decomposition of chloride of silver. This decomposition can be performed in various ways: Poggendorff, several years ago, described a process in which it was effected by galvanism; this appears to me to be preferable to all others hitherto known, and the one here described can only be regarded as a modification of it. Well-washed precipitated chloride of silver is to be put into a cup of silver, platina or copper the outer surface of which is covered with wax in such a manner that only a round space of one or two inches in diameter, according to the size of the cup, remains uncovered. On the bottom of a larger earthen cup a disc of amalgamated zinc is to be laid, on the middle of which the cup containing the chloride of silver is placed, in such a manner that the portion not covered with wax may come in contact with the zinc. Water slightly acidulated with sulphuric acid is now poured into the apparatus, until it rises above the margin of the inner cup, so that this will be completely sunk in the water. The decomposition of the chloride of silver immediately commences at the edge of the cup containing it and proceeds inwards to the middle; this is readily known by the dark gray color assumed by the silver as it separates; the decomposition will be completed in from 24 to 48 hours; its completion may be known by there being no longer any chloride of silver visible on stirring the precipitate. The silver thus procured is to be washed with water, and any small residue of chloride of silver which it sometimes retains may be got rid of by diluted ammonia. The silver thus prepared is perfectly pure. It is readily seen that any foreign metals that may be contained in the zinc, can never mix with it, as the disc of zinc lies during the whole operation below the cup containing the silver and never comes in contact with it.

CRYSTALLIZATION OF GLASS.

Some interesting experiments on this subject have been made by M. Leydolt, in the course of his investigations upon the crystallization of the silicates. He had examined agate by subjecting it to the dissolving action of fluohydric acid, and obtained a surface with *projecting crystals* of quartz, that were left untouched by the acid. On subjecting glass in the same manner, he was surprised to see that it was far from homogeneous in its texture. All the kinds of glass examined contain more or less perfectly distinct crystals, regular and transparent encased in an amorphous base. The crystals were brought out by exposing it to the vapors of fluohydric acid and vapor of water, and arresting it when the crystals appear; the amorphous part is a little the most soluble in the acid. M. Leydolt observes also that some natural crystals pure and transparent and apparently homogeneous, present similar deficiency in homogeneity with the glass; and he has the subject under further examination.

ON THE DISTRIBUTION OF IODINE.

A MEMOIR, it is well known, has been recently published in the proceedings of the French Academy by M. Chatin, on the existence of iodine in the atmosphere, in rain-water, soils, &c.* Mr. McAdam, of Edinburgh, in a letter to Prof. Jameson, published in the Philosophical Journal for July, states that he has endeavored with great care to verify the results obtained by M. Chatin, but without success. As the fixed alkalies and their carbonates were re-agents made use of by M. Chatin, Mr. McAdam is inclined to refer the iodine found, to these bodies, Mr. McAdam's success in detecting iodine in pearl ashes leads to the belief that this substance will be found more generally distributed in the vegetable kingdom than it has hitherto been supposed to be; and this opinion is strengthened by the fact that it has in several instances been detected in charcoal.

RESEARCHES ON THE SULPHURETS WHICH ARE DECOMPOSABLE BY WATER. BY E. FREMY.

THE object of this paper is to make known the production and principal properties of a class of sulphurets hitherto little examined, and the study of which is alike interesting to chemists and geologists, from the light which it throws on the formation of mineral waters. When we consider the action of water on the sulphurets, we find that these compounds may be divided into three classes; the first comprises the sulphurets of the alkalies and of the alkaline earths which dissolve in water; the second is formed of the insoluble sulphurets; the third consists of the sulphurets of boron, silicon, magnesium and aluminum, which are decomposed by water; these latter are scarcely known, owing to their preparation having hitherto been accompanied with great difficulties. In order to a thorough investigation of all the questions which are connected with the decomposition of the sulphurets by water I first sought for a method by which they might be easily prepared, which is as follows. It is well known that sulphur exerts no action upon silica, boracic acid, magnesia and alumina. I imagined it might be possible to replace the oxygen in these substances by sulphur by the intervention of a second affinity, as that of carbon for oxygen. Such decompositions, produced by two affinities are not rare in chemistry; and in some yet unpublished experiments on the fluorides, I had observed that the sulphuret of carbon completely decomposed the fluoride of calcium mixed with silica, producing sulphuret of calcium, I was therefore led to presume that the sulphuret of carbon, acting by its two elements upon the preceding oxides, would remove the oxygen by means of the carbon which it contains, and would at the same time form sulphurets; this supposition I found

* See Annual of Scientific Discovery for 1851, p. 231.

confirmed by experiment. In fact, I have obtained the sulphurets of boron, silicon, magnesium and aluminum, by submitting boracic acid, silica, magnesia and alumina to the action of sulphuret of carbon at a high temperature. To facilitate the reaction, and remove the sulphuret from the decomposing action of the alkalies contained in the porcelain tubes, it is sometimes useful to mix the oxides to be reduced with charcoal, and to form them into little balls similar to those which are used in the preparation of chloride of silicon. These sulphurets correspond to the oxides from which they are derived.

The sulphuret of silicon had been obtained in small quantities by Berzelius in the reaction of sulphur upon silicon, and by M. Pierre in the decomposition of chloride of silicon by hydrosulphuric acid. I have obtained this substance with the greatest ease, by passing the vapor of sulphuret of carbon over pellets of charcoal and gelatinous silica placed in a porcelain tube heated to a bright red. The sulphuret of silicon condenses in the tube in beautiful white silky needles, which are not very volatile, but are readily carried along by the vapor. To show the interest which attaches to the examination of this substance, it will suffice to mention here two of its reactions. When sulphuret of silicon is heated in a current of moist air, it is decomposed and furnishes silky crystals of anhydrous silica ; it is evident that we may explain by means of this experiment the natural production of certain filamentose crystals of silica. The sulphuret of silicon in the presence of water is decomposed with a brisk evolution of hydrosulphuric acid into silica, which remains entirely dissolved in the water, and is not deposited until the liquid is evaporated. It is impossible not to connect this curious property with those natural conditions under which certain mineral waters and siliceous incrustations are formed. As the sulphuret of silicon is probably produced in all those cases where silica is submitted to the double action of a binary compound which cedes sulphur to it, and at the same time appropriates its oxygen, this sulphuret is probably not so rare as has been hitherto thought; and by admitting its presence in those rocks in which sulphurous springs occur, we might explain the simultaneous existence of silica and sulphuretted hydrogen in the principal sulphurous waters. This hypothesis is in some measure confirmed by the interesting observations of M. Descloizeaux, which show that the siliceous springs of the Geysers of Iceland contain a large quantity of sulphuretted hydrogen. In explaining the formation of sulphurous and siliceous waters by the decomposition of the sulphuret of silicon, I am only extending the ingenious theory proposed by M. Dumas to explain the formation of boracic acid. The sulphurets of boron and aluminum were prepared like the sulphuret of silicon, and are likewise decomposed by water. The sulphuret of magnesium I obtained by passing sulphuret of carbon over pure magnesia; in this case the presence of charcoal does not appear to be of any use. This sulphuret crystallizes and is soluble in cold water; when its solution is kept at the ordinary temperature, there is but a feeble disengagement of sulphuretted hydrogen; but when heated to ebullition, a lively effervescence of sulphuretted hydrogen takes place and there is an immediate deposition of magnesia.—*Comptes Rendus*, *July*, 1852.

ON THE SEPARATION OF MANGANESE.

Dr. Gibbs in a communication to Silliman's Journal, September, 1852, gives the following statements in regard to the precipitation of manganese: —

Schonbein in a memoir on the relations of peroxide of lead and ozone, has pointed out the remarkable fact that peroxide of lead precipitates manganese completely from its solutions in chloro-hydric and sulphuric acids, a compound of peroxide of lead and peroxide of manganese being formed. A portion of the lead is at the same time reduced to protoxide and unites with the acid with which the manganese was combined. Schonbein appears not to have remarked the importance of this observation in an analytical point of view.

In investigating the subject carefully, I have been led to the conclusion that the peroxide of lead constitutes one of the most valuable re-agents in analytical chemistry, since by means of it the oxide of manganese may be easily and completely separated from a number of other bases, without the employment of ammoniacal salts. The use of ammonia, as is well known, frequently renders analyses conducted by the ordinary methods laborious and inaccurate, either from the number of operations involved, from the absorption of carbonic acid from the air, or from the unavoidable loss in driving off the ammoniacal salts by heat. The fact which I have determined, and which serve as the basis of the analytical application of the peroxide of lead are as follows: —

Peroxide of lead completely precipitates manganese from neutral solutions in chloro-hydric, sulphuric and nitric acids, slowly in the cold, but very rapidly by digestion or by boiling. The presence of an excess of chloro-hydric or sulphuric acid does not prevent the complete precipitation of the manganese; in these cases, however, chlorine or oxygen is set free, and the quantity of lead dissolved is greater than that which corresponds to the quantity of manganese precipitated. Such an excess of acid should be avoided as far as possible.

The presence of an excess of nitric acid prevents the precipitation of the manganese, since hyper-manganic acid is formed and remains in solution. Tartaric acid, and those organic substances which are burned at the expense of the peroxide of lead, do not interfere with the precipitation of the manganese. The organic matter is first destroyed by the oxygen of the peroxide of lead, and afterwards the manganese is precipitated by the excess of the peroxide added. When the quantity of organic matter present is large, it is always better to separate the manganese by means of sulphydrate of ammonium in the usual manner. When, however, oxalic acid is present, we may avoid the use either of an inconvenient quantity of peroxide of lead, or of sulphydrate of ammonium, by means of chlorine or bromine. Either of these agents readily converts oxalates into carbonates by a well known reaction. The presence of an excess of free acetic or succinic acid, does not prevent the complete precipitation of manganese by peroxide of lead. The same observation applies to the presence of sulphate, nitrate, and chloride of ammonium, and therefore, probably to all ammoniacal salts. Salts of protoxide of iron are oxidized and partially precipitated by peroxide of lead. The same remark applies to the salts of cobalt. The precipitation is not complete even after long digestion upon the sandbath.

The salts of nickel and zinc are not precipitated by peroxide of lead, and the nickel undergoes no higher oxidation. Peroxide of lead when perfectly free from protoxide does not precipitate baryta, lime, magnesia, strontia, alumina from their solutions. The same remark applies, as might be supposed, *a fortiori*, to the alkaline bases. The application of these facts to the quantitative separation of manganese from the above mentioned bases, with the exception of iron and cobalt, is obvious.

Dr. Gibbs then proceeds at some length to consider the several cases separately.

ROSIN OIL.

We derive the following facts relative to the manufacture and use of rosin oil for mechanical purposes, from a report submitted to the manufacturing companies of Lowell, Mass., by a committee appointed to investigate the subject. Dr. Samuel L. Dana, chairman.

The committee have considered this subject in relation to its manufacture, lubricity, and economical use. Dr. Dana after carefully investigating the subject states as follows: — "It was early evident to me that the amount of practical information on the subject was very limited, and rested on no fixed principles. I therefore devoted my time to the investigation of principles relating to the process. I am satisfied, after producing about 1,000 gallons, that, with due care guided by principles which have been established, rosin oil of a uniform quality may be continuously produced at a very low rate per gallon. It was desirable, for some purposes, that rosin oil should be deprived of its characteristic odor without detriment. This difficult point has been completely effected, and many gallons have been thus prepared, which have been used by the companies. Deodorization will not probably materially increase the cost of the oil. The first oily product of the distillation of rosin, by a slight and cheap process, becomes applicable to all heavy machinery when mixed with its bulk of sperm oil. The Merrimac Manufacturing Company have used constantly, for several months, this mixture on all parts of their steam engines, except the cylinder, &c., on all their blowing fans, revolving at a speed of 600 or 700 turns per minute, and on all the bearings in the print yard. No evil has resulted from its use. It spends nearly the same as pure sperm oil. It was found, moreover, that while first run rosin oil was found perfectly applicable to all heavy bearings, after undergoing a slight process, yet when deodorized, a chemical change or motion among its particles was induced, by which it gradually thickened and became unfit for lubrification. This fact led me to believe that rosin oil, under certain circumstances, is an unstable compound. Hence, it was desirable, to put it into a stable state by removing the body or bodies which caused motion to occur. This was effected, and a perfectly limpid and fixed oil was obtained, quite free from the peculiar odor of rosin oil.

In reply to certain queries propounded by the committee to an eminent French chemist, communications have been received, which fully show that we are not behind the French manufacturers of rosin oil, either in quality or quantity of product; they have brought to our knowledge a new preparation from rosin oil, in a semi-solid or lardy state, now much used in France, with a steady annual increasing demand. This preparation is a substitute for the various well known substances used in a fatty or soft-solid state for greasing wheels, gearing and heavy shafting. Following the specific directions for the preparation of this substance, it was found that a hard body like shoemaker's wax was produced; an almost instantaneous solidification occurring. After many trials, however, with great modifications of proportions and time, the desired compound was produced, possessing the properties described, and appearing like the samples received from France. This rosin fat has been used with success on iron gearing, and my opinion is favorable to its use as a substitute for tallow, and at a cost much below the average price of that article. The consumption of tallow at the Merrimac Cotton Mills, for the year ending November 15th, 1851, was 4,500 lbs., which may be, probably, replaced by the rosin oil substitute.

In regard to the lubricity of the oil, the committee states, that rosin oil can be used for lubrification, only when mixed with its bulk of pure sperm oil. By accurate experiments it appears that spinning machinery requires more, and weaving machinery less power, when rosin and sperm oil are used, than when pure sperm oil alone is employed. This may be explained by reference to the kind of machinery, looms consisting chiefly of cam movements. Machinery falls naturally into two classes; 1st. That with fine or light bearings. 2d. That with cam movements, or with heavy bearings. All machines of the first class will probably require more, and all of the second class less power with the mixture of rosin and sperm oil, than with pure sperm only. Deducting the less power required by some machines, from the greater demanded by others, the committee would avoid the question, whether the cheaper mixed oil would not pay for the balance of greater power, by throwing out all the fine machinery, as a class to which the rosin mixed oil is inapplicable.

Experiments made with great care, with the same dynamometer, and under the same circumstances gave the following results: — The average from the trials on nine spinning frames, shows that 13 8-10 per cent. more power is required with the mixture of rosin and sperm oil, than with sperm alone.

The average from the trials on six stretchers, shows that 3 7-10 per cent. more power is required with the mixture, than with sperm alone.

The average from the trials on five looms, shows that 4 6-10 per cent. less power is required with the mixture, than with the sperm alone.

In regard to the economy of rosin oil, it is stated that the mixed oil spends about as economically as pure sperm, and no serious evil has resulted from mixed oil in the long experience of the use of this article. It will be recollected that rosin oil can be used only when mixed with its bulk of sperm oil. Under this division, therefore, the committee have considered to what extent rosin oil my be substituted for sperm in the cotton mills of Lowell. As the bases of their calculation, the oil statistics of the Merrimac Company have been assumed. The total sperm oil used for lubrification by the Merrrimac Cotton Mills for the year ending November 15th, 1851, was 6,772 gallons, — of this amount rather more than one-quarter (26,722 0-0) . . . . . or 1,813 gallons were used for spinning, leaving a balance of 4,959 gallons. Of this balance, rather less than one-fourth, or 1,192 gallons, were used in weaving, which requires by experiment 4 6-10 less power with mixed oil, than with sperm alone, leaving 3,767 gallons applicable to machinery, which the committee class among those with heavy bearings, and which requiries, at least, no more power with the mixed oil, than with sperm oil only. We have, then, in the Merrimac Company's Mills 4,959 gallons, or about three-fourths of all the sperm oil used there, for which may be substituted a mixture of equal parts of rosin and sperm oils, thus diminishing the annual amount of sperm oil by 2,479.5 gallons, or nearly three-eights of the whole. The Merrimac Mills are using about one-sixth of the power of the Lowell Corporations. If the other mills use oil in about the proportion above, the total annual diminution of sperm oil, by substituting rosin oil, will be 14,877 gallons."

Small as the annual saving in sperm oil thus appears, the committee are of opinion, that it will have been highly important that this result has been approximated, since that amount will probably be multiplied by all heavy bearing machinery in the country now oiled with sperm, and thus an amount of that article will be thrown into the market, which may tend to lower its price and improve its quality."

ON THE TREATMENT OF FAT FOR THE PREPARATION OF CANDLES.

MM. Masse and Treboullet, in a communication to the *Bulletin de la Societe l' Encouragement*, states : — It is well known that fat may be made to acquire a soapy character by the influence of sulphuric acid. In the manufacture of candles the fat is heated with sulphuric acid, or subjected to mechanical friction therewith ; it is then washed, and the mass being placed in a still, is heated to between 200° and 250° Centigrade to drive off the aqueous vapor and with it the fatty acids. With palm oil, the effect of this treatment is as follows: —

Palm oil melts at 30° Centigrade; after the action of sulphuric acid at 38°; after the washing with water at 44.5° Centigrade; after the distillation at 46°. The first product of distillation liquefies at 53.5°, the point of liquefacation then sinks, and the product comes gradually more and more to have a tendency to crystallize. If the entire product be pressed together, the mass has a melting point of 54.5°, the same as that which first passed over. Some fats, however, present considerable differences in these respects.

IMPROVEMENT IN THE MANUFACTURE OF GAS.

Some improvements have been recently patented in England, by Messrs. Barlow and Gore for the manufacture of gas, which are highly spoken of by the London Mining Journal. The processes are based, 1st, upon an improved method of rendering luminous the gases resulting from the perfect decomposition of water or steam; and, 2d, upon the conservative influence which hydrogen exercises in protecting the matter upon which the illuminating power of gas depends from decomposition by heat. The first has been often attempted, with dubious and disputed success. The failures are all traceable to the same sources — first, to the impossibility of securing the complete decomposition of water or steam by any of the means employed, and to the consequent production of a large quantity of vapor, exercising a fearfully destructive influence over the carbonaceous matter undergoing decomposition for the purpose of rendering the water gases luminous; and, secondly, to the presence in the water gases of from 10 to 15 per cent. of carbonic acid, the injurious effects of which upon the flame need not be alluded to, and the expenses of abstracting which by any of the ordinary methods are so considerable as materially to augment the cost of manufacture, besides diminishing the volume of saleable gas. The present patentees propose to obviate these difficulties by first condensing the water gases, so as to deprive them of all excess of vapor, and then to pass them through a heated retort containing carbonaceous matter, by which the whole of the carbonic acid gas will be converted into twice its bulk of carbonic oxide gas, and the pure hydrogen and the carbonic oxide gases in equal volumes, free from carbonic acid, are afterwards admitted in regulated quantities into retorts where carbonaceous matter is undergoing distillation or decomposition, and by which they are rendered highly luminous. The conservative effect of hydrogen upon olefiant gas has not, we believe, hitherto been noticed by chemists. It may, however, be demonstrated by the following very simple experiment: — If olefient gas be passed through a red hot tube, the carbon will be deposited, and the gas be thereby converted into light-carburetted hydrogen, a gas of very low illuminating power. If, however, hydrogen be added to the olefiant gas, the same process may be repeated without causing any deposition of carbon, and with only a diminution of illuminating power in the mixed gases, due to the increased volume of the non-illuminating gas — hydrogen.

The practical effect of this property, when applied to gas making, is to reduce the quantity of combustible products, such as tar, &c., and entirely to prevent the deposition of carbon on the interior surface of retorts. The importance of these discoveries will be readily understood, when we state that the experience of the patentees leads them to the conclusion that upwards of fifty per cent. may be added to the volume of gas yielded by all descriptions of materials ordinarily used for that purpose, without any diminution of the illuminating power, so that 15,000 cubic feet will be the probable future product from one ton of Newcastle coal, and 75,000 cubic feet of London gas from the same quantity of Boghead Cannel. — *London Mining Journal.*

FLAX COTTON.

A PARLIAMENTARY document lately published in England, contains a report made by Sir Robert Kane, on Claussen's invention for the production of flax cotton. Experiments were made by Sir Robert, on a smaller scale than had been intended, in consequence of the want of a sufficient supply of flax. The experiments made were of two kinds, of the results of which the following account is given: —

The first was as to the direct preparation of flax cotton from flax straw, in which the separation and cleansing of the fibre from the refuse part of the stalk was made a part of the process, and this was not by any means satisfactorily done. The second was as to the conversion of tow or low priced flax into flax cotton; and, although in this material the fibre has been already prepared and cleaned by the previous dressings, the product obtained did not approach in fineness of texture, uniformity of structure or cleanness of mass to the quality of the specimens of flax cotton that are usually exhibited by M. Claussen's agents. Under these circumstances, Sir Robert Kane considers the trials "to have been in so far negative as the agents acting for M. Claussen found it impossible to produce satisfactory results in those works which they had themselves selected, and where they had been working previously." At the same time it is admitted that much weight must be conceded to the defective mechanical arrangements. In winding up his report, after mentioning incidentally that when the trials had been concluded and found unsatisfactory, a letter was received from M. Claussen declining to be responsible for the results, and stating that he would prefer that the inquiry should be conducted at some works he had erected near London, Sir Robert Kane observes: —

"In regard to the more purely scientific portion of the inquiry, I beg leave to report that several interesting facts have been already ascertained as to the real nature of the material produced, and as to the true action of the materials used. Without being understood to announce a positive conclusion, which in a report of progress would be premature, I beg to state that I am pretty well satisfied that M. Claussen's process does not at all produce a material approaching in structure or organic quality to cotton. The views of the bursting up of the fibres put forward by some persons who have come forward to explain the process in public do not appear to be well founded. The flax fibres are in M. Claussen's process excessively finely divided and separated from each other, but each remains still a thorough and complete flax fibre, and quite unlike cotton, and the same amount of division, and the same fineness and pliability of fibre may be given, and often is given, to flax by simple dressing, especially if the flax had been overretted. This point as to structural character is, however, so fundamental to the value and quality of the flax cotton, that I deem it indispensable to follow up still further the careful microscopic examination of the material in all its stages, and shall, therefore, reserve for a future complete report details and drawings."

M. Hamel lately delivered an address before the Imperial Academy of Russia, on the subject of flax cotton, in which he gives a different account of its invention to what is generally supposed. According to him, a native of Holstein, named Ahnesorge, by trade a dyer and bleacher, had applied himself for several years to improving flax spinning, as well as to turn to account the tow, which is of little value. For this purpose he made several journies, and in 1838 went to St. Petersburgh with a sample of about a dozen pounds of a cottony material from flax tow. In 1846 the king of Denmark, having been informed of M. Ahnesorge's industrious efforts, sent him a sum of money to help in establishing a manufactory, but just as he had begun, at Neumeistler, the manufacture of cotton and woolen fabrics, mixed with his cotton from flax tow, the disastrous war of the Duchies broke out, and M. Ahnesorge sought refuge in London, where he arrived in October, 1848.

Having applied to one of the principal patent agents for advice, on what steps he should take to procure a patent for his invention, he was introduced to M. Claussen, who, delighted with his project, made an agreement with him, by which he was to take out the patent in his name. Ahnesorge commenced his labors in M. Claussen's house, in London. His articles were highly spoken of, but he wanted the necessary funds to develope the manufacture. A native of Hamburgh, named Auguste Quitzow, resolved to carry on the manufacture in a large way in Yorkshire. He bought a place between Bradford and Leeds, and with the consent of Claussen, engaged Ahnesorge to prepare the flax, and make the cotton according to his method. M. Hamel says that all the samples, both white and dyed, exhibited at the Crystal Palace in the name of Claussen, as well as in that of Quitlow, Schelennger & Co., were made by M. Ahnesorge ; the public were not informed of this circumstance. The attempts to card and spin Ahnesorge's products were made near Rochdale, in a factory that Mr. Bright, the well-known politician had placed at the disposal of M. Claussen, who had, in fact, taken out the patent in his own name. The high price of cotton, at the time of the Great Exhibition, had led to the hope that a project for substituting flax would easily find purchasers, and this was the reason why M. Claussen, described, in this patent, a process for cutting the cotton flax into small pieces, of the same length as the cotton rovings, so as to be able to card and spin them on the machines constructed for cotton. Besides, he wishes it to be supposed that, by placing the flax thus cut up, after it has been boiled in a solution of bi-carbonate of soda, into sulphuric acid diluted with water, it will split, from developing carbonic gas, in appearance resembling cotton. M. Claussen has started a company with a capital of £250,000 to £500,000, to carry on the manufacture, and he exerts every possible effort to obtain purchasers for his patent. To exhibit his patented process of splitting the flax, he has rented a place at London, where M. Ahnesorge (who is never named) has first to prepare the flax or tow by boiling it in a solution of soda, and where afterwards, the experiment of chemical effervescence is made before visitors. This is called the splitting process.

M. Hamel declares it to be impossible to change the flax into a fibrous matter resembling cotton, which is the work of nature. He is decidedly opposed to the project of cutting up the dressed flax into a sort of tow. The superiority of flax over cotton consists, in a great measure, in the greater length of its fibres. The result, therefore, would be to convert a primary valuable material into a very inferior one.

PREPARATION OF CYANIDE OF POTASSIUM.

M. Cleman, of Paris, gives the following detailed account of the process for obtaining this salt in a pure state, the accomplishment of which is a matter of some difficulty: —

Mix intimately eight parts of ferro-cyanide of potassium, perfectly de-hydrated by calcination, and three parts of perfectly dry carbonate of potash, and heat the mixture in a covered crucible, or what is better an iron pot, until the fused mass attains a red heat, when it will become limpid, and a sample taken out with the rod and cooled, will appear perfectly white, in this state all the ferro-cyanide is reduced. If the crucible be now taken out of the fire, the disengagement of the gas ceases when the mass has become a little cool, and the iron which has been separated in the operation so disposes itself, that with a little address and slight tapping of the crucible, the principal part of the cyanide of potassium may be poured off from the iron which remains in the crucible. To obtain the cyanide perfectly free from iron, place it across an iron ladle, pierced with fine holes, and strongly heated beforehand, in a vessel also heated, of greater height than width, either of silver, iron, or porcelain, or even fire ware, but with smooth sides, and let it gradually cool. In this state the ferruginous portion may be extracted by means of a sharp instrument from that which is free from iron. The purity of the cyanide of potassium entirely depends on the purity of the materials employed; the presence of sulphur in the carbonate of potash should therefore be avoided; the ferro-cyanide of potassium of commerce almost invariably contains sulphate of potass, the presence of which is objectionable. The use of purified tartar might perhaps be advantageously substituted for that of carbonate of potash. Should any sulphur be present, a sulphuret of potassium would be formed in the cyanide of that metal, from which considerable inconvenience would arise in the employment of the cyanide in chemical analysis, and in its application to the preparations of the gold, silver, and copper solutions employed in the electro-plating processes. When the mixture is melted, as before mentioned, there is at first formed only cyanide of potassium and carbonate of the protoxide of iron; but this last quickly changes, at the temperature to which it is exposed, into carbonic acid, carbonic oxide, and sesqui-oxide of iron; and this last, when the cyanide of potassium is melted, becomes converted into metallic iron. It is only by a long sustained heat that the carbonate of protoxide of iron is decomposed, so that long after the decomposition of the ferro-cyanide of potassium, and the formation of cyanide of potassium has taken place, there is still a disengagement of gas. Consequently, the proportion of cyanide of potassium, which is simultaneously formed, should entirely depend on the duration of the fusion. The iron which remains after a prolonged fusion of the cyanide of potassium, out of contact of air, being washed with hot water, disengages, when an acid is poured on it, not only hydrogen, but always a little carbonic acid gas.

If we follow the directions given in most chemical works, in which it is stated that the materials must be melted, so that the mass submitted to a bright red heat becomes tranquil, — only a grey colored product will be obtained.

If a closed iron vessel be employed, and the disengaged gases collected, it will be seen that in proportion as the temperature rises, the relative proportion between the carbonic acid and the carbonic oxide changes, the latter constantly increasing. It is evident that at a high temperature, one portion of the carbonic acid, which passes through the cyanide of potassium, should be reduced into carbonic oxide, and this reduction, without doubt, extends even in part to the carbonic oxide itself; that is to say, that its carbon is separated, and that this renders the product of a grey color. If we dissolve in cold water some cyanide of potassium completely free from particles of iron, and which has thus become grey, and filter the solution, there remains in the filter a black substance, which, being dried, burns away completely on a slip of platinum, and in fact, possesses all the qualities of charcoal. This carbon, in a state of extreme division, does not separate, either by fusion or repose, from the cyanide of potassium, on account of its feeble specific gravity. If a little of this grey cyanide be added to each new melting, it may be purified from this carbon, and no injury done to the product of the new materials employed, as the iron in separating, withdraws the finely-divided carbon, and leaves the cyanide in a state of purity.

LIQUID GLUE.

M. Dumolin publishes the following article on the preparation and nature of liquid glue, in the Comptes Rendus, Sept., 1852. Chemists well know that heating and cooling repeatedly a solution of glue, (gelatine,) in contact with the air, it looses its property of becoming a jelly. M. Gmelin has shown, that a solution of fish glue in a sealed tube, placed in a water bath heated to the boiling point for several days, exhibits the same phenomena, *i. e.* the glue remains liquid, does not gelatinize upon cooling.

The change effected, is one of the most difficult problems to resolve, of organic chemistry. It appears to be a product of the action of the oxygen of the air and the water upon the glue, as demonstrated from the action of a small quantity of nitric acid, on a solution of strong glue. We know that on treating gelatine with an excess of this acid in the presence of heat, it is converted into malic and oxalic acids, fat, tannin, &c. This does not occur when we treat the glue dissolved in its weight of water, with a very small quantity of nitric acid; we obtain only a strong glue which preserves a long time its primitive qualities, and which no longer has the property of gelatinizing. In this manner the glue sold in France under the name of liquid and unchangeable glue, is fabricated. This glue is exceedingly convenient for cabinet makers, joiners, pasteboard manufacturers, toy makers, &c., since it can be used cold. It is prepared as follows: —

Dissolve two pounds of strong glue in one quart of water in a glue kettle, or in a water bath, when the glue is entirely melted, add little by little, to the amount of ten ounces of strong nitric acid. This addition produces an effervescence due to the disengagement of hyponitric acid, when the whole of the acid is added, remove the vessel from the fire, and leave it to cool. I have preserved glue thus prepared, more than two years in a stoppered flask, without its undergoing any alteration. This liquid glue is very convenient in chemical operations. I have employed it with advantage in my laboratory, for the preservation of different gases, the same as lute, covering the little bands of linen with the glue."

PERFUMERY AND THE ARTIFICIAL EXTRACTS OF FRUIT.

DR. PLAYFAIR, in his lecture on the Results of the Great Exhibition, thus briefly notices a new class of perfumes and essences, which of late have attracted no little attention.

Much aid has been given by chemistry to the art of perfumery. It is true that soap and perfumery are rather rivals, the increase of the former diminishing the use of the latter. Costly perfumes, formerly employed as a mask to want of cleanliness, are less required now that soap has become a type of civilization. Perfumers, if they do not occupy whole streets with their shops, as they did in ancient Capua, show more science in attaining their perfumes than those of former times. The jury in the exhibition, or rather two distinguished chemists of that jury, Dr. Hoffman and M. De la Rue, ascertained that some of the most delicate perfumes were made by chemical artifice, and not, as of old, by distilling them from flowers. The perfume of flowers often consists of oils and ethers, which the chemist can compound artificially in his laboratory. Commercial enterprise has availed itself of this fact, and sent to the exhibition in the form of essences, perfumes thus prepared. Singularly enough, they are generally derived from substances of intensely disgusting odor. A peculiarly fetid oil, termed "fusel oil," is formed in making brandy and whisky. This fusil oil, distilled with sulphuric acid, and acetate of potash, gives the oil of pears. The oil of apples is made from the same fusel oil, by distillation with sulphuric acid and bichromate of potash. The oil of pine apples is obtained from a product of the action of putrid cheese on sugar, or by making a soap with butter, and distilling it with alcohol and sulphuric acid, and is now largely employed in England in the preparation of the pine apple ale. Oil of grapes and oil of cognac, used to impart the flavor of French cognac to British brandy, are little else than fusel oil. The artificial oil of bitter almonds now so largely employed in perfuming soap, and for flavoring confectionery, is prepared by the action of nitric acid on the fetid oils of gas tar. Many a fair forehead is damped with eau de millefleurs, without knowing that its essential ingredient is derived from the drainage of cow houses. The wintergreen oil, imported from New Jersey, being produced from a plant indigenous there, is artificially made from willows, and a body procured in the distillation of wood. All these are direct modern appliances of science to an industrial purpose, and imply an acquaintance with the highest investigations of organic chemistry. Let us recollect that the oil of lemons, turpentine, oil of Juniper, oil of roses, oil of copaiba, oil of rosemary, and many other oils, are identical in composition; and it is not difficult to conceive that perfumery may derive still further aid from chemistry.

Prof. Fehling, in the Wurtemberg Journal of Industry, gives the following abstract of what is at present generally known respecting the composition and production of some of the artificial extracts of fruit. He says:

Amongst the chemical preparations exposed at the London Exhibition, the artificial extracts of fruits were particularly deserving of attention. Although some of these extracts, as, for instance, butyric ether, have already found applications, their use has been hitherto only on a very limited scale. It is now, however, no longer to be doubted but that the majority of our artificial organic compositions will, ere long, be extensively applied, and their practical applications cannot but have a very stimulating effect on the study of organic chemistry, which will again most probably lead to the discovery of technical applications for the new organic compositions, which the investigations of our modern chemists have furnished us with. Among the extracts of fruit exhibited by a London manufacturer, those which more particularly attracted attention were pine apple oil, bergamot pear oil, apple oil, grape oil, cognac oil, &c. Several of these oils have been analyzed by M. Faiszt, of Stuttgardt. We give here a succinct description of some of these extracts, and of their manufacture.

Pine Apple Oil.—This product consists of a solution of 1 part of butyric acid ether, in 8 to 10 parts of spirits of wine. For preparing butyric acid ether, pure butyric acid is required, and this is obtained most readily, and in the greatest purity, by the fermentation of sugar or of St. John's bread, (*siliqua dulcis.*) For preparing butyric acid from sugar, M. Bentch takes a solution of 6 pounds of sugar, and half an ounce of tartaric acid in 26 pounds of water, which is left to stand for some days; at the same time about a quarter of a pound of old decayed cheese is diffused in 8 pounds of sour milk, from which the cream has been removed; and after this has also stood for some days, it is mixed with the first solution, and the whole is kept from four to six weeks at a temperature of about 24° to 28° Reaumer, water being added from time to time to replace that which is lost by evaporation. After the evolution of gas has entirely ceased, the liquid is dissolved with its own bulk of water, and finally 8 pounds of crystallized soda, dissolved in 12 pounds to 16 pounds of water, are added to it. The liquid is then filtered and evaporated till it weighs only 10 pounds, when a quantity of 5½ pounds of sulphuric acid, (*nordhausen*, or fuming sulphuric acid,) diluted with 5½ pounds of water, is carefully mixed with it by small portions at a time. The butyric acid, in the state of an oily substance, will now appear on the surface of the liquid, from which it may be skimmed off; but as the remaining liquid still contains some butyric acid, it is submitted to distillation, by which means another portion of diluted butyric acid is obtained, which may be concentrated by means of melted chloride of calcium, or by saturating it with carbonate of soda, evaporating and decomposing by sulphuric acid. By this method 1¾ pounds of pure butyric acid are obtained from 6 pounds of sugar.

M. Marsson says that the same product may be obtained from St. John's bread, (*siliqua dulcis*,) by taking 4 pounds of mashed St. John's bread, and mixing it with 10 pounds of water and 1 pound of chalk; the liquid matter must be maintained from three to four weeks at a temperature of from 25° to 35° Reaumer, and be often and well stirred, and from time to time the water that has evaporated must be replaced. After all fermentation has ceased, a quantity of water equal to the bulk of the liquid is added to it, and afterwards a concentrated solution of 2½ pounds to 2¾ pounds of carbonate of soda, when it is finally evaporated. To the concentrated liquid is then added 1½ pounds to 2 pounds of sulphuric acid, diluted with 2 pounds of water; and the remainder of the process is performed in the same manner as already described. By this method a little more than half a pound of colored butyric acid will be obtained. The acid, however, retains a peculiar smell from the St. John's bread, which continues even in the ether prepared from the same, whereas that prepared from sugar gives an ether of a very pure smell. It will be found advantageous to agitate the oily butyric acid with chloride of calcium, in order to deprive it entirely of its moisture.

For preparing butyric acid ether, (butyrate of oxide of ethyle,) from butyric acid, 1 pound of butyric acid is dissolved in 1 pound of rectified alcohol, (95° Tralles,) and is mixed with one-half to one-fourth of an ounce of concentrated sulphuric acid; the compound is heated for some minutes, when the butyric acid ether will form a thin layer on the top. The whole is then mixed with half of its bulk of water, and the upper layer taken off; the remaining liquid being submitted to distillation, yields another quantity of butyric acid ether, which is mixed with that obtained in the first instance, and the whole well agitated with a very diluted solution of soda, in order to deprive it of all the acid; which operation should be repeated several times if a very pure ether is desired to be obtained. Care should be taken to use but small quantities of the diluted soda solution at a time, so as not to lose too much ether, this latter being in some measure soluble in water. When large quantities are to be acted upon, the washing water (*eau de lavage*,) is collected, mixed with an equal volume of spirits of wine, and distilled, by which means a solution of pure butyric acid ether in spirits of wine is obtained.

Butyric acid ether may be also obtained immediately from butyrate of soda, by dissolving 1 part of this salt in 1 part of rectified alcohol, adding 1 part of sulphuric acid, and heating some minutes. The ether collects on the top of the liquid, and is purified by washing with water and with diluted soda solution.

For preparing pine apple oil, 1 pound of butyric acid ether is dissolved in 8 pounds to 10 pounds of spirits of wine, which should have been previously deprived of its empyreumatic or fusel oil. Pure French spirits of wine will be found best suited for this purpose. According to the purpose for which the pine apple oil is to be applied, either rectified alcohol of 80° to 90° Tralles, or brandy of 40° to 50°, should be used for dissolving the ether. 20 drops to 25 drops of such an extract will suffice for giving a strong pine apple odor to 1 pound of sugar solution; to which some acid, such as tartaric or citric acid, is generally added.

Bergamot Pear Oil. — What is called pear oil is an alcoholic solution of acetate of oxide of amyle, and acetate of oxide of ethyle, prepared from potato fusel oil, (the hydrate of oxide of amyle.) The potato fusel oil, or oil of potato spirits (in German, *fuseloel*,) is the compound distilled over towards the end of the first distillation of spirits made from potatoes, and is an oily liquid of a very strong and nauseous odor. This oil, in the state in which it is obtained from large potato brandy distilleries, is never pure; but it may be purified by agitating it with a diluted soda solution, when the pure fusel oil collects as an oily layer on the top of the liquid; this oily substance is then submitted to distillation, and that part which distils over at 100° to 112° Reaumer, is collected, and forms the pure fusel oil.

For preparing acetate of oxide of amyle from this fusel oil, 1 pound of pure ice vinegar is mixed with an equal quantity of fusel oil, to which is added half a pound of sulphuric acid; the liquid is digested for some hours at about 100°, when the acetate of oxide of amyle separates, particularly on being mixed with a small quantity of water. The remaining liquid, when mixed with more water, yields, on being submitted to distillation, a further quantity of acetate of oxide of amyle. The entire mass of acetate of oxide of amyle thus obtained is now agitated several times with water, and a little soda solution, in order to deprive it of all free acid.

The acetate of oxide of amyle may also be obtained by taking 1 part of fusel oil to 1½ part of dry acetate of soda, or 2 parts of dry acetate of potash, with 1 to 1½ parts of sulphuric acid. The liquid having been kept for some time at a gentle heat, the acetate of oxide of amyle is separated by adding water, and proceeding as above explained. 15 parts of acetate of oxide of amyle are mixed with 1½ part of vinegar ether (vinegar naptha, acetate of oxide of ethyle,) and dissolved in 100 to 120 parts of spirits of wine, as in the case of pine apple extract; an acid, for instance, tartaric or citric, should be added to the sugar solution, on making use of the pear extract, which addition makes the flavor of the bergamot pear better distinguishable, and the taste acquires at the same time more of the refreshing qualities of fruit.

Apple Oil. — What is called apple oil, is a solution of valerianate of oxide of amyle in spirits of wine, which may be obtained as a secondary product when fusel oil is distilled with chromate of potash and sulphuric acid for the preparation of valerianic acid. The light solution which collects in the tops of the distilled liquid contains valerianate of oxide of amyle, together with other liquids, such as aldehyde, which gives to the product a less agreeable taste and smell. It is therefore to be preferred for preparing pure valerianate of oxide of amyle.

For preparing valerianic acid, 1 part of fusel oil is mixed by small portions with 3 parts of sulphuric acid, and afterwards 2 parts of water are added. At the same time, a solution of 2¼ parts of bichromate of potash in 4½ parts of water, is heated in a tubular retort; the first liquid is then permitted to flow very slowly into the liquid of the retort in such manner that the boiling continues but very slowly. The liquid which is distilled over is saturated with carbonate of soda, and is evaporated either to dryness for obtaining valerianate of soda, or to the consistency of syrup, when sulphuric acid is added, (say two parts of concentrated acid diluted with the same quantity of water, for every three parts of crystalline carbonate of soda.) The valerianic acid forms an oily layer, on the upper part of the liquid; which latter will still yield some valerianic acid, on being submitted to distillation. For preparing valerianate of oxide of amyle, 1 part by weight of pure fusel oil (hydrate of oxide of amyle,) is mixed carefully with an equal quantity by weight of common English sulphuric acid; the resulting solution is added to 1¼ parts of oily valerianic acid, or to 1½ parts of dry valerianate of soda, and is treated by a water bath, and then mixed with water, by which means the impure valerianate of the oxide of amyle will be separated; this is washed several times with water, afterwards with a solution of carbonate of soda, and finally again with water. In preparing this compound, it is essential, that the mixture of sulphuric acid and fusel oil, with valerianic acid, should not be heated to a too high degree, or too long, as the product would thereby acquire an insufferably pungent smell, when required for use. 1 part of valerianate of oxide of amyle is dissolved in 6 or 8 parts of spirits of wine, and acid is added in the same manner, as has been before explained in the preparation of other extracts.

Artificial Oil of Bitter Almonds. — When Mitscherlich, in 1834, discovered nitro-benzole, he little thought, after twenty years to find this body in an industrial exhibition. He certainly, at that time pointed out the remarkable resemblance which the odor of nitro-benzole had to that of oil of bitter almonds; but the only sources for obtaining benzole at that time, viz., the oil of compressed gas, and the distillation of benzoic acid, were much too expensive, and put an end to the idea of substituting the use of nitro-benzole for oil of bitter almonds. Mansfield, however, in 1849, showed by careful investigation, that benzole may be procured easily and in large quantities from oil of coal tar, and this discovery has not been lost sight of in the arts. Among the articles of French perfumery in the Great Exhibition, with the title of *artificial oil of bitter almonds*, and the fanciful name of *essence of Mirbane*, there were several specimens of oils, which consisted of more or less pure nitro-benzole. The apparatus used in the preparation of this substance is that proposed by Mr. Mansfield. It consists of a large glass worm, the upper end of which branches into two tubes, which are provided with funnels. A stream of concentrated nitric acid flows slowly through one of these funnels, whilst the other is for the benzole, (which for this purpose need not be absolutely pure.) At the point at which the tubes of the funnels are united, the two bodies come in contact, the chemical compound formed becomes sufficiently cooled in passing through the worm, and only requires to be washed with water, and finally with some weak solution of carbonate of soda, to be ready for use. Although the nitro-benzole closely resembles oil of bitter almonds, in physical properties, it possesses, however, a somewhat different odor, readily recognized by a practised person. However it answers well for scenting soap, and would be extensively applicable for confectionary and for culinary purposes. For the latter purpose it has the special advantage over oil of bitter almonds, that it contains no prussic acid.

The application of organic chemistry to perfumery, is still in its infancy; and we may expect that a careful survey of those ethers and etherial compounds with which we are at present acquainted, and those which are daily being discovered, will lead to further results. The interesting caprylic ethers which M. Blouis has lately discovered are remarkable, for their extremely aromatic odor, (thus the acetate of caprylic oxide possesses an odor as strong as it is agreeable,) and promises, if they can be obtained in larger quantities, to yield materials for perfumery. — *Hoffman's letter to Liebig.*

The subject of the composition and artificial production of the various extracts of fruit and other similar perfumes and essences, strikingly illustrates the wonderful progress which has been made in organic chemistry within the last few years. A position has been taken by some chemists who have carefully investigated this subject, which cannot at present be controverted, that the extracts or perfumes

20*

of the various fruits which can be artificially prepared in our laboratories from the basic organic radicals, are identical, and the same with those which nature carefully elaborates in the apple, the pear, the pine apple, banana, and the like. The whole subject has been investigated more carefully, and has been applied to more practical purposes than the public is generally aware of. Take for instance the well known perfumes, known as "Lubin's Extracts," extract of geranium, millefleurs, new-mown hay, and many others; all of these are stated to be prepared from two or three of the common and cheap essential oils, and from the organic radicals. In addition to perfumes the most agreeable, odors of the most disgusting and nauseous character can also be produced by like means; as for instance, the odor of the bedbug, squash-bug, and of many of the common weeds and plants. As an odor, or perfume of a different character can be produced by the action of each different acid on the different oxides of the organic radicals, the number of bodies of this character capable of being produced is almost innumerable, and may possibly embrace every known odor, or perfume, which is now recognized in the animal, vegetable, or mineral kingdom.

The various artificial extracts of fruit have been applied to the flavoring of an agreeable species of confectionary known as the "acidulated fruit drops." These have been denounced as poisonous by some persons, on the ground that fusel oil is known to produce deleterious effects; and as a natural consequence the confectionary referred to has been discarded. There is, however, no foundation for such statements or belief, and if the confectionary flavored with these extracts has in any case produced injurious effects, it is undoubtedly to be referred to an injudicious consumption of it, and not to any inherent deleterious property. — *Editor.*

POISONOUS CHLOROFORM.

The following is a extract from a letter addressed to the Boston Medical and Surgical Journal, by Dr. C. T. Jackson, respecting the poisonous qualities of chloroform, when the so-called fusel oil is contained in it.

Dr. Jackson says: — I have had a strong suspicion that the very sudden deaths resulting from the inhalation of chloroform must have been produced by the presence of some poisonous compound of amyle, the hypothetical radical of fusel oil, or the oil of whisky; and I began a series of researches upon this subject several years ago, but was called off from my work by unexpected persecutions. This work I have resumed, and I will now state what facts and inductions I am able to lay before the public:

1. When chloroform, and the alcoholic solution of it called chloric ether, was made from pure alcohol diluted with water, no fatal accidents occurred from its judicious administration.

2. When chloroform was made, as it now too frequently is, from

common corn, rye and potato whisky, death began to occur, even when the utmost care was taken in its administration.

From these data, it might justly be inferred that some poisonous matter exists in the cheap chloroform of commerce, and I suspected that it arose from the fusel oil which exists in the whisky. Having succeeded in procuring some very pure fusel oil, (of whisky,) I undertook the researches which have resulted in the conviction that it is the amyle compound that produces the poisonous matter of certain kinds of chloroform. When mixed with hypochlorite of lime (bleaching powder) and water in the same way as we prepare alcohol for the production and distillation of chloroform, I found that the mixture in the retort, after agitation and standing some time, became warm, indicating that a reaction was taking place between the fusel oil and the hypochlorite of lime.

After some hours the retort was placed in a water bath, and distillation was effected, the volatized liquid being condensed by means of one of Liebig's condensers. A clear colorless liquid came over, which was at once recognized as having the peculiar odor of bad chloroform. It is perhaps a ter-chloride of amyle, but has not yet been submitted to analysis. It is so powerful that merely smelling of it makes one dizzy. In order to make sure that the fusel oil was all decomposed, I again mixed the product of distillation above mentioned, with a new lot of bleaching powder and water; and after three hours, with frequent agitation, it was again distilled, and gave what I regard as the pure unmixed poison.

If my views are correct, it follows:

1. That all chloroform intended for inhalation as anæsthetic agent, should be prepared from pure rectified alcohol, to be diluted with water when used for distillation from hypochlorite of lime.

2. That no druggist should sell for anæsthetic uses, any chloroform which is not known to have been properly prepared as above suggested.

3. That the mixture of chloroform and alcohol, commercially known under the name of strong chloric ether, must be made with the same precaution as chloroform.

The following experiments were subsequently made by Dr. Jackson, which conclusively prove the poisonous effects of fusel oil when mixed with chloroform: — A full grown rat, confined in a quart glass jar, inhaled the vapor of the fusel oil compound 40 minutes without any apparent injury.

A kitten seven days old inhaled the vapor of this compound nineteen minutes, without apparent effect.

Three kittens, of the same litter, were confined in three separate vessels, also saturated with this vapor, thirty-three minutes, and when released appeared as unharmed as a fourth kitten, of the same litter, confined in a similar vessel supplied with atmospheric air.

A person inhaled this vapor twelve minutes without any effect.

The rat, of the above mentioned experiment, was then exposed to the mixed vapors of chloroform and of the fusel oil compound. In fifty-five seconds he rolled upon his side, and in three and a quarter minutes he was taken out dead.

A half-grown cat, in a vessel of equal capacity, bore the vapor of chloroform alone but thirty seconds before he fell on his side, and was taken out dead in two minutes.

A kitten, of the litter above mentioned, exposed to the vapor of chloroform, became insensible in two minutes. It was taken out in two minutes and twenty-three seconds and partially revived. It was again returned to the jar, and in two minutes became insensible, but continued to breathe slowly for nine minutes, when it was taken out, and finally recovered.

In all the above experiments the air in the jars was repeatedly removed with the aid of a bellows.

CHLORIC ETHER, CHLOROFORM, AND TINCTURE OF CHLOROFORM.

THE following statement prepared by Dr. A. A. Hayes, of Boston, at the request of Dr. Warren, and published in the Boston Medical Journal, clearly sets forth the distinction between the various anæsthetic agents, chloric ether, chloroform and tincture of chloroform.

Chloric Ether. — This substance is the product arising from the action of hypochlorites of the alkalies, alkaline earths, on a large excess of alcohol, much diluted with water. It is obtained by distillation, and when carefully prepared contains chloroform, chlorinated ether, and alcohol. In its formation, a large quantity of acetic acid is produced, and unites with chlorine and the base of the hypochlorite used in producing it.

It is a permanent compound, possessing the grateful odor and sweet taste of chloroform; when evaporated from the hand, or clean linen, it leaves no odor adhering to the surface. In this state it is efficient and convenient for use, as an anæsthetic agent. It is indefinite in composition, but when decomposed by mixture with two bulks of water, it should deposit about one-third of its original bulk of heavy oily fluid. The extended use of this substance by some of the surgeons of the Massachusetts General Hospital, has led to the attempt to substitute for it, the tincture of chloroform. It will be seen that these are not like bodies, and as it is more difficult to prepare chloric ether than chloroform, the manufacture of the former will doubtless remain in the hands of the skilful pharmaceutists.

Chloroform. — This substance, as a secondary product, is found after many reactions, in which chlorine and hydrocarbons are present. When obtained from hypochlorites and alcohol, the proportion of the latter substance is very small relatively to that of the hypochlorite used. After careful purification it is a definite compound of well-known physical characters. There is, however, an important chemical character recently observed, which should form a part of its history— it is decomposed by solar light. In the early stages of its changes, the odor remains fragrant for some time, but is succeeded by a suffocating and corrosive vapor, arising from the action of hydrochloric (muriatic) acid on hydrocarbons present. If the remaining chloroform is carefully washed and purified, and again exposed, the same changes succeed; conclusively proving that the property is inherent.

The risk attending the use of compounds having the same odor, but really foreign in composition arising from the use of alcohol, which contains fusel oil, in the manufacture of chloroform, is obvious. There is, however, a preparation sold under the name of tincture of chloroform, which is objectionable, and as it has been substituted for chloric ether, has been examined.

When chloroform is added to alcohol of 85 per cent., it dissolves until about double the value of the alcohol has been mixed. After subsidence, a singular change has taken place; the water, fusel oil, and some alcohol, unite to form a layer on the surface of the dense alcoholic solution of chloroform. This may be removed, but the solution remains too strong for use. Any alcohol of the shops added, introduces water, hastening the change which chloroform undergoes. When anhydrous alcohol is used, unless distillation has been a resort, the tincture is subject to the same change from neutral to acid state, as chloroform exhibits. After such change hydrochloric acid may be found in it uncombined, unfitting it for any use.

Theoretically and from observation, the compound chloric ether seems to be the most permanent and convenient form in which the power of chloroform can be exhibited, and as such, should take the place of chloroform, in medical and surgical practice.

The following correct method of preparing chloric ether, is furnished by Mr. Atwood, of Boston, a chemist of much experience in the subject. He says: —

"In my process for the production of chloric ether, the alcohol is perfectly freed from fusel oil. A larger proportion of alcohol and water are also employed than in the manufacture of chloroform. The following are the proportions I use, viz: — Chloride (hypochlorite) of lime, 10 lbs.; water, 8 gallons; pure alcohol, 1 gallon; carbonate of soda, (crystallized,) half pound. Break down the chloride of lime in the water until the excess of hydrate of lime is in a uniform pulpy mass, and the chloride is perfectly dissolved. Place the mass in a still capable of containing twice the quantity, and introduce the alcohol. Mix perfectly and apply a moderate fire under the still until distillation commences. Continue the distillation as long as a portion of the distillate will deposit chloroform on being mixed with its bulk of water, then change the receiver and collect one gallon of alcoholic liquid.

Add water to the first portion of the distillate as long as chloroform is precipitated. Separate the light liquid from the chloroform, and wash the latter in twice its bulk of water containing the carbonate of soda. Separate the chloroform from the carbonate of soda and weight it.

Mix the chloroform, washings, and alcoholic liquid in a still placed in a water-bath. After twenty-four hours' repose, distill three times the weight of the chloroform, and mix perfectly. Preserve in well-stopped bottles.

The 'chloric ether' must not redden litmus paper, or give rise to a precipitate when mixed with a solution of nitrate of silver."

ON THE VULCANIZATION OF INDIA RUBBER.

An elaborate memoir on the sulphuration of caoutchouc has been communicated to the French Academy by M. Payen, of which the following is an abstract. The principal conditions of success, says M. Payen, in the practical operation of sulphuration have been carefully determined in England, America and France, but it has not been known in what the chemical action consisted; there was no accurate idea concerning what has been called the desulphuration; finally, certain alterations, especially the rigidity and fragility of several objects after sometimes a very short duration of the use for which they were destined, could not be comprehended, nor, consequently, prevented. The researches I have undertaken, will, I think, clear up this point of applied science; I will first describe what occurs in one of the first processes of vulcanization, still employed by several manufacturers. If a sheet of caoutchouc, two or three millimetres in thickness, be kept for two or three hours immersed in sulphur, liquified at the temperature of 201° to 208° Fahr., the liquid will penetrate into the pores as water or alcohol would do, and the weight of the sheet will be increased 10 or 15 per cent. No considerable modification, however, will have been made in the properties of the organic matter; it may be fashioned, and its recent sections joined the same as in the normal state. Solvents will attack it with the same energy. It is, however, less porous. If, then, we raise in any medium whatever, inert of itself, the temperature to 275°, 302°, or 320° Fahr., the conversion will be effected in a few minutes. The mark would be overshot by prolonging the action of the heat; the product would become gradually less supple and less elastic, and would very soon be hard and brittle. This last alteration would be more complete if the caoutchouc were maintained at the same temperature, (275° to 320° Fahr.,) in fused sulphur; the proportion of the latter body absorbed would gradually increase, until it became, in 24 hours, almost equal to the weight of the organic matter, or would constitute 48 per cent. of the compound. From the commencement of the action of the sulphur at this temperature, a slight but continuous disengagement of sulphuretted hydrogen occurs. At the same time an equivalent quantity of organic matter, containing more carbon than caoutchouc does, is separated, and may be extracted with a hot solution of caustic potassa or soda, which do not perceptibly attack the mass of caoutchouc combined with the sulphur. Liquid sulphur, at the temperature of 302° absorbs, and may retain, a volume of sulphuretted hydrogen almost equal to its own. A curious phenomenon results from the foregoing facts. At the moment when the abatement of temperature allows the sulphur to crystalize, every crystalline particle liberates a bubble of gas; the latter is sometimes disengaged, and sometimes is interposed among the crystals; so that the entire mass gradually swells up, increases from 15 to 20 per cent. in its original bulk, instead of diminishing, as it should have done during a normal crystallization of sulphur.

Instead of making the liquid sulphur penetrate at a temperature approaching its fusing point, caoutchouc may be mixed by means of a mechanical grinding, with 12 or 20 times its weight of sulphur in fine powder; the properties of the organic substance are not changed, it may be modelled and joined as in the normal and unmixed state. If the temperature be then raised to the degree at which the vulcanization is effected, it takes place as in the first case, and the above mentioned alterations would likewise be manifested. In regard to the composition and properties of the caoutchouc vulcanized by the means above indicated, it has been found, that when the suitable term has not been exceeded, the organic matter contained sulphur in two different states; from 1 to 2 per cent. are retained in intimate combination, and the surplus remains simply interposed between its pores. The sulphur in excess, uncombined, is gradually eliminated from the caoutchouc by the mechanical action alternately exerted by the extension which closes the pores, and the contraction which opens them. This effect lasts for several months. Many chemical agents more or less quickly or completely effect the elimination of the interposed sulphur, especially solutions of caustic potassa or soda, with the aid of heat, (and even without heat if renewed several times within a month,) sulphuret of carbon, essence of turpentine, benzine and anhydrous ether. These liquids swell up the organic matter to such an extent that its volume is very soon increased eight or nine times. Ether removes sulphur in a very peculiar manner; a small portion is first dissolved, and then carried out, when it is separated into crystalline particles; other particles successively dissolved in the interior follow the same course, and the crystals soon become very bulky, affecting the octahedral form. Neither essence of turpentine, or benzine bring to the outside the crystalline particles of sulphur carried into the thickness of the swelled-up substance. Ether and sulphuret of carbon, kept for a long time in contact with vulcanized caoutchouc retain in solution 4 or 5 hundredths of caoutchouc, which may be isolated by evaporating several times and redissolving in ether which eliminates the free sulphur, and then by alcohol which removes from 1 to 1-50 per cent. of fatty matter. The caoutchouc thus extracted may be separated into two parts; one, very ductile dissolved by benzine, which deposits it in evaporating; the other more tenacious, and less extensible, is not dissolved. These two parts come from the interior of the plates, at a certain depth where the combination is less intimate and less abundant in sulphur than near the surface. After vulcanization, caoutchouc is also formed of two parts endowed with unequal cohesion and solubility; this is recognized by keeping a strip steeped for two months in a mixture of 10 parts of sulphuret of carbon and one part of anhydrous alcohol; the portion dissolved consists of interposed sulphur, which is removed after dessication by a solution of caustic soda; there then remains the least aggregated and least resistant organic substance, which is yellowish and translucent. The undissolved portion then remains under the form of a tenacious strip, which has become brown and less transparent. The following are the proportions obtained, besides the fatty matter: tenacious insoluble portion, 65; soft soluble portion, 25; sulphur in excess, 10.

The process of vulcanization in the cold way, invented by Mr. Parker, of England, consists in immersing the sheets, or tubes of caoutchouc in a mixture of 100 parts of sulphuret of carbon, and 2.5 protochloride of sulphur. The liquid in penetrating into the organic substance, swells it, and deposits the sulphur, which combines with the caoutchouc, abandoning the unstable combination which it formed in the chloride. The superficial portion would be too strongly vulcanized and become brittle, if these objects were not removed in one or two minutes, and immediately immersed in water. In this case the chloride of sulphur, decomposed by its contact with the water, ceases to act on the surface, while the portions which have entered farther in continue their sulphurizing action on the interior. This is an ingenious means of regulating this kind of vulcanization by the cold way.

A process, which seemsstill more preferable, as regards the healthiness and regularity of the operation, is due to the same inventor. It is effected by keeping the objects to be vulcanized immersed for two or three hours in close vessels, in a solution of 25° Baume, of polysulphuret of potassium, at a temperature of 284° Fahr., and submitting to a washing in an alkaline solution, and then in pure water. We are thus enabled to combine caoutchouc with a useful proportion of sulphur, without allowing an excess of it to be interposed in its pores, thus avoiding the inconveniences of the unequal sulphurization of the organic substance.

COMPOSITION FOR SILVERING GLASS.

PREPARE a mixture of 30 grains ammonia, 60 grains nitrate of silver, 90 grains spirit of wine, and 90 grains of water. When the nitrate of silver is completely dissolved, filter the liquid and add a small quantity of sugar, for example, 15 grains of the grape sugar previously dissolved in a mixture of 1½ ounces of water, and 1½ ounces spirit of wine.

For silvering a glass it is sufficient to leave this solution in contact with the glass during two or three days.— *Civil Engineer and Architect's Journal.*

PREPARATION OF PURE METHYLIC ALCOHOL.

WOHLER has given a very simple and elegant method of preparing pure wood-spirit from the raw material of commerce, which is of interest both to the chemist and pharmaceutist. Raw wood-spirit is to be mixed with an equal weight of sulphuric acid, avoiding an elevation of temperature. The mixture is to be allowed to stand a day, then distilled from two parts by weight of binoxalate of potash. A volatile fluid at first passes over, after which the oxalate of methyl condenses in the neck of the retort. The receiver is now to be changed and the distillation continued as long as the ether comes over. The neck of the retort is then to be gently warmed and the oxalate allowed to flow into the receiver when it is to be strongly pressed between folds of bibulous paper, and then freed from volatile products by long fusion. In this way it is obtained directly perfectly colorless. The liquid which passes over first contains also oxalate of methyl which is readily obtained by evaporation and crystallization. The pure oxalate of methyl prepared in this manner is now to be distilled with water; pure wood-spirit passes over and oxalic acid remains in the retort. [This method obviously presents great advantages over the tedious processes of Dumas and Kane.] — *Ann. der Chemie und Pharmacie*, lxxxi.

FORMATION OF SULPHURIC ACID FROM SULPHUROUS ACID AND OXYGEN.

Wohler has published a few observations relating to the formation of sulphuric acid, which, although involving no new principle, promise to be of great importance in a manufacturing point of view. The action of spongy platinum at a high temperature upon a mixture of sulphurous acid and air or oxygen, has long been known. A patent was even granted to Peregrine Phillips for the manufacture of sulphuric acid by this process, the anhydrous acid formed being condensed and united to water in an appropriate receiver. The method was however abandoned as a more extended experience showed that the platinum speedily lost its power of condensation. Wohler has now found that various metallic oxides possess in a high degree the property of causing the union of mixed gases. When the oxides of copper, iron, or chromium, are heated to a low redness in a glass tube and a mixture of sulphurous acid and air or oxygen is caused to pass over them, thick white vapors of anhydrous sulphuric acid are formed. A mixture of the oxides of chromium and copper prepared by precipitation was found to be particularly efficient; the same quantity of oxide appeared capable of converting an unlimited quantity of the mixed gases into sulphuric acid, and the production of sulphuric acid was so easy and rapid as to lead to the idea of practical application on a large scale. Metallic copper in a state of powder produces sulphuric acid in a similar manner, but only when heated and when its surface has become converted into oxide. No hydrate of sulphuric acid is formed by passing the vapor of water over the oxide at the same time with the gaseous mixture. Platinum foil polished and cleaned acts upon the gaseous mixture like spongy platinum, but not at ordinary temperature. A mixture of the oxides of copper and iron prepared by precipitation and ignited, becomes and remains incandescent when warmed and held in a current of hydrogen gas.— *Ann. der Chemie und Pharmacie*, lxxxi.

ON THE DECOLORIZING POWER OF CHARCOAL AND OTHER BODIES.

It is generally said that charcoal is the only simple body which possesses the property of absorbing coloring matters dissolved in a liquid; it results, moreover, from the labors of Bussy and Payen, that decoloration by charcoal is a purely physical phenomena, a phenomena of dyeing. Several compound bodies, (alumina, sulphuret of lead prepared by the humid way, and hydrate of lead) also possess the property of decoloring liquids; but chemists for the most part, regard the action which the oxides exert on coloring matters in the preparation of lakes as a chemical action, different from that of charcoal. However, Berzelius thought he might compare the decoloration by the oxides and the metallic salts with that produced by charcoal. In a communication submitted to the French Academy by M. Filhol, the author proves that charcoal is not the only simple body which possesses the property of decoloring liquids; sulphur, arsenic, and iron, resulting from the reduction of hydrogen, have appreciable decoloring power. The number of compound bodies endowed with an appreciable decoloring power is much greater than has been supposed, as this property seems to depend much more on the state of division of these bodies than on their chemical qualities. It was also shown that a certain body which easily appropriates one coloring matter, may have very little tendency to remove another; thus bone phosphate of lime (artifically obtained) with difficulty decolors a solution of sulphindigotate of soda, whilst it acts on tincture of litmus more energetically than animal black. The decoloration is in the great majority of cases, a purely physical phenomena; thus, the same coloring matter is absorbed by metalloids, metals, acids, bases, salts, and organic substances, besides it is easy, by employing suitable solvents, to procure the color unaltered from the body by which it had been absorbed. — *Comptes Rendus*, 1852.

DEODORIZING PROPERTIES OF COFFEE.

The London Medical Gazette gives the result of numerous experiments with roasted coffee, proving that it is the most powerful means, not only of rendering animal and vegetable effluvia innocuous, but of actually destroying them. A room in which meat in an advanced degree of decomposition had been kept for some time, was instantly deprived of all smell, on an open coffee roaster, being carried through it, containing a pound of coffee newly roasted. In another room exposed to the effluvium occasioned by the clearing out of a cess pit, so that sulphuretted hydrogen and ammonia in great quantities could be chemically detected, the stench was completely removed within half a minute, on the employment of three ounces of fresh roasted coffee, whilst the other parts of the house were permanently cleared of the same smell by being simply traversed with the coffee roaster, although the cleansing of the cess pit continued several hours after.

The best mode of using the coffee as a disinfectant is to dry the raw bean, pound it in a mortar, and then roast the powder on a moderately heated iron plate until it assumes a dark brown tint, when it is fit for use. Then sprinkle it in sinks or cess pools, or lay it on a plate in the rooms which you wish to have purified. Coffee acid or coffee oil acts more readily in minute quantities.

ADULTERATION OF BEER WITH STRYCHNINE.

Graham and Hoffman, at the instance of a prominent English brewer, Mr. Alsopp, and in consequence of reports, originating in Paris, that English ale and beer occasionally derived its bitterness from strychnine, have carefully tested various specimens of these beverages, but without discovering a trace of the poisonous alkaloid. Strychnine when present in no greater quantity than 1-1,000 of a grain may be detected by the following process. The suspected powder is to be moistened with a drop of undiluted sulphuric acid and a few fragments of bichromate of potash added. An intense beautiful violet color immediately appears at the points of contact which quickly spreads through the whole fluid, and after a few minutes again vanishes. The presence of small quantities of organic matter prevents this reaction; in testing beer the authors adopted the following process. Half a gallon of beer to which half a grain of strychnine had been added was shaken with two ounces of animal charcoal, and the fluid allowed to stand over night. The next day the beer was found to be almost free from bitterness, the strychnine having been precipitated with the coal. The coal was thrown on a filter, washed, boiled with alcohol and the alcoholic filtrate distilled. The residue in the retort was shaken with a few drops of a solution of caustic potash and about an ounce of ether. The etherial solution evaporated on a watch glass gave a mass in which the presence of strychnine was easily detected by the test above given.—*Ann. der Chemie und Pharmacie.*

ADTLTERATION OF ANCHOVIES.

The London Lancet gives the result of the investigation of the Analytical Sanitary Commission into the composition of "Anchovies," as vended in the metropolis. Having analyzed 28 samples, the following conclusion has been arrived at: That seven of the samples consisted entirely of Dutch fish. That two of the samples consisted of a mixture of Dutch fish and anchovies. That the brine in 23 of the samples was charged with either bole Armenian or Venetian red, the quantity varying considerably in amount; but in most cases the brine was saturated with these earthy powders to such an extent that they might be obtained and collected from the botton of the bottles almost by teaspoonfulls. The commissioners add: —"It is not to be inferred that these samples in which no Dutch fish were detected consisted of the true anchovy, since we have ascertained that two other kinds of fish besides the Dutch are commonly imported and sold as 'true anchovies,' and 'real Gorgonas' — namely French and Sicilian fish." A further investigation established the fact, that not one-third of the 28 samples consisted of Gorgona anchovies.

ON THE ANALYSIS OF OPIUM, ESPECIALLY WITH REFERENCE TO THE PROPORTION OF MORPHIA CONTAINED IN IT.

The following new process for the examination of opium is given by Dr. Riegel, of Carlsruhe, in the *Jahrbuch de Pharmacie*, Nov.——. Half an ounce of opium to be examined is cut in small pieces and bruised in a mortar with alcohol at 71°; the fluid is then expressed through linen, and the refuse washed with from ten to twelve drachms of the same alcohol; the alcoholic solution is then to be filtered into a glass containing one drachm of spirits of ammonia. In twelve hours' time, all the morphia, with some narcotine and meconate of ammonia, will have become deposited. In order to effectually separate the morphia, the adhering meconate of ammonia must be removed by washing in water and then shaking the crystals in pure ether, or better still in chloroform, in which the narcotine is readily dissolved, while the morphia remains entirely insoluble. After this treatment the morphia remains behind in large gritty crystals, slightly discolored. This process may be varied by employing boiling alcohol and powdered opium, and adding the solution still hot, to the solution of ammonia. According to good authorities, 15 grammes of opium should yield at least 1.25 grammes, or 8.33 per cent. Reich estimates 10, and others 12 per cent. The author gives the percentage of morphia which is obtained by the various processes of different experiments, and states that the largest proportion (13.50 per cent.) is procured by the process above described, which he considers also to be the simplest and most certain for ascertaining the proportion of morphia.

The following process is also recommended by Dr. Riegel for the detection of small quantities of opium. To the suspected substance some potash is to be added, and then shaken with ether. A strip of white blotting paper is to moistened with the solution several times repeated. When dry, the paper is to be moistened with muriatic acid, and exposed to the steam of hot water; if opium be present, the paper will be more or less colored red.

METHOD FOR DETECTING THE ORGANIC ALKALOIDS.

The following paper, by Prof. Stass, of Brussels, is published in the *Bulletin de l'Academie Royal de Medecine de Belgique*.

Whatever certain authors may have said on the subject, it is possible to discover, in a suspected liquid, all the alkaloids, in whatever state they may be. I am quite convinced that every chemist, who has kept up his knowledge as to analysis, will not only succeed in detecting their presence, but even in determining the nature of that which he has discovered, provided that the alkaloid in question is one of that class of bodies, the properties of which have been suitably studied. Thus he will be able to discover coniine, nicotine, aniline, picoline, petinine, morphine, codeine, narcotine, strychnine, brucine, veratrine, colchicine, delphine, emetine, solanine, aconitine, atrophine, and hyoscyamine. I do not pretend to say, that the chemical study of all these alkaloids has been sufficiently well made to enable the experimenter who detects one of them to know it immediately, and affirm that it is such an alkaloid, and no other. Nevertheless, in those even which he cannot positively determine or specify, he may be able to say that it belongs to such a family of vegetables, the Solanaceæ, for example. In case of poisoning by such agents, even this will be of much importance. The method which I now propose for detecting the alkaloids in suspected matters, is nearly the same as that employed for extracting those bodies from the vegetables which contain them. The only difference consists in the manner of setting them free, and of presenting them to the action of solvents. We know that the alkaloids form acid salts, which are equally soluble in water and alcohol; we know, also, that a solution of these acid salts can be decomposed, so that the base set at liberty remains either momentarily or permanently in solution in the liquid. *I have observed that all the solid and fixed alkaloids above enumerated, when maintained in a free state and in solution in a liquid, can be taken up by ether when this solvent is in sufficient quantity.* Thus, to extract an alkaloid from a suspected substance, the only problem to resolve consists in separating, by the aid of simple means, the foreign matters, and then finding a base which, in rendering the alkaloid free, retains it in solution, in order that the ether may extract it from the liquid. Successive treatment by water, and alcohol of different degrees of concentration, suffices for separating the foreign matters, and obtaining in a small bulk, a solution in which the alkaloid can be found. The bicarbonates of potash or soda, or these alkalies in a caustic state, are convenient bases for setting the alkaloids at liberty, at the same time keeping them wholly in solution, especially if the alkaloids have been combined with an excess of tartaric or of oxalic acid.

To separate foreign substances, animal or otherwise, from the suspected matters, recourse is commonly had to the tribasic acetate of lead, and precipitating the lead afterwards by a current of sulphuretted hydrogen. As I have several times witnessed, this procedure has many and very serious inconveniences. In the first place, the tribasic acetate of lead, even when used in large excess, comes far short of precipitating all the foreign matters; secondly, the sulphuretted hydrogen, which is used to precipitate the lead, remains in combination with certain organic matters, which undergo great changes by the action of the air, and of even a moderate heat; so that animal liquids, which have been precipitated by the tribasic acetate of lead, and from which the lead has been separated afterwards by hydrosulphuric acid, color rapidly on exposure to the air, and exhale at the same time a putrid odor, which adheres firmly to the matters which we extract afterwards from these liquids. The use of a salt of lead presents another inconvenience, viz: the introduction of foreign metals into the suspected matters, so that that portion of the suspected substance is rendered unfit for testing for mineral substances. The successive and combined use of water and alcohol at different states of concentration, permits us to search for mineral substances, whatever be their nature; so that in this way nothing is compromised, which is of immense advantage when the analyst does not know what poison he is to look for.

It is hardly necessary to say, that in medico-legal researches for the alkaloids, we ought never to use animal charcoal for decolorizing the liquids, because we may lose all the alkaloid in the suspected matters. It is generally known that animal charcoal absorbs these substances at the same time that it fixes the coloring and odoriferous matters.

The above observations do not proceed from speculative ideas only, but are the result of a pretty long series of experiments which I have several times employed for discovering these organic alkaloids. To put in practice the principles which I have thus explained, the following is the method in which I propose to set about such an analysis: — I suppose that we wish to look for an alkaloid in the contents of the stomach or intestines; we commence by adding to these matters twice their weight of pure and very strong alcohol;* we add afterwards, according to the quantity and nature of the suspected matter, from 10 to 30 grs. of tartaric or oxalic acid — in preference, tartaric; we introduce the mixture into a flask, and heat it to 160° or 170° Fahr. After it has completely cooled, it is to be filtered, the insoluble residue washed with strong alcohol, and the filtered liquid evaporated *in vacuo.* If the operator has not an air-pump, the liquid is to be exposed to a strong current of air at a temperature of not more than 90° Fahr. If, after the volatilization of the alcohol, the residue contains fatty or other insoluble matters, the liquid is to be filtered a second time, and then the filtrate and washings of the filter evaporated in the air-pump till nearly dry. If we have no air-pump, it is to be placed under a bell jar over a vessel containing concentrated sulphuric acid. We are then to treat the residue with cold, anhydrous alcohol, taking care to exhaust the substance thoroughly; we evaporate the alcohol in the open air at the ordinary temperature, or still better, *in vacuo;* we now dissolve the acid residue in the smallest possible quantity of water, and introduce the solution into a small test tube, and add, little by little, pure powdered bicarbonate of soda or potash, till a fresh quantity produces no further effervescence of carbonic acid. We then agitate the whole with four or five times its bulk of pure ether, and leave it to settle. When the ether swimming

* When we wish to look for an alkaloid in the tissue of an organ, as the liver, heart, or lungs, we must first divide the organ into very small fragments, moisten the mass with pure strong alcohol, then express strongly, and by further treatment with alcohol exhaust the tissue of every thing soluble. The liquid so obtained is to be treated in the same way as a mixture of suspected matter and alcohol

on the top is perfectly clear, decant some of it into a capsule, and leave it in *a very dry place* to spontaneous evaporation.

Now, two orders of things may present themselves — either the alkaloid contained in the suspected matter is liquid and volatile, or solid and fixed. I shall now consider these two hypotheses.

Examination for a Liquid and Volatile Alkaloid. — We suppose there exists a liquid and volatile alkaloid. In such a case, by the evaporation of the ether, there remain in the inside of the capsule some small liquid striæ, which fall to the bottom of the vessel. In this case, under the influence of the heat of the hand, the contents of the capsule exhale an odor more or less disagreeable, which becomes, according to the nature of the alkaloid, more or less pungent, suffocating, irritant; it presents, in short, a smell like that of a volatile alkali, masked by an animal odor. If we discover any traces of the presence of a volatile alkaloid, we add then to the contents of the vessel, from which we have decanted, a small quantity of ether, 1 or 2 fluid drachms, of a strong solution of caustic potash or soda, and agitate the mixture. After a sufficient time, we draw off the ether into a test-tube, exhaust the mixture by two or three treatments with ether, and unite all the etherial fluids. We pour afterwards into this ether, holding the alkaloid in solution, 1 or 2 drachms of water, acidulated with a fifth part of its weight of pure sulphuric acid, agitate it for some time, leave it to settle, pour off the ether swimming on the top, and wash the acid liquid at the bottom with a new quantity of ether. As the sulphates of ammonia, of nicotine, aniline, quinoleine, picoline, and petinine are entirely insoluble in ether, the water acidulated with sulphuric acid contains the alkaloid in a small bulk, and in the state of a pure sulphate; but as the sulphate of coniine is soluble in ether, the ether may contain a small quantity of this alkaloid, but the greater part remains in the acidulated watery solution. The ether, on the other hand, retains all the animal matters which it has taken from the alkaline solutions. If it, on spontaneous evaporation, leaves a small quantity of a feebly colored yellowish residue, of a repulsive animal odor, mixed with a certain quantity of sulphate of coniine, this alkaloid exists in the suspected matter under analysis. To extract the alkaloid from the solution of the acid sulphate, we add to the latter an aqueous and concentrated solution of potash or caustic soda; we agitate and exhaust the mixture with pure ether; the ether dissolves ammonia, and the alkaloid is now free. We expose the etherial solution at the lowest possible temperature to spontaneous evaporation; almost all the ammonia volatilizes with the ether, whilst the alkaloid remains as residue. To eliminate the last traces of ammonia, we place, for a few minutes, the vessel containing the alkaloid in a vacuum over sulphuric acid, and obtain the organic alkaloid, with the chemical and physical characters which belong to it, and which it is now the chemist's duty to determine positively. I applied the process which I have described to the detection of nicotine in the blood from the heart of a dog poisoned by 2 cubic centims. (0.78 cubic inch) of nicotine introduced into the æsophagus; and

I was able, in a most positive manner, to determine the presence of nicotine in the blood. I was able to determine its physical characters, its odor, taste, and alkalinity. I succeeded in obtaining the chloroplatinate of the base perfectly crystallized in quadrilateral rhomboidal prisms of a rather dark yellow color, and to ascertain their insolubility in alcohol and ether.

I have applied the same process to the detection of coniine in a very old tincture of hemlock, and I was equally successful in extracting from the liquid colorless coniine, presenting all the physical and chemical properties of this alkaloid. I was also able to prove that the ether which holds coniine in solution, carries off a notable portion of this alkaloid, when the solvent is exposed to spontaneous evaporation.

Examination for a Solid and Fixed Alkaloid. — Let us now suppose that the alkaloid is solid and fixed; in that case, according to the nature of the alkaloid, it may happen that the evaporation of the ether resulting from the treatment of the acid matter, to which we have added bicarbonate of soda, may leave or not a residue containing an alkaloid. If it does, we add a solution of caustic potash or soda to the liquid, and agitate it briskly with ether. This dissolves the vegetable alkaloid, now free, and remaining in the solution of potash or soda. In either case, we exhaust the matter with ether. Whatever be the agent which has set the alkaloid free, whether it be the bicarbonate of soda or potash, or caustic soda or potash, it remains, by the evaporation of the ether, on the side of the capsule as a solid body, but more commonly as a colorless milky liquid, holding solid matters in suspension. The odor of the substance is animal, disagreeable, but not pungent. It turns litmus paper permanently blue.

When we thus discover a solid alkaloid, the first thing to do is to try and obtain it in a crystalline state, so as to be able to determine its form. Put some drops of alcohol in the capsule with the alkaloid, and leave the solution to spontaneous evaporation. It is, however, very rare that the alkaloid obtained by the above process, is pure enough to crystallize. Almost always it is contaminated with foreign matters. To isolate these substances, some drops of water, feebly acidulated with sulphuric acid, are poured into the capsule, and then moved over its surface, so as to bring it in contact with the matter in the capsule. Generally we observe that the acid water does not moisten the sides of the vessel. The matter which is contained in it separates into two parts; one formed of greasy matter which remains adherent to the sides; the other alkaline, which dissolves and forms an acid sulphate. We cautiously decant the acid liquid, which ought to be limpid and colorless, if the process has been well executed; the capsule is well washed, with some drops of acidulated water, added to the first liquid, and the whole is evaporated to three-fourths *in vacuo*, or under a bell jar over sulphuric acid. We put into the residue a very concentrated solution of pure carbonate of potash, and treat the whole liquid with absolute alcohol. This dissolves the alkaloid, while it leaves untouched the sulphate of potash, and excess of carbonate of potash. The evaporation of the alcoholic solution gives us the alkaloid in crystals. It is now the chemist's business to determine its properties, to be able to prove its individuality. I have applied the principles which I have just expounded to the detection of morphine, iodine, strychnine, brucine, veratrine, emetine, colchicine, aconitine, atrophine, hyoscyamine; and I have succeeded in isolating, without the least difficulty, these different alkaloids, previously mixed with foreign matters. I have thus been able to extract by this process, morphine from opium, strychnine and brucine from nux vomica, veratrine from extract of veratrum, emetine from extract of ipecacuanha, colchicine from tincture of colchicum, and the like. Thus it is in all confidence that I submit this process to the consideration of chemists who undertake medico-legal researches.

ON THE DETERMINATION OF PHOSPHORIC ACID BY MOLYBDATE OF AMMONIA.

SILLIMAN'S Journ l for May contains the following article by Mr. W. J. Craw, of New Haven, on the determination of phosphoric acid by molybdate of ammonia:

The determination of phosphoric acid has always been one of the most important and most difficult problems of analytical chemistry. The bases with which it is most frequently united, are iron, alumina, the alkalies and alkaline earths. Several of these combinations are decomposed with very great difficulty, the phosphate of alumina in particular, resisting nearly every effort to reduce it to its component parts. Although good methods have been proposed for the analysis of many of the simple phosphates, that of phosphate of lime for instance, yet it usually happens that several of these occurs together; and until very recently no process has been devised which could effect the separation of phosphoric acid from all the bases previously mentioned, when in company. A great amount of labor has been spent by chemists, within the last few years, in the effort to overcome this difficulty. Numerous ways have been tried with greater or less success, but most of these contain inherent difficulties, which in many cases prevent their applications. Even Rose's process by carbonate of baryta, though a monument of profound knowledge and admirable research, is yet too complicated to yield good results, except in the hands of those who have practised it so often as to be perfectly familiar with all the necessary precautions. The great desideratum of a simple and accurate method for the determination of phosphoric acid, with whatever substances it may be combined, has been supplied by Sonnenschein. He states that the yellow precipitate produced by molybdate of ammonia in the solution of a phosphate, contains phosphoric acid as an essential constituent, and not, as asserted by Svanberg, and Struve, an accidental admixture. From several analyses of this compound he finds it to contain about three per cent. of phosphoric acid. A number of trials were also made to find whether by this means phosphoric acid could be separated and determined quantitatively which were completely successfull. For this purpose a large quantity of the molybdate solution is prepared as follows: one part of molybdic acid is dissolved in eight parts of ammonia, and twenty of nitric acid. The phosphate is dissolved in nitric acid, and there is added to it, a quantity of molybdic acid equal to about thirty times that of the phosphoric acid. The solution with the precipitate is digested for some hours with the aid of a very gentle heat, filtered, and washed with the same solution which was used for the precipitation. The whole is then dissolved in ammonia, and the phosphoric acid thrown down by a magnesian salt. The presence of molybdic acid is not injurious, as the double molybdate of ammonia and magnesia is easily soluble. Sonnenschien's experiments on the separation of phosphoric acid from alumina and other bases all gave very good results.

With a view of confirming this discovery, and also of ascertaining with more precision the cause of the peculiar behavior exhibited by this substance towards re-agents, numerous trials have been made with it by Mr. Craw. Solutions of the caustic alkalies, and the alkaline carbonates and phosphates, dissolve the yellow compound even in the cold. So do also chloride of ammonium, and oxalate of ammonia. The mineral acids also act upon it to some extent. Cold water dissolves it with great difficulty, though it is soluble in hot water. It appears to be decomposed to a small extent by the combined influence of air and moisture, as it turns blue when dried in the atmosphere after washing with water. Its behavior towards solvents is changed by the presence of molybdate of ammonia, so that it becomes nearly insoluble in acids even on boiling. The act of solution is probably in all cases attended with decomposition and removal of molybdic acid which is prevented by the presence of molybdate of ammonia. Some quantitative experiments were also made on the separation of phosphoric acid from the bases, and the results obtained confirm those of Sonnenschein, and show that the method as regards accuracy, is all that can be desired, while in point of simplicity, it is superior to any of the old processes. It will prove of especial advantage in cases where, as in the analysis of soils, a small quantity of phosphoric acid is associated with a variety of other substances existing in much larger proportion. It may be important to remark, that when effecting the precipitation by means of molybdate of ammonia, this, as well as nitric acid, should be in decided excess. To ascertain when this is the case, before filtering off the solution, a drop of it may be transferred to a solution of sulphuretted hydrogen, when a brown precipitate of sulphuret of molybdenum will appear. After separating the yellow precipitate from the solution, the latter should be always allowed to stand for some time in a warm place, to see whether any additional precipitate is formed.

ON A SPECIAL ACID OF THE LUNGS.

M. Dumas recently presented a paper to the academy, giving an account of his and M. Verdiel's researches on a special acid secreted by the pulmonary parenchyna in most animals, and which may be found free, but is usually combined with a salt of soda. Obtained in the crystalline form, it is a brilliant body, strongly refracting light. It does not lose its water of crystallization at a temperatue of 100° Centigrade; but when heated still more, it decrepitates, melts and is decomposed, giving rise to empyreumatic products. Much coal remains, which disappears without leaving any traces of ash. It is soluble in water and boiling alcohol, but not in cold alcohol or ether. Its ultimate analysis exhibits definite proportions of carbon, hydrogen, oxygen, nitrogen and sulphur. It forms crystallized salts with bases, and expels carbonate acid from the carbonates. The existence of this substance is of high physiological interest; for the acid thus secreted by the parenchyma comes in contact with the carbonate of soda of the blood, transported by the capillaries, and decomposes it, uniting with the soda and setting free the carbonic acid which is exhaled. The presence of a portion of this acid in the free state, in the parenchyma, indicates that it is really there that it is formed, and not in the blood, which is an alkaline fluid. By uniting with the soda of the blood, the acid does not change the reaction of that fluid, since it merely takes the place of the carbonic acid which is expelled during expiration. —*Journ. de Chemie Medicale.*

ON CHROMIC ACID AS AN ESCHAROTIC.

Chromic acid has been on the recommendation of Dr. Heller tried in many cases as an escharotic, and the results thus far obtained justify a further trial of it in cases in which a deeply penetrating, gradual caustic, and one constant in its effect would be indicated. When employed in substance, its action is exceedingly slow and gradual, occupying many hours; nevertheless in intensity it exceeds that of the caustic alkalies. In extremely concentrated solution, its action is less penetrating and less gradual, but at the same time, it is more continuous than that of all other known caustics; on the other hand, the more dilute the solution, the more transient and superficial is the effect. The facility with which its action can thus be graduated renders it in all cases a suitable escharotic. The method of application is as follows: the surrounding parts having been protected by folds of lint, adhesive plaster, &c., the chromic acid is spread with a spatula on the part to be cauterized, so as to form a layer scarcely a line in thickness, which is covered with lint, kept in its place by adhesive plaster. The concentrated solution may be applied by means of a glass rod, or hair pencil, and the part after a few moments' exposure covered with lint. If chromic acid be applied to sound parts, a moderate sensation of burning commences in ten or fifteen minutes after the application, increasing for three or four hours, and then diminishing for about an equal space of time. Its application to ulcerated parts excites similar sensations instantaneously. Undissolved chromic acid causes severer and more permanent pains; these are also more violent when the cutis vera itself, and not morbid growths is cauterised. The pain does not disturb the patient's sleep, and is incomparably less than that caused by other caustics, such as sulphuric or nitric acids, nitrate of silver, corrosive sublimate, caustic potassa, &c. According to Dr. Heller's experiments, all organic compounds are soluble in the easily deoxidable chromic acid, their ultimate elements being raised to a higher degree of oxidation, and partly uniting with the acid. An elevated temperature accelerates this process. Smaller animals, mice, birds, &c., were so completely dissolved by chromic acid in fifteen or twenty minutes, that no trace of their bones, skin, hair, claws or teeth could be discovered.

WHY BREAD BECOMES STALE.

At a late meeting of the French Academy a discussion took place respecting the grave yet apparently simple question why bread becomes stale. M. Boussingault laid down that staleness is not, as is generally supposed, caused by the proportion of water diminishing; but arises from a molecular state which manifests itself during the cooling, becomes afterwards developed, and persists as long as the temperature does not exceed a certain limit. M. Thenard said, that it is cause by bread being a hydrate which heat softens, and to which a lower temperature gives more consistency.

PRESERVATION OF ANIMAL SUBSTANCES.

The following is an abstract of a communication to the French Academy, by M. Blandet:—

The hyposulphite of soda and the chloride of zinc are both employed for the preservation of dead bodies by injection. I placed blood in a concentrated solution of each of these salts, and in about a fortnight, after exposure to the air, the blood appeared bad in the hyposulphite, though still liquid and black; while the chloride of zinc gave a precipitate, but without bad odor. I experimented with another salt, a chloride like the salt of zinc, and alkaline the same as the salt of soda —*the chloride of barium*. This salt maintains the blood liquid the same as the salt of soda, and preserves it without odor the same as the salt of zinc. The author thinks that by employing it for the injection of the human subject, we may preserve the aspect of the living body, the blood being rendered imputrescable by the chloride of barium — *Comptes Rendus.*

A NEW STYPTIC.

A pharmacien, at Rome, Signor Pagliare, has recently succeeded in discovering a liquid possessing so extraordinary a power of coagulating blood, that if to a large basin containing this fluid one drop of the styptic be added, complete solidification ensues, so that the basin may be inverted without causing any blood to be lost. The practical advantages of this styptic are consequently very great, inasmuch as, by its timely application, the bleeding from large and dangerous wounds may be immediately staunched. In addition to the other valuable qualities of this liquid, it is totally devoid of poisonous agency, and easily prepared as follows: — Take 8 ounces of gum benzoin, 1 pound of alum, and 10 pints of water. Boil all together for the space of eight hours in an earthenware glazed vessel, frequently stirring the mass, and adding water sufficient to make up the original quantity of that lost by ebullition, taking care, however, to add the water so gradually that boiling may not be suspended. The liquid portion of the compound is now to be strained off, and preserved in well-corked bottles. It is limpid, like champagne as to color, possessing a slightly styptic taste, and an agreeable odor.

ALKALIES IN PLANTS.

At a recent meeting of the Botanical Society, London, Dr. Daubeny detailed some experiments undertaken by him at the Oxford Botanic Garden, with the view of determining whether the usual quantity of potash and soda existing in barley might be made to vary by causing the plant to grow in soil impregnated with more than the ordinary quantity of one or the other of these alkalies. He found that when the barley had grown in a soil which had been dressed with a strong solution, either of carbonate of soda or of chloride of sodium, the ashes of the plant contained about eight per cent. more soda than was present when the plant had grown in a soil impregnated with carbonate of potash, or left unimpregnated. This difference may admit of explanation by supposing one alkali capable of replacing the other within the organism of the plant; but the author thinks it more probable that it arose from the sap circulating through the plant at the time when it was cut, containing in the one case more soda than it did in the other. The saline contents of the fluid of the sap would of course be confounded with those which had been actually assimilated by the plant, and hence, from the variation in its composition, must tend to modify the amount of the alkalies obtained from the ashes of the plant in each instance, according to the nature of the material with which the soil had been impregnated.

ON THE EFFICACY OF BURNT CLAY.

Dr. Voelcker publishes a communication in the Chemical Gazette, for April, on the causes of the agricultural efficacy of burnt clay, in which he shows conclusively, that the change effected, and benefit resulting, is entirely of a chemical nature.

Prof. Johnson, the well known Agricultural Chemist, had previously expressed the opinion that the mechanical effects of the burning upon clay, were insufficient to explain its efficacy, and first pointed out the true solution of the phenomena in the chemical changes which the soil undergoes.

Pure clay, silicate of alumina, is rarely found; such a soil could never be improved by burning. The ordinary clay soils, however, contain besides this chief ingredient, a considerable proportion of sand, undecomposed fragments of felspar, mica, granite, and other minerals, with more or less sand, carbonate of lime, magnesia, free or uncombined alumina, oxide of iron, silicate of potash, traces of phosphorus, and sulphuric acid, and chlorine. Now of these substances, the silicate of alumina, pure clay, does not of itself contribute at all to the direct nurture of plants, as it is not found in the ashes of cultivated plants. We must look, therefore, for the direct fertilizers of this soil, amongst the accessory or foreign ingredients of agricultural clays. Of these, the lime, magnesia, sulphuric acid, silica, and chlorine, which are essential to the growth of plants, are found in most soils, or if deficient, can be supplied at a cheap rate. The chief value of an agricultural clay, depends, therefore, on the proportion of phosphoric acid, potash, and soda it contains. Potash is a most essential element, and its chief source in ordinary soils is the clay. Clay is in many cases, derived from felspar, a double silicate of alumina and potash; and frequently contains some undecomposed fragments of felspar and other minerals. Plants can only avail themselves of the soluble potash, and not that which occurs in the form of felspar, which must first be decomposed by long exposure to air and water; but, as the soluble potash in the clay soil, sooner or later, will be exhausted by the removal of the crops grown upon it, the soil becomes gradually more and more sterile. Although by long exposure felspar may be decomposed, yet it is now demonstrated that moderate calcination much accelerates this action. In burning clay properly, a large amount of potash is liberated by the action of the carbonate of lime present, upon the double silicate of potash and alumina. This chemical reaction, which occurs at a high temperature, results in the formation of silicate of lime, and carbonate of potash. Those clays, then, which are improved by burning, must be the ones that contain the foreign ingredients named, and undecomposed felspar. The pure pipe and porcelain clays, would not be improved at all, by the process of soil burning.

We can now understand, why burnt clays, especially improve the root crops, such as turnips, carrots, swedes, mangolds, potatoes, &c., which require much potash as nutriment, the ashes of these plants, containing nearly half their weight of this alkali.

ON THE ABSORPTION OF THE SOLUBLE HUMATES AND ULMATES BY PLANTS.

M. Soubeiran demonstrated some time since the important fact, so long denied by Liebig and his supporters, that alkaline ulmates and humates are absorbed by vegetation. The experiments of Soubeiran have been recently verified in the fullest extent by M. Malguti.

A plant of Lampsana, whose roots were immersed in a solution of ammonia, continued to vegetate and prosper. The solution, which was changed every day, was partially discolored. Oats passed very well through all the stages of vegetation in a soil deprived of organic matters, and containing a little sulphate and phosphate of lime, and which was watered from time to time with ulmate of ammonia. Those who do not believe in the absorption of humus will accept with difficulty results obtained with a plant (Lampsana) which was found in an abnormal state. They will add that there is nothing to prove that oats accomplish their vegetation under the influence of ulmate of ammonia, since in the soil it must find phosphate and sulphate of that base. Indeed, if we put sulphate of lime, or powdered calcined bones (or more properly artificial tribasic phosphate of lime,) in contact with ulmate of ammonia, ulmate of lime is formed, and at the same time, sulphate and phosphate of ammonia; and again, when we put sulphate and phosphate of ammonia in contact with ulmate of lime, a double decomposition ensues. In all cases there is a division, and four salts are formed.

An experiment detailed by Malguti was as follows: I half filled two large funnels with gravel, and the other half with powdered brick, containing one per cent. of calcined bones, and as much chalk. I sowed in these two artificial soils, moistened with distilled water, the same quantity of cress seed. During germination I prepared by means of turf, perfectly neutral ulmate of ammonia, which I divided into two equal lots, each about two quarts. One of these was set aside, and the other was kept for watering the two soils. The seeds having sprung up four days after they were sown, I began to water them every day, one with 100 cubic centimetres of distilled water, and the other with the like quantity of ulmate of ammonia. After five waterings, the difference between the two vegetations was very evident. That which had been watered with the ulmate was of a deep green; the other which had been treated with water was of a light green. After eighteen waterings, that is to say after the experiment had lasted twenty-two days, the most luxuriant plant threatening to fall, I cut it down. The two crops dried in the air and under the same circumstances weighed, that watered with water, 12,550 grs.; that watered with the ulmate of ammonia, 15,150 grs. The soil impregnated with the ulmate was then washed until the water passed out colorless and limpid; dilute hydrochloric acid was then added and the washing continued until the water became neutral. The treatment with acid was succeeded by treatment with ammoniacal water, and the two treatments were alternated, until it was quite certain that the soil did not contain a trace of ulmic acid. All the waters colored by ulmate of ammonia were combined with the rest of the lot employed and the whole brought to a state of neutrality, and to the bulk of two quarts. Two lots of liquid were thus produced; the first containing a quart, one-half of the ulmate of ammonia originally produced, and kept for comparison; the second, a liquid containing all the ulmic acid remaining in the soil; over and above what might have been extracted by the plant. The ulmic acid in both was then precipitated in the form of ulmate of lime, and separately washed, dried and weighed under like circumstances. It was found that the ulmate of ammonia used for watering the cress had lost 2,367 grammes of ulmic acid, as it was given by the ulmate of lime dried *in vacuo.* It might be supposed that the ulmic acid might have remained in the soil, under an unknown form, which might escape the action of re-agents; but this transformation could not be the result of the contact of the ulmic acid either with the earthy matter, or with the external parts of the roots. Now, this is a question of proving that this acid is absorbed, and not of saying what becomes of it after the absorption.

This experiment and those of M. Soubeiran, seem to me to prove the absorption of the soluble ulmates during vegetation, and at the same time their utility. — *Comptes Rendus*, 1852.

RAIN, A SOURCE OF THE NITROGEN IN VEGETATION.

M. Barral, from some analyses of rain-water collected at two distinct spots in the grounds of the Observatory at Paris, during the last five and six months of the past year, has shown us that the rain-water is there charged with nitric acid, ammonia, chlorine, lime and magnesia, to an extent scarcely to be credited, were it not the actual result of experiment. Taking the average of these analyses, and reducing the French weights to our own standard of 7,000 grains to the pound, it will be seen, in these six months, the rain which fell on a space of ground at the Observatory at Paris, equal in area to an English acre, contained, as nearly as possible, 7.75 pounds of ammonia; 36.50 pounds of nitric acid; 5.56 pounds of chlorine; 12.60 pounds of lime; 4.81 pounds of magnesia.

From July to December is usually the drier half of the year, as well as that in which the less fuel is consumed, so that we may safely double these quantities, in estimating the annual supply per acre of nitrogeneous compounds, gradually distributed over the country by the rain. For the sake of illustration, we have calculated the amount of the solid constituents of the rain falling on an area equal in extent to Great Britain, and balancing the various causes likely to lessen or to increase the quantity of these matters, which would so fall on this island, we may venture to set one against the other, and apply the above statement to our own country, as the basis of an estimate, which singularly manifests the "power of littles," as well as the grand scale on which even the minutest of natural phenomena proceed. Thus, on the Parisian data, the weights of these fertilizing materials annually supplied to the soil of this island by the rain, amount to about 400,000 tons of ammonia; 1,850,000 tons of nitric acid; 279,-000 tons of chlorine; 640,000 tons of lime; 244,000 tons of magnesia.

Making every allowance for errors of experiment, which, however, would rather increase than diminish these quantities, excepting, it may be, the amounts of the two last on the list, these researches of M. Barrel prove to us that, the amount of fertillizing matter conveyed to the soil by the rain, must exercise a constant and most important influence on the vegetation of a country. These facts also tend to throw still further doubt upon the peculiar efficiency of the salts of ammonia, and of the acid of the nitrates as manures; for we find in rain-water a constant supply of these nitrogeneous matters, not applied once, or at most twice, in the year, as is the case with the various artificial manures, such as the nitrates of potash and of soda, Peruvian, and those guanos which contain a large proportion of soluble ammoniacal salts, and the various ammoniacal composts, made and sold in this country, the utility of which must chiefly depend on the concurrence of several favorable conditions of the plants, the soil and the weather; for we find that the nitrogen required for the growth of the plant is supplied in the fittest state for assimilation (viz., that of great dilution,) and at all stages of its growth, by every shower that falls. The later opinions entertained by Liebig, of the superior value of the alkaline and earthy constituents of manures, *i. e.*, the potash, soda, lime, magnesia, and the phosphates and sulphates of these bases, to that of their nitrogeneous compounds, derive much weight from these experiments of M. Barral, which show that a vast amount of nitrogeneous fertilizing matter is distributed by the rain but none of the fixed alkalies, or of the salts of phosphoric and other acids, equally important to the due growth of vegetables, and which, unless naturally existing in sufficient amount in the soil, must be supplied by the application of manure, or the plant will either dwindle, or yield an imperfect produce, owing to an insufficient supply to one portion of its requsite constituents, however much it may be stimulated by an abundant application of ammoniacal fertilizers. The prevailing use of these manures, which are so highly charged with the salts of ammonia, readily account for the increasing "steeliness" which is observable in English wheat, arising in great measure, as remarked by Liebig, from a superfluous and unnecessary supply of the ammoniacal stimulants, and a deficiency in the more important constituents of the cereals, viz.—the earthy phosphates and alkaline salts, which are not brought to the growing corn in the rain, like the nitrogeneous constituents. — *London Critic.*

ON THE SEPARATION OF BUTTER FROM CREAM BY CATALYSIS.

At the American Association, Albany, President Hitchcock read the following paper, on the separation of butter from cream by catalysis: —

It is well known that the separation of butter from cream, during the winter months, by the ordinary process of churning, is often very difficult, from some chemical changes in the proximate principles. From my own small kitchen dairy, the complaint on this subject had so often reached me, that I was led a few years since to inquire whether there were not some remedy. My thoughts were turned to that principle in chemistry, to which Berzelius gave the name of *catalysis.* In observing the process of churning with the old-fashioned cylindrical churn, I had noticed that along the handle, when the cream had been subject to a more powerful agitation, butter would show itself much earlier than in the body of the churn. Hence I inferred that by acting on a small quantity of the cream, the separation might be easily effected in that portion: and it seemed not improbable that by seizing the exact moment when the separation was taking place, and adding more cream, the process might be communicated to that also in a catalytic manner; and if so, perhaps any quantity might in like manner be made to yield its butter.

I made the experiment, and was successful. I put a small quantity of cream in the churn at first, and, by a few moments strong agitation, brought it to that state, familiar to a practised eye, when the butter is separating. An assistant stood with the principal mass of the cream, ready to pour it gradually into that where the butter was in a nascent state, which I continued to agitate with even increased briskness as more and more cream was added. The effect was magical; for in a few minutes, I several times had the pleasure of seeing several quarts of cream give up its butter. I found, however, that if the fresh cream were poured in too fast, it would stop the process; and that it would not answer to let the agitation cease for an instant.

I have delayed for two or three years to state these facts publicly, because I had hoped to make additional experiments on the subject; but more important matters have prevented. I cannot, therefore, say of how much practical value my statements may be. I tried experiments enough to convince me, that although the requisite manipulations would require some skill, it would not be greater than many other processes common upon farms. The common churn, however, is not adapted to the experiment. I think one might be invented that would meet the case; but I must leave the whole matter to any others who may feel interest enough in it to carry forward what I have only suggested.

It was suggested by those who took charge of the butter thus eliminated, that it seemed more difficult to separate and the whey completely, than when obtained by the ordinary process. To this point, therefore, the attention of the experimenter should be turned.

FORMATION OF ARTIFICIAL CELLULAR TISSUE.

NOTWITHSTANDING chemistry has made us acquainted with the composition of organic bodies, and the microscope has pointed out their structure, we have yet much to learn with regard to the particular operations by which definite forms are assumed by the elementary tissues. Many considerations concur to establish the probability of the proposition, that the fluid state is necessarily the first in which the elements of a tissue must exist previously to their undergoing a morphic determination, precipitation, histomorphosis, or whatever analogous term may be assumed to denominate the simplest change which may be supposed to occur in the passage of a perfectly amorphous fluid into a tissue of definite shape. We owe to Ascherson a knowledge of the interesting fact, that the contact of two homogeneous fluids, oil and albumen, results invariably in the immediate production of elementary forms. Still more recently, M. Melsens, by a series of observations and experiments, has established the possibility of one of these fluids undergoing distinct and very remarkable histomorphosis. In regard to this interesting phenomena, M. Melsens says: — "We know that many feeble acids do not precipitate albumen from its solution; my experiments have reference especially to the trihydrated phosphoric and acetic acids; this ceases to be the case when albumen is present with those salts which have no apparent chemical action on it; the reactions change for acetic acid as well as the phosphoric, with their equivalents of base, and some acid phosphates as well, precipitate it more or less completely. The following is the process by which I prepare the salified solution of albumen: — The white of an egg is mixed with its volume of water and filtered; this constitutes the *normal solution of albumen*, with a specific gravity of 1,020. The filtered liquor is saturated with salts, which are added in excess, after which the fluid is filtered again, to separate the excess of salts; the fluid resulting from this second filtration, may be denominated the *normal saturated albumen*. The normal albumen saturated with chloride of sodium has a specific gravity of about 1,200."

My experiments have been made with almost all the salts which are without an apparent action on albumen, as well as with those which begin to precipitate it, but whose precipitations are soluble either in an excess of albumen or of the salt. I will not pronounce on the nature of the precipitates obtained; but it will appear evident that we must in the generality of cases admit, that the albumen is precipitated in consequence of a particular physical disposition of the liquid; that if at times the precipitation does not occur immediately, in dilute liquor for example, agitation may cause a troubled condition of the fluid, as occurs in precipitation, crystallization, solidification of water, of sulphate of soda, &c. Tribasic phosphoric acid precipitates normal albumen saturated with salts; certain salts, among which are borax, phosphate of soda, acetates of soda, and potassa, form an exception to this rule; however, if the fluid be agitated with a glass rod, a troubled condition is slowly produced by the mechanical action. The solutions of albumen with other salts are all precipitated by phosphoric acid; these precipitates are soluble in an excess of the acid. The presence of the salts, therefore, permits us to make with albumen and the trihydrated phosphoric acid an experiment which requires with normal albumen, the monohydrated phosphoric acid which precipitates it, and the trihydrated, which dissolves the precipitate formed.

"If," says M. Melsens, "after the preceding experiments I am induced to believe that the particular physical constitution of the liquids plays some part in the precipitation of albumen, those which follow cannot leave the least doubt as to the action of agitation. Some very dilute liquids remain limpid until beaten with a glass rod, when they become troubled, and immediately parcels of fibres may be seen to form under the influence of agitation; under the microscope these appear as very distinctly organized forms, which by juxtaposition and felting together constitute actual membranes. We have thus a phenomena conformable to the production of mineral precipitates by the influence of agitation. In another experiment a current of air was passed through a solution of normal salified albumen, sufficiently dilute not to allow of the froth passing out of the vessel. This froth was seen to be transformed into a solid body insoluble in ammonia, potassa, water, or dilute acids. To obviate two objections which might be started to this experiment, air saturated with the vapor of water, and hydrogen purified by caustic potassa and saturated with vapor, were successively employed. Lastly, to avoid all sources of error, a solution of albumen diluted with water was agitated *in vacuo* by converting the vessel into a sort of water hammer, after expelling the air by heat and an air-pump, the orifice being subsequently hermetically sealed. The solution, perfectly limpid at first, became troubled after a few agitations, and a membrane was rapidly formed."

The solid bodies thus formed from a limpid solution of albumen by the simple effect of agitation, have been subjected to microscopic examination of M. Gluge, from whose report we make the following extracts: — "The albumen of the white of an egg, solidified by mechanical actions resembles false membranes, and even serous. It is presented to our view under the form of membranes covered with granulations from one-half to one millimetre, in diameter, white semi-transparent, about one-fourth or one-half millimetre thick, and sufficiently elastic. With a magnifying power of three hundred we can distinguish an amorphous substance, finely punctuated, in which are found fibres, sometimes isolated, sometimes united in bundles like the fibres of cellular tissue, more often easily isolated and elastic. More rarely there may be seen large and transparent fibres, analogous to those which are met with in fibrine. In the middle of these fibrous bundles may be observed granulations composed of little globules of 1-400 to 1-800 of a millimetre in size, and enclosing some bubbles of air. These globules are sometimes very regularly grouped and then form rounded masses."

Dr. Lyons who has carefully examined a specimen of albuminous membrane prepared by M. Melsens, with a high magnifying power, says: — "The granular base constituted a very considerable portion of the entire specimen, but did not appear to be uniformly disposed throughout it, as in some portions it formed nearly the entire, while in others it was almost altogether replaced by fibres. The solidifying force would thus appear not to have acted with uniformity. To determine what modifications of it produced granular matter — what fibres — what again caused the formation of the little spherical bodies — are questions, perhaps, of too delicate a nature to admit of ready solution. Could we arrive even at an approximate explanation, a great step would be achieved in the history of the obscure process of histogenesis. The most interesting of all the structures observable in this preparation are the spherical bodies. They are nearly uniform in size, grouped quite close to each other, and present nearly uniform characters. Under all conditions of light, both as to intensity and obliquety, they presented a sort of nucleus, which in all was of a long elliptical shape, although the bodies themselves appeared as nearly as possible spherical. This nucleus was in length equal to about one-half the diameter of the sphere, and in breadth about one-eighth. What was the nature of these bodies? They were certainly not either spheres of oil, or bubbles of air; there was not the slightest probability of the former substance being present; air bubbles they also could not be; the specimen had been at rest in spirit for a very considerable time, while as more positive evidence of their cell structure I would adduce the peculiar nucleus, which in all was oblong, and did not disappear under any conditions of light. May we then regard them as nucleolated nuclei, or small nucleated cells? These discoveries have filled me with the highest hopes of seeing before long some large advances made in this hitherto almost unworked field of investigation."

ON SPONTANEOUS HUMAN COMBUSTION.

MM. Bischoff and Liebig, employed as *experts* in the recent celebrated case of the Countess of Gorlitz, not only declared that her case presented an example of *post mortem* burning, which proved to be true, but took the occasion absolutely to deny the trustworthiness of any of the cases of spontaneous human combustion on record. This position M. Devergie combats, founding his argument upon the consideration of a case which occurred to himself, and of the various accounts of other examples that have been recorded by trustworthy persons. Although the term *spontaneous* is not strictly a correct one, inasmuch as there has always been an immediate cause of the combustion, he retains it for want of a better; and he considers the leading characteristic of these cases to be the *absence of harmony between the mass of the parts burned and the feebleness of the agent of combustion.* He enumerates the following peculiarities, as exemplified by most of the facts on record: 1. The extent and depth of the burns, as compared with the feeble proportion of combustible matter employed in their production. 2. Indulgence in spirituous liquors by the victims. 3. The far greater frequency of the occurrence in women, and especially in old women. 4. The presence of an accidental determining cause. 5. So complete is the combustion in some cases that nothing but the ashes remain, and these are always of the same fatty soot. 6. The combustion while acting on a mass of flesh and fat has usually spared highly inflammable bodies in the vicinity. 7. The flame when seen has always been described as of a blueish color and as inextinguishable. M. Devergie points out how these circumstances differ from those observed in the Countess's case and in death from ordinary combustion. When this extends from the clothes to the person, very large superficial burns are produced, which from their very size prove fatal; but there is no instance of bodies becoming completely carbonized or reduced to the condition in which they are found in these cases. It is true, that when the amount of combustible body exists in due proportion to the body to be burned we may see such effects produced, but the *absence of this relation* is the prime characteristic of these cases. A mere lamp or hot cinder suffices; while in the experiments made upon the Countess's body 125 pounds of wood had to be used. The other capital point is, the *isolation of the combustion amidst combustible bodies*, the most inflammable substances remaining uninjured. In the Countess's case the floor and chairs, even at a distance, were burned. In M. Devergie's case, complete combustion of the body had taken place in a little wooden room five or six feet broad by eight or nine feet long, and yet two muslin curtains at the window were uninjured. In all the cases, too, *abuse of alcohol* is mention; and although Bischoff laughs at this as a mere invention of the persons of the vicinity, for the purpose of pointing a moral, it is too particularly specified in all the cases to admit of doubt, and it is to this abuse of alcohol that M. Devergie is disposed to attribute the production of the phenomenon. The quantity excreted by the urine and sweat is probably not in due relation to that imbibed; and a vital modification is impressed upon the tissues, by reason of which they become endowed with a greater combustibility, either mechanically, or by the transformation of the absorbed alcohol combined with the tissues into a new substance. — *Annales d'Hygiene.*

CHEMICAL TESTIMONY IN CASES OF POISONING.

M. Orfila, in a recent capital case for poisoning in France, took occasion to represent to the court the reason why experts could not reply to the question so often put to them, as to whether a sufficient quantity of poison to cause death had been administered, and the danger, in reference to the suppression of crime, the insisting upon such a question gave rise to. The chemist may only be able to detect the thousandth, or the twenty-thousandth part that has been administered, when the poison has been evacuated or excreted, and the discharges have not been preserved. If all the poison has been thus expelled he may not be able to detect even a trace, and yet, although in the one case, what he has detected has been insufficient to cause death, and in the other he has found none at all, so that the jury may pronounce that no poisoning has occurred, yet has the person died of such poisoning. To ascertain the whole amount of poison that remains in the body, the entire frame would have to be submitted to analysis, which is clearly impracticable; while calculations of the quantity existing in the whole body from that which has been obtained from a part, would give rise to the greatest errors, inasmuch as the poison is not equally distributed over the whole frame, some portions of this absorbing and retaining much more of it than others. Different processes also employed by the same hand afford very different quantities, as does the same process performed by chemists of different degrees of expertness. The French law, too, does not require any decision on this point, as it punishes the attempt to poison by any substance that may cause death — this applying not to the proportion employed, but to the substance used.

ON THE ELIMINATION OF CERTAIN POISONS.

The following is an abstract of a paper recently read before the French Academy by M. Orfila: —

When a poison has been absorbed and carried into the tissues of a living being, does it remain indefinitely within these tissues? or is it expelled from them? In the latter case, in how long a time does the animal economy effect the expulsion? Finally, in what way is the poison conveyed out?

These three questions include all that relates to the diminution of poisonous substances. The experiments relative to the study requires a very long time. In eighteen months I was able to experiment on only four poisonous substances — bichloride of mercury, acetate of lead, sulphate of copper, and nitrate of silver. These experiments have taught me that when the above poisonous substances are administered to animals, that mercury disappears in general from the organs in eight or ten days. In only one case I found it to take eighteen days. Lead and copper are found in the intestinal parietes and in the bones eight months after they have ceased to be introduced into the stomach. Silver, whose presence in the liver may in some cases be demonstrated after six months, is not found in any organ of other animals, seven months after the administration of nitrate of silver. In the course of these researches I have seen that lead, copper, and mercury pass into the urine; but whilst the two former are carried away by the renal secretion, only two days after the administration of the copper or lead compound, the mercury continues to be carried off by this excretion eight days after the introduction of the mercurial preparation. I have never been able to detect silver in the urine of animals which have taken nitrate of silver.

I beg for a moment to call attention to the applications which may be made by the medical jurist of a knowledge of the elimination of poisonous substances. When I began this work, I had especially the view of facilitating the solution of some problems which might impede or stop the course of justice, if the practitioner did not possess the most precise knowledge on this portion of toxicological physiology. A few examples will suffice to show the benefit to be derived from the study in medical jurisprudence.

A. An individual who had been subjected to a mercurial treatment by corrosive sublimate, died four months after the cessation of the treatment, being poisoned by a mercurial preparation. The analysis, which is performed by the processes hitherto known, detects mercury in the organs. The defence is able, in consequence of these antecedents, to raise strong doubts, as to the origin of the metal. According to my experiments we can ascertain that the mercury does not proceed from the mercurial medicaments taken four months previous to death; for after the administration of corrosive sublimate, the mercury does not remain in the animal tissues more that eighteen days.

B. Should a man survive a poisoning by corrosive sublimate for fifteen days, it is very possible that the chemists consulted in the case would find no mercury in the organs. They would, however, commit a great error should they conclude that there had been no attempt to poison. This error is impossible when we are acquainted with the above-named facts.

C. A workman in a white lead factory died two months after having ceased to manipulate saturnine preparations. In his organs the chemist finds lead. Had this lead been given criminally, or does it proceed simply from the compounds absorbed by the workman in the factory? To give a satisfactory reply to this question, the operator must carefully study the development and the symptoms of the malady which preceded the death, and combine these facts with those furnished by the study of elimination.

It is rational to make a comparison of the process hitherto proposed for the detection of lead, copper, and mercury contained in organic compounds, before studying their elimination. Three processes are employed in the search for lead and copper, they really differ from each other only in the agents employed for the carbonization of the animal matter. These agents are nitric acid, nitric acid mixed with one-fifth of chlorate of potassa, and sulphuric acid. From my experiments I conclude that the carbonisation by nitric acid is superior to the others; that the mixture of nitric acid and chlorate of potassa does not give good results, and, finally, that carbonisation by sulphuric acid is far inferior to the others. When we seek for mercury, the best of known processes consist in carbonising the organic matter with sulphuric acid. M. Lanaux proposes the destruction of this matter by a current of chlorine. Comparative experiments have shown me that this last process is more sensible than the former. — *Comptes Rendus.*

ON THE ACTION OF OZONE ON MIASMATA. BY M. SCHONBEIN.

M. SCHONBEIN'S additional researches have still further developed the analogy of this substance to chlorine, and leave no doubt of the injurious effects it may exert on the respiratory organs when in excess. Mice soon perish in an atmosphere containing 1-6,000. The quantity which prevails in the atmosphere is very variable, being proportionate to the amount of electricity, and therefore at its maximum in winter, and its minimum in summer. It is, however, highly probable that, when existing only in minute quantities, it exerts a purifying effect on the atmosphere by destroying various deleterious miasmata. There are a great number of inorganic gaseous bodies, which when diffused in scarcely appreciable quantities, yet render the air irrespirable. An incessant source of miasmata exists in the variety of gaseous compounds which are incessantly liberated by the decomposition of the innumerable masses of organic beings which perish on the surface of our globe. Although the composition of most of these is unknown, it is supposed that their accumulation would render the air unfit for respiration. Nature has, however, provided the means of destroying such deleterious compounds as fast as they are generated, for M. Schonbein regards ozone, which is so constantly generated under electrical influence, and is so powerful an agent of oxidation even at ordinary temperature, as specially destined to that end. His experiments prove that air containing 1-6,000 of ozone can disinfect 540 times its volume of air produced from highly putrid meat: or that air containing 1-3,240,000 of ozone can disinfect an equal volume of air so corrupted. Such experiments show how little appreciable by weight miasmata may be, which are yet sensible to the smell, and how small is the proportion of ozone necessary for the destruction of all the miasmata produced by putrifaction of organic matter and diffused in the atmosphere. We may admit that the electrical discharges which occur incessantly in different parts of the atmosphere and determine there the formation of ozone, purify the air by ridding it of oxidizable miasmata, at the same time that these are destroyed by ozone, the organic miasmata cause its own disappearance, and prevent dangerous accumulation of it. The opinion that storms purify the air may not be without foundation, as a large quantity of ozone is then produced. In the author's experiments, he has always found a large proportion of ozone in the vicinity of the stormy clouds of Jura; and the air ozonized by phosphorus by experiment, gives forth a similar smell to that perceived amidst storms in mountainous regions. It is very propable that in certain localities the balance between the ozone and the miasmata does not prevail and disease may be the consequence. As a general rule, however, numerous experiments have shown that the air contains free ozone, so that no free oxidisable miasmata can there exist. M. Schonbein recommends that the atmosphere should be tested for ozone, in localities and at periods where fevers and other forms of disease prevail, so that the results of accumulated observations may be obtained.— *Arch. des Sciences.*

Dr. Moffatt, of England, in a paper read before the Meteorological Society, shows by a series of very elaborate tables, that an apparent connexion is discoverable between the first appearance, increase, decrease and disappearance of atmospheric ozone with the decrease and increase of the readings of the barometer and thermometer and the state of the weather generally. Also that prevalent diseases form groups corresponding with certain meteorological conditions. In the formation of these tables Dr. Moffatt has paid strict attention to all the lesser fluctuations of the barometer and thermometer, being convinced that there exists a great necessity for so doing, from the slightest variations in the reading of the barometer being followed by a change in the direction of the wind, and the appearance and increase, or decrease and disappearance, of ozone. Ozone Dr. Moffatt considers to be intimately connected with falls of rain, hail, snow, and sleet, and dynamic electricity, but that it is not necessary for any of these to occur for ozone to be produced; for if the barometer reading increases, and a current of air sets in from the northern points of the compass after or with any of these, ozone will disappear, but if the barometer reading decreases and the wind comes from southward it appears to increase in proportion to the decrease of the reading of the barometer and the force of the current. The fall of temperature accompanying ozone he thinks is possibly attributable to the wind becoming north during the continuation of an ozone period or at its termination. According to the observations contained in this paper, the potato and other diseases occur at the same time and appear to be produced by the same causes. As ozone is invariably attendant upon these causes, Dr. Moffatt was induced to try its effects upon vegetable life by means of actual experiments. In August, 1851, two plants were placed under a glass case, so resting upon slips of wood as to permit the air freely to pass beneath and an ozone test-paper was fixed in the crown of each glass. A watch-glass containing a piece of phosphorus was placed upon the soil in the pot which contained a longiflora. In the course of ten hours the test-paper became tinged and the interior of the glass was bedewed with moisture. At noon on the following day, or eighteen hours from the first action of the phosphorus, dew drops were perceived to hang from the points of the leaves; the test-paper in the other glass did not show the slightest change. In two days the leaves began to assume a brownish tinge, and became darker, until nine days after the commencement of the experiment the branches began to droop, and on the tenth the whole plant was completely withered; the ozone paper was not deeply tinged, less so than was frequently found to be the case in twenty-four hours in common atmospheric air. The other plant continued healthy. The experiment was repeated upon two geraniums with the same result; that which was exposed to the influence of ozone, although the stronger of the two plants, perished in seven days, whilst the other remained possessed of its vitality and continued to blossom. The principal conclusions arrived at by Dr. Moffatt from the observations contained in his paper are, — that the greatest number of diseases occur with decreasing readings of the barometer and thermometer, and with appearance and increase of ozone, — that certain diseases would appear peculiar to certain directions of the wind, — that epilepsy and sudden deaths occur most frequently at the commencement of an ozone period, — that the potato disease accompanies the diseases in the animal kingdom, — and that atmospheric ozone is injurious not only to animal but to vegetable life.

ON A PECULIAR PROPERTY OF ETHER, AND OF SOME ESSENTIAL OILS.

THIS property, which has just been made known by Prof. Schonbein, so well known by his discovery of ozone, is similar to that possessed by phosphorus, when put in contact under certain circumstances with pure oxygen, or of atmospheric air, of developing that powerful oxidising agent, which has received the name of ozone. If, says M. Schonbein, a little ether is poured into a bottle of pure oxygen, or of atmospheric air, and exposed to the diffused light, agitating it from time to time, the ether, after an interval of four months will have acquired new properties. Although it does not act on litmus paper, it decolors the solution of indigo, converts pure phosphorus into phosphoric acid, eliminates the iodine from iodide of potassium, changes sulphate of protoxide of iron, into bibasic sulphates and acids, transforms yellow cyanide of potassium into red cyanide, and converts sulphuret of lead into sulphate, etc. The essential oil of turpentine, and that of citron produce the same effects, if treated in the same way. Accordingly to M. Schonbein this new property is due to the presence of oxygen in an exalted chemical condition. — *Jour. de Chemie.*

ANALYSIS OF PERSPIRATION.

The analysis of perspiration has hitherto given contradictory results to the several analysts who have examined it; it is still doubtful. M. Favre has, however, presented to the French Academy an important memoir upon this subject, in which he establishes some facts and exhibits results new in the history of secretions. He has isolated from perspiration two immediate principles, whose existence in that liquid was never suspected; one is *urea*, a composition found in several other humors, and an azotic acid discovered by M. Favre, and which he calls *sudrique* acid. Among the elements whose existence remained an object of doubt to physiologists was lactic acid. M. Favre was so skilful and he had so large a quantity of perspiration to operate on (no less than 80 pounds!) he succeeded in obtaining six grammes of lactate of zinc. M. Favre ascertained that the chlorure of sodium, by its large proportion, must be considered as the essential mineral element of the liquid secreted by the sudoriparian glands. The almost absolute absence of other inorganic materials (such as phosphates and sulphates) in perspiration throws new light upon the secreting functions, and proves this singular fact: the saline substances dissolved in the blood are eliminated one to the exclusion of another, by the different glandular apparatus of the system. For example, in analysing two equal proportions of urine and of perspiration, 28 pounds of each coming from the same subject, the first gave 21 *grammes* of alkaline sulphates and the second only one *decigramme.*

ON A METHOD OF GETTING RID OF SAL-AMMONIAC IN ANALYSIS.

We copy the following communication by Dr. J. Lawrence Smith, from Silliman's Journal, Jan., 1853. There is nothing in mineral analysis more embarrassing than the accumulation of sal-ammoniac towards the end of an analysis, especially where potash or soda are to be estimated. The only method now adopted to get rid of this ammoniacal salt, is to volatilize it by heat, which if the quantity be considerable, is attended by no little annoyance, and a certain loss of more or less of the fixed alkalies which may be present. I have recently discovered a mode of overcoming that difficulty, and much experience has proved its value, the method is simply to add nitric acid to the solution containing the sal-ammoniac and alkalies, and heat it gently over a lamp or sandbath in a glass flask or porcelain capsule. The nitric acid may be added either before the liquid is concentrated, or after concentration; a most quiet decomposition ensues, and the liquid readily evaporates to dryness leaving nothing but the fixed alkalies if they be present. I am in the habit of using a little more than three grammes of pure nitric acid of ordinary strength to every gramme of sal-ammoniac supposed to be present in the liquid. The exact nature of the decomposition which ensues cannot now be stated, but there is doubtless formed, besides other things — chlorine, hyponitric acid and nitrogen.

GEOLOGY.

THE FUTURE OF GEOLOGY.

Regarding the geological scale of formations as an artificial scheme, founded on local considerations, although an instrument and scale of great value when used judiciously, the questions have to be answered, whether the terms of its graduation be required, and whether, as we have them, they are complete. See those broad stripes of demarcation printed on every geological diagram between the terms palæozoic and secondary, secondary and tertiary. These lines are popularly understood to mark boundaries between a complete cessation of one great system of types of species, and the commencement of an entirely new series of creatures, animal and vegetable. They really mark prodigious gaps in our knowledge of the sequence of formations and the procession of life. One of these supposed impassible boundaries, that between "tertiary" and "cretaceous," threatens rapidly to give way, and to vanish in due time, as speedily as artificial social distinctions in society. In France, Belgium, Germany, and England, there are symptoms of an intergrowth between the long separated "chalk" and "eocene." Strata are coming to light which rudely insist on finding elbow-room among our neatly-packed systems and formations, Janus-like fossils are turning up with two sets of features. Our preconceived notions of what ought to be are sadly disconcerted. An already extensive terminology is threatened with an inundation of new terms, too necessary to be evaded. If we are not mistaken, there are little clouds rising on the geological horizon that indicate revolutions elsewhere in the series. That narrow black line drawn on geological diagrams between the words "Trias" and "Permian," has more meaning in it than its dimensions indicate. The line between "Eocene" and "Cretaceous," has swollen out, broken up, and is enlarging fast into intermediate sections. But all its changes and increase will be as nothing compared with those that must take place by and by in its representative lower down. If we interpret aright, the signs indicated by extinct organisms preserved to us in palæozoic rocks, and the comparison of them with others in the lowest mesozoic or secondary strata, there is a gap in our knowledge of the succession of formations, the extent of which it is almost disheartening to think upon. Although the palæozoic fauna and flora, are assuredly portions of the same unique system of organized nature, with the assemblages of creatures of after-date in time, they exhibit differences in detail so great that, on superficial consideration, we might almost be inclined to regard them as belonging to some other world than our own. These differences are such as at present set all our calculations respecting the climatal conditions of the primeval (palæozoic) epochs at defiance. But that these oldest of creations were linked with those that came after, and those amidst which we live, is evident in the number of generic types common to all, and expressed yet more strongly in the presence of straggling representatives of types of life, characteristically palæozoic, among the very lowermost strata of the secondary period. All analogy teaches us, however, that there is a graduation of one geological period into another; and every day's advance in research goes to confirm this belief. The facts to which we have alluded indicate evidences of such a graduation of palæozoic into secondary. But the stages of that graduation, the intermediate formations, have not yet been discovered. Calculating from the amount of blank in the series of organized types, there must have been a vast interval of time intervening between the Permian and Triasic epochs, during which, doubtless, sediments were being deposited in seas, sea-beds upheaved, animals and plants flourishing, generations and generations, nay more, creations and creations, appearing, succeeding and disappearing; and yet of all these universal accumulations and organized assemblages, there has not been as yet a fragment found.

"They are but ill-discoverers," wrote Lord Bacon, "that think there is no land when they can see nothing but sea." Columbus had fewer signs to warrant his belief in a new continent than we have to indicate an unexplored and as yet unseen geological world. Such signs cannot be dissipated by any appeal to the series of strata already investigated. If we jot out on the map of the world those portions which have been sufficiently examined, at once palæontologically and geologically, the space covered by our ink makes but a poor show. Our hope lies in the rapidly advancing progress of comparative geology, especially through the aid and sure operations of organized surveys. All over Europe such surveys are in progress, or about to commence, sanctioned as they ought to be by governments of every shade of opinion. Some three or four years ago, it was publicly declared that the geology of England was completed; a plausible announcement, since almost every corner has been subjected to the tramp and hammers of geologists. Yet, if we are not greatly mistaken, even the geology of England has much still to be done. It is ably sketched out; portions of it have been developed with skill and ability; but by far the greater part will yield a luxuriant harvest of discovery to those able and willing to enter upon the task. The nearer we come to geologizing by square miles or leagues, the more interesting will be the results of our labors, and the economical value of geological researches depends mainly upon such works. — *Westminster Review*, 1852.

ON THE CAUSES OF THE CHANGE OF CLIMATE AT DIFFERENT GEOLOGICAL PERIODS.

THE following is an abstract of the recent address of Mr. Hopkins, President of the Geological Society of England The author first considers the influence on the earth's superficial temperature of a central heat, supposed to be the remains of a former and very much greater heat which has been gradually diminishing during some indefinite period of time. The effect on the superficial temperature due to this cause may have been formerly of any amount, but is now reduced to within one-twentieth of a degree of Fahrenheit, of that ultimate limit to which it would be reduced in an indefinite period of time, supposing the external conditions under which the earth is now placed, such as the amount of radiation from the sun and stars, and the state of the atmosphere, to remain as at present. Poisson has calculated that it would require 100,000 millions of years to reduce the present temperature by about one-fortieth of a degree of Fahrenheit. It is probable, therefore, that many millions of years must have elapsed since the central heat can have elevated the earth's superficial temperature by a single degree. The author also explained that any very sensible increase of superficial temperature from this cause must have been attended with an exceedingly rapid rate of increase of the internal temperature in descending below the earth's surface. It is only, however, to the more remote geological periods that we can refer for any very sensible change in the climatal conditions of our globe due to this cause. Such changes, also, must manifestly be continually from a higher to a lower temperature ; and, therefore, we must appeal to some other cause to account for such oscillations of temperature as those of the glacial period. Poisson suggested that the present internal temperature of our globe might not be due to its primitive heat, but to the fact of the solar system having passed through some region of stellar space of which the temperature, owing to stellar radiation, is much greater than that in which it is now placed. Without professing to say how far this cause may have influenced the climatal conditions of the earth at former remote periods, the author shows that, reasoning from all we know respecting the relative positions of the stars and the probable motion of the solar system, this cause cannot have produced a change so great as that which must have taken place during the glacial epoch, at a time so recent as we have reason to believe that epoch to have been. The author next proceeds to examine the effects of changes in the disposition of land and sea, and of the consequent changes in the direction of ocean currents. The map of isothermal lines, recently published by MM. Humboldt and Dove, enables us to estimate the influence of the existing configuration of land and sea, and that of currents superinduced thereby, and thus we are enabled to estimate approximately the effects of like causes in different hypothetical cases. The isothermal lines have thus been constructed by the author for the following cases: 1. When the progress of the gulf stream into the North Sea is supposed to be intercepted by land connecting the northern point of Scotland with Iceland, and that island with the continent of Greenland. 2. The next case assumes the elevation of the land now constituting western Europe to a sufficient height to produce such glaciers as those the effects of which we recognize in that region as having been produced during the glacial period. 3. The northern portion of the Atlantic is supposed to be converted into dry land by the elevation of its bed. 4. In the last case, the absence of the gulf stream with its influences upon the western coast of Europe is assumed, together with the submergence beneath the sea of a large portion of northern and western Europe. In this part of his memoir the author restricts himself chiefly to the consideration of these cases with the view of ascertaining how the cold of the glacial epoch can be best accounted for, together with its consequent glaciers of sufficient magnitude to produce the phenomena now so universally attributed to them. Having constructed the isothermal lines in any of the above cases for January and July, he deduces the mean annual temperature at any proposed place. He can then calculate the height at that place of an imaginary surface in the atmosphere, the temperature of which, at every point, is equal to 32° Fahr. This imaginary surface must of course meet the surface of the earth along a line for every point of which the mean annual temperature is that just mentioned; and any line upon this imaginary surface (as that in which it intersects the surface of a mountain,) is called a *line of* 32° *Fahr.* In estimating the height of this line, the author adopts the results given by Humboldt and others, as to the decrease of temperature for an assigned increase of height in ascending from the earth's surface. The next step is, to ascertain the position of the snow-line in reference to the *line of* 32°. In tropical regions the former line is *below* the latter; in higher latitudes it is generally above it. Whenever the difference between the summer and winter temperature is small, the snow line has a comparatively low position with respect to the line of 32°. By means of these and other inferences, drawn from existing cases, we are able to estimate approximately the relative positions of these two lines in our hypothetical cases, and thus knowing by calculation the height of the line of 32° at any proposed place, we can estimate that of the snow line at the same place. Now, it appears by observation that nearly all the well known glaciers, of sufficient magnitude to be considered of the first order, descend about 4,000 or 5,000 feet below the snow line, and that the smaller glaciers descend only to smaller distances below that line. We are thus enabled in any hypothetical case to form an approximative estimate of the distance which a glacier would probably descend beneath its snow line; or, knowing the height of that line by the means above stated, we can thus estimate the height above the sea level to which the lower extremity of the glacier would probably descend. The author then proceeds to apply these principles to cases 2, 3, and 4 above mentioned, and to determine the conditions under which glaciers, sufficiently large to produce certain observed glacial phenomena, would exist in Western Europe. In case 2 it would be necessary that that region should be elevated into a mountainous range of not less than 10,000 feet in height; a conclusion inadmissible, on account of the entire absence of all independent geological evidence in support of it. The hypothesis of case 3, Mr. Hopkins rejects for a similar reason. Case 4 is then discussed at length. It is shown that glaciers of the required magnitude would in that case exist in the region of Western Europe, if in addition to the absence of the gulf stream we suppose the existence of a cold current from the north of a moderately refrigerating influence. This latter current, however, might not be essential. The entire diversion of the present gulf stream into some other channel, which is required by this view of the subject, would be the necessary consequence of that submersion of the North American continent, of which we have such conclusive evidences during the glacial period; for in such case the current which sets into the Gulf of Mexico would manifestly continue in its north-westerly direction along the present valley of the Mississippi and the range of the Rocky Mountains to discharge itself into the Atlantic Ocean. This would correspond to the glacial period on this side the Atlantic; but along the new course of the gulf stream there would be a much warmer climate than at present, —and that such a climate has there existed at a recent geological epoch seems to be abundantly proved by vegetable remains which have been found between Hudson's Bay and the Rocky Mountains, precisely in the line which the warmer current would take.

A subsidence of the American Continent, of less than 2,000 feet would render the ocean continuous from the Apalachian chain, on the east, to the Rocky Mountains on the west, and there seems reason to believe that the subsidence may possibly have attained to a considerably greater amount. Now, it is manifest that the gulf stream is reflected in a north-easterly direction across the Atlantic, by the continent of North America, which arrests the north-westerly course by which the current reaches the Gulf of Mexico. But when that continent was submerged, as above supposed, the current would necessarily continue its north-westerly course, and probably along the foot of the Rocky Mountains directly into the Arctic Sea. This is the manner in which it is conceived the gulf stream was diverted from the shores of Western Europe. This diversion of the current is not to be regarded as a mere hypothesis adopted to account for any particular fact, but as a necessary consequence of that submergence of the North American continent.

Again, if this enormous current discharged itself into the Arctic Sea, it would seem extremely improbable that it should not give rise to some great determinate counter-current out of that sea. Now it appears highly probable that a considerable tract of land must have existed at the period of which we are speaking in the present region of north-eastern America, and Greenland. If this were the case, the only practicable outlet for a great current from the Arctic Sea would be across the submerged portion of northern Europe, or along the present North Sea, between Greenland and Norway; for the passage through Behring's Straits, even with a considerable subsidence of the land on either side, would be neither sufficiently wide nor deep to form a considerable outlet. Under such circumstances, it would scarcely seem more necessary that the gulf stream should hold its original north-westerly course over the submerged continent of America, than that it should complete its circuit by passing through the Arctic Sea, and returning to the Atlantic across the submerged land of Europe, as it now completes a more circumscribed circuit by being constrained to pass along the northern portion of the Atlantic itself.

The effect of this diversion of the gulf stream from its present course, would not be less remarkable in elevating the temperature of the northern shores of America and Asia, than in reducing that of western Europe. It can be shown that the mean annual temperature of Iceland is increased 18° or 20° Fahr., and the January temperature 34°, by the influence of this important current. There can be no reasonable doubt, therefore, of its raising the temperature of the north-western coast of America, from the Mackenzie river to Behring's Straits, by an amount at least equal to that by which it now elevates the temperature of Iceland. Further, it is highly probable that the principal course of the current in the Arctic Sea would not be far from the coasts of northern Asia, the temperature of which would thus be affected in a manner similar to that of the coast of America eastward of Behring's Straits. The temperature of winter immediately east of the Ural Mountains, would also be considerably moderated, as already stated, by the extension of the European sea towards their western flanks. The climate of the low lands of northern Asia would thus differ from the present climate of that region, as much as the existing climate of the western coast of Norway differs from that which would desolate that region in the absence of the gulf stream.

According to this view of the subject, the former existence in northern Asia of the immense numbers of large Mammalia indicated by the abundance of their fossil remains, no longer presents the slightest difficulty; and the theory receives a still further confirmation from an observation made by Sir John Richardson in his "Arctic Searching Expedition," just published. The author observes, " The existence of these numerous testimonials of an ancient fauna is suggestive of many curious speculations, and geologists seem hitherto to have failed in explaining the circumstances under which accumulations so vast could occur in such high latitudes. The difficulty is increased when we consider that these bones have not been detected to the east of the Rocky Mountains in high latitudes." This increased difficulty, however, is at once removed by the theory now proposed, for the region in which these remains are not found, must either have been covered with the waters of the ocean to the foot of the Rocky Mountains at the period when these Mammalia occupied the region to the westward, or if land existed on the north-east of the present American continent, it was probably too cold to be inhabited by them. Their disappearance from the country bounding the Arctic Sea, from the Rocky Mountains to the Ural, would be the consequence of the withdrawal of the gulf stream from the more eastern, and of the European ocean from the more westerly portion of that region. Fossil plants also, belonging to a comparatively warm climate, have been found east of the Rocky Mountains, on the coast of the North Sea; and extensive beds of lignite exist along the eastern flank of those mountains. So far as these phenomena may be of Pleistocene origin, they may be at once accounted for by this theory.

Before the depression of the North American continent was sufficient to admit the gulf stream to flow freely to the Arctic Ocean, the northern part of that continent would be converted into an Arctic sea, and this would correspond to the first part of the glacial drift period in that region. On the gradual elevation of the land after its greatest depression the north-western course of the gulf stream would be again arrested, and the northern portion of the American continent would be again converted into an Arctic sea. The temperature of the region of the eastern portion of North America would probably not be much affected by the alteration in the course of the gulf stream, nor would it probably be very different from that which obtains at present along its eastern coasts. It may also be added, that the continued course of the gulf stream into the Arctic Ocean would very probably generate a cold counter-current from the North Sea across the submerged portion of Europe, such as has been above alluded to. The author is anxious to direct the attention of geologists to this view of the subject, in the hope that it may be tested by such further observations as may bear more immediately upon it. It appears to him to satisfy better than any other theory the present known conditions of the great problem which the glacial epoch presents to us.

DRIFT OF THE NORTHERN AND WESTERN STATES.

M. Desor, who has devoted much time to the examination of the drift, or quarternary deposits of the Northern States, recently presented an abstract of his observations to the Geological Society of France. M. Desor classifies the superficial and *non-indurated rocks* of the waters of the St. Lawrence, and the Upper Mississippi, as follows;

1st, Alluvium; 2d, marine drift; 3d, fresh-water drift; 4th, drift proper, or diluvium. M. Desor proceeds as follows:

Alluvium is here, as everywhere, the least developed member; comprising the deltas of rivers, sand banks, shallows, and dunes. The *marine* drift passed at first among the American geologists, under the name of *Tertiary*, and comprises deposites of clay, sand and gravel, containing *marine* shells.

I propose to call them by the name of *Laurentian*, because these deposites are largely developed in the littoral valleys of the Atlantic; and principally in the great valley of the River "St. Laurent," (Lawrence,) and its affluents. It is thus I distinguished them from the similar deposites, that contain any fresh water fossils. Along the side of the Laurentian beds, and almost in contact with them, but at a little higher level, is found a series of deposites, externally very much like them, but without marine shells. This formation has no analogue in the continent of Europe; and it constitutes in America, the most marked feature in the geology of the quarternary period. Coming from the sea coast, we meet with it first, on the shores of Lake Erie, where it forms slopes, and terraces, composed at the lower parts of blue clay, and hard pan, surmounted by loam and gravel. A moment's observation convinces any one, that these ridges, terraces and slopes, are not the result of violent action; but that they were deposited in quiet waters. As the fossils are rare, as they differ in many respects from the Laurentian, doubts naturally arise as to their origin, and their age. Are they marine, or are they lacustrine? The same doubts rest upon the loamy deposites, that form the surface material over the vast space, occupied by the States of Wisconsin, Illinois, and Iowa, and the shores of the Mississippi Some geologists have called them by the name of *loess*, from their resemblance to the "loess" of the Rhine.

But these doubts have recently been removed, by the discovery by Mr. Whittlesey, in the blue marly clay of Lake Erie, at Cleveland, of fresh water and terrestrial shells, (Helecianœ and Planorbis,) at 25 to 50 feet above the level of the water. The same gentleman has collected numerous specimens of buried timber and leaves, from the same deposites, in which they are very abundant. M. Lesquereux has recognised among them, the leaves of the spruce (*Abies nigra*,) the common cranberry (*Vaccinium*) which now grows in that country, and many species of Cyperaceeœ.

Mr. Whittlesey soon after discovered fresh water shells in the loess-like deposites, on the shores of the Mississippi, including many species of Planorbis, one of Cyclas, and a Physa, at 60 to 180 feet above the level of the river. The same shells have been recently observed near St. Louis, (250 to 300 feet above the stream,) and at New Harmony upon the Wabash. Very lately, Dr. Rigsby has found on the banks of the river Notawassaga, that empties into the Bay of St. George of Lake Huron, in Canada, a bed of fresh water shells, (Unios) covered with deposites of much thickness, but he has not given us their elevation above the lake. Mr. Murray, of the Canadian Geological Society, has explored the northern shore of Lake Erie, and finds that the superficial deposites are composed of the same materials as those upon the southern shore opposite; and although he has not discovered there any shells, he does not doubt but the marly clays of Canada, and the sandy and loamy beds resting upon them, were deposited by the same waters, as those on the American side. If we examine the map, and the position of these deposites, and remember the elevation at which the fossils are found, at different points, we must infer, that there existed at the quartenary epoch, two immense sheets of fresh water in North America; one occupied the basin of the Upper Mississippi, the other, that of the Canadian Lakes, but both formed one vast sea of fresh water; from which, however, we must exclude the basin of Lake Ontario, which was marine, or salt water. The comparison of the levels, where the shells were found, at Cleveland, and on the Mississippi, shows that these great basins were not then isolated, but communicated with each other by many valleys, such as the Wabash and the Illinois; so that the basin of the lakes, which is now separated from that of the Mississippi, at that epoch discharged its waters into the basin of this great river. Mr. Hubbard, of the Michigan Survey, says, there exists a depression between Lakes Huron and Michigan, through the valley of Saginaw Bay, where there was a connection of the waters.

The existence of these fresh water deposites being now demonstrated, it becomes necessary to give them a specific name, to distinguish them from the marine, or Laurentian formation. The geological corps of the United States, in Michigan, propose to call them *Algonquin*, from a powerful nation of Indians, who heretofore inhabited the region of the lakes, and the heads of the Mississippi. It has not been definitely adopted, because there are doubts whether the drift proper that occupies the central and elevated parts of Ohio, Wisconsin and Michigan, is not of the same age. It was at first admitted, that the lacustrine deposites of Lake Erie, (on which Cleveland is situated,) although at a lower level, was nevertheless more recent than the "drift," and perhaps, contemporary with the "Laurentian." More recent researches have not confirmed this view; and many geologists, at the head of whom is Mr. Whittlesey, are now inclined to think, that the lacustrine or the "Algonquin" beds, are members of the "drift proper," modified by local action and circumstances, and that they pass insensibly into each other. If this is really so, it will follow, not only that the Laurentian is more recent than the lacustrine formation; but what is more important, the whole drift beds of the West must be regarded as a fresh water deposit. The difficulty in this case arises, in conceiving of banking, or highlands sufficiently elevated, to hold the waters of such a basin, for the drift deposites attain the height of 1,600 feet above tide, between Lake Superior and Lake Michigan, without including the erratic blocks, or "boulders" that are found still higher. Unfortunately, there have no shells been found in the elevated coarse drift. The only fossils that these beds have furnished, are parts of trees, leaves, &c. It is to be hoped that shells may be discovered; but until then, the identity of the drift with the Algonquin, or lacustrine formation, must remain in suspense. I should remark, that there is found on the surface of the lacustrine, as well as on the Laurentian, and on the proper "drift," boulders of all dimensions. The mere statement of this fact, proves that they were not transported by the same agent that has scratched, striated and polished, the rocks in place. If this agent was a *glacier*, we can no longer attribute to it the transportation of boulders, for in that case, their transportation should be contemporary with the polishing of the rocks; but there is between them the whole period, during which the lacustrine beds were being deposited. There are also, on the surface of the lacustrine of Lake Erie, (and other lakes) ridges and elongated hillocks, like the "osars" of Sweden, showing like them, traces of stratification, which proves that they were all formed under water. Neither the lacustrine or the Laurentian contain the bones of mammiferous animals, such as the Mastodon, Elephant, &c.; it being now established, that at the Big-bone lick, and in numerous other places at the west, heretofore referred to the drift period, are more recent deposites, such as "valley drift" and Alluvium.

M. Verneuil remarked, that he had never met with the fresh water drift, far from the great lakes and rivers of North America; and that it appeared to him, to be attributable to an ancient extension of their waters.

GEOLOGICAL DISCOVERIES IN SOUTH AFRICA.

Among African discoverers little known to the general public, is Mr. Bain, surveyor of roads in Cape Colony. This gentleman, in the course of his duties, has made some remarkable observations and discoveries in the geological structure of South Africa. He has shown that the oldest rocks form a broken coast fringe around the southern extremity of Africa, and are surmounted by sand stones, which from the fossils they contain, are the equivalents of the Silurian rocks. These primeval strata, occupying the highest grounds, of which Table mountain is an example, and dipping inland from all sides, are overlaid by carboniferous strata. Above all these ancient strata, says Mr. Murchison, in his address before the Geographical Society, and occupying, therefore, a great central trough or basin, strata occur which are remarkable from being charged with terrestrial and fresh-water remains only; and it is in a portion of this great accumulation that Mr. Bain disinterred fossil bones of most peculiar quadrupeds. One of the types of these, which Professor Owen named *Dicynodon*, from its bidental upper jaw, is a representative, during a remote secondary period, of the lacustrine associates of the hippopotami of the present lakes and waters. The contemplation of these discoveries, has therefore led me to point out to you how wide is the field of thought which the labors of one hard-working geologist have given rise to, and to express, on my part, how truly we ought to recognize the merits of the pioneer among the rocks, who enables us, however inadequately, to speculate upon the entirely new and grand geographical phenomenon, that such as South Africa is now, such have been her main features during countless past ages, anterior to the creation of the human race. For the old rocks which form her outer fringe, unquestionably circled round an interior marshy or lacustrine country in which the Dicynodon flourished at a time when not a single animal was similar to any living thing which now inhabits the surface of our globe. The present central and meridian zone of waters, whether lakes, rivers, or marshes, extending from Lake Tchad to Lake Ngami, with hippopotami on their banks, are, therefore, but the great modern, residual, geographical phenomena of those of a mesozoic age. The differences, however, between the geological past of Africa and her present state are enormous. Since that primeval time the lands have been much elevated above the sea-level—eruptive rocks piercing in parts through them; deep rents and defiles have been suddenly formed in the subtending ridges, through which some rivers escape outwards, whilst others flowing inwards are lost in the interior sands and lakes; and with those great ancient changes entirely new races have been created.

Travellers, continues Mr. Murchison, will eventually ascertain whether the basin-shaped structure, which is here announced as having been the great feature of the most ancient, as it is of the actual geography of Southern Africa, (*i. e.*, from primeval times to the present day,) does, or does not extend into Northern Africa. Looking at that much broader portion of the Continent, we have some reason to surmise, that the higher mountains also form, in a general sense, its flanks only. Thus, wherever the sources of the Nile may be ultimately fixed and defined, we are now pretty well assured that they lie in lofty mountains at no great distance from its east coast. In the absence of adequate data, we are not yet entitled to speculate too confidently on the true sources of the White Nile; but judging from the observations of the missionaries, and the position of the snow-capped mountains called Kilmanjaro and Kenin, (only distant from the eastern sea about 300 miles,) it may be said that there is no exploration in Africa, to which greater value would be attached than an ascent of them from the east coast, possibly from near Mombas. The adventurous travellers, who shall first lay down the true position of these equatorial snowy mountains, and shall satisfy us that they not only throw off the waters of the White Nile to the north, but some to the east,—and will further answer the query, whether they may not also shed off other streams to a great lacustrine and sandy interior of this continent, will justly be considered among the greatest benefactors of this age to geographical science.

The great east and west range of the Atlas, which in a similar general sense forms the northern frontier of Africa, is, indeed, already known to be composed of primeval strata, and eruptive rocks, like those which encircle the Cape Colony on the south, and is equally fissured by transverse rents. As to the hills which fringe the west coast, and through the apertures of which the Niger and the Gambia escape, we have yet to learn if they are representatives of similar ancient rocks, and thus complete the analogy of Northern with Southern Africa. But I venture to throw out the general suggestion of an original basin-like arrangement of all Africa, through the existence of a grand encircling girdle of the older rocks, which, though exhibited at certain distances from her present shores, is still external as regards her vast interior.

With no region of the old world have we been, till very lately, so ill-acquainted as Africa. But now the light is dawning quickly upon us from all sides; and in the generation which follows, I have no doubt that many of the links in the chain of inductive reasoning, as to the history of the successively lost races of that part of the globe, will be made known, from the earliest recognizable zones of animal life, through the secondary and tertiary periods of geologists. Passing thence to the creation of mankind, and to the subsequent accumulation of the great delta of the Nile, we have recently been put in the way of learning, what has been the amount of the wear and tear of upland or granatic rocks, and what the additions to the great alluvial plain of Lower Egypt, since man inhabited that most holy region, and erected in it some of his earliest monuments. But how long will it be before we shall be able to calculate backwards by our finite measure of time, to those remote periods, in which some of the greatest physical features of this continent were impressed upon it,—when the lofty mountains from which the Nile flows, were elevated, and when the centre of Africa was a great lacustrine jungle, inhabited by the Dicynodon, and other lost races of animals?

WESTERN HIMALAYA AND TIBET.

In the years 1847–8, an expedition was fitted out by the East India Company, for the exploration of the western Himalaya and Tibet. A journal of these travels and geological researches, has recently been published in England, by Dr. Thomson, one of the party, and a son of the celebrated chemist of that name. From this book, which contains much new and interesting scientific information, we derive the following extract. Many of the places examined and described, have never before been visited by any European traveller. The old, and still popular notion of Tibet, is that of a great mountain table land, or a series of table lands, at the back of the Himalaya, by which mighty chain its southern boundary is made, a barrier broken through by the Indus at one extremity, and the Brahmaputra at the other, while its northern limit is similarly walled in by the Kouenlun chain; the country thus supposed to exist is entirely imaginary. There is, indeed, no such table land. Nor is there, indeed any such great continuous chain as the Himalaya itself. The line of snowy peaks running parallel to the plains of India are not so many summits of one Alpine chain, but are separated from each other by deep ravines, through which flow large and rapid rivers. Between the Indus and the plains of north-west India is a rugged and mountainous track 150 miles broad. Kashmir is the only plain of any extent among these mountain ranges. The mountains between the Indus and the plains may be referred to two great groups, which may be respectively termed the Cis-Sutlej and Trans-Sutlej Himalayas. Tibet is the region among and of these mountains between their outer ramifications and the great chain of Kouenlun beyond the Indus. This chain separates Tibet from Yarkand and Kohoten. Over this stupendous barrier there are said to be only four passes, all crossing regions of eternal snows, and two traversing enormous glaciers. The Karakoram Pass is one of these, and is 18,200 feet above the level of the sea. The visit to this extraordinary locality is thus described by Dr. Thomson:—

"On the 19th of August, I started to visit the Karakoram pass, the limit of my journey to the northward. The country round my halting-place was open, except to the north, where a stream descended through a narrow valley from a range of hills, the highest part of which was apparently about 3,000 feet above me. All the rivers had formed for themselves depressions in the platform of gravel which was spread over the plain. I ascended this valley for about six miles: its width varied from 200 yards to about half a mile, gradually widening as I ascended. The slope was throughout gentle. An accumulation of alluvium frequently formed broad and gently-sloping banks, which were cut into cliffs by the river. Now and then large tracts covered with glacial boulders were passed over; and several small streams were crossed, descending from the northern mountains through narrow ravines. About eight miles from my starting-point the road left the bank of the stream, and began to ascend obliquely and gradually on the sides of the hills. The course of the valley beyond where I left it continued unaltered, sloping gently up to a large snow-bed, which covered the side of a long sloping ridge four or five miles off. After a mile, I turned suddenly to the right, and, ascending very steeply over fragments of rock for four or five hundred yards, I found myself on the top of the Karakoram pass—a rounded ridge connecting two hills which rose somewhat abruptly to the height of perhaps 1,000 feet above me. The height of the pass was 18,200 feet, the boiling point of water being 180.8°, and the temperature of the air about 50°. Towards the north, much to my disappointment, there was no distant view. On that side the descent was steep for about 500 yards, beyond which distance a small streamlet occupied the middle of a very gently sloping valley, which curved gradually to the left, and disappeared behind a stony ridge at the distance of half a mile. The hills opposite to me were very abrupt, and rose a little higher than the pass; they were quite without snow, nor was there any on the pass itself, though large patches lay on the shoulder of the hill to the right. To the south, on the opposite side of the valley which I had ascended, the mountains, which were sufficiently high to exclude entirely all view of the lofty snowy mountain seen the day before, were round-topped and covered with snow. Vegetation was entirely wanting on the top of the pass, but the loose shingle with which it was covered, was unfavorable to the growth of plants, otherwise, no doubt, lichens at least would have been seen. Large ravens were circling about overhead, apparently quite unaffected by the rarity of the atmosphere, as they seemed to fly with just as much ease as at the level of the sea.

"The great extent of the modern alluvial deposit concealed, in a great measure the ancient rocks. At my encampment a ridge of very hard limestone, dipping at a high angle, skirted the stream. Further up the valley a hard slate occurred, and in another place a dark blue slate, containing much iron pyrites, and crumbling rapidly when exposed to the atmosphere. Fragments of this rock were scattered over the plain in all states of decay. On the crest of the pass the rock *in situ* was lime-stone, showing obscure traces of fossils, but too indistinct to be determined; the shingle, which was scattered over the ridge, was chiefly a brittle black clay slate."

Conceive a vast tract of country, the lowest valley of which is as high as the summit of the Faulhorn in Switzerland, and many of whose habitable spots are nearly as lofty as the summit of Mont Blanc, composed of prodigous mountain chains from 17,000 to 19,000 feet above the sea, with occasional peaks exceeding 22,000 feet, winding and interlacing, intersected by deep and narrow valleys—ravines on an enormous scale—with too arid a climate to support forests, or any coniferous tree except alpine junipers—covered by a sky cloudy in winter, clear and bright in summer, and a powerful sun heating the bare black rocks, whilst the air is rent by winds of fearful violence—and we can form a picture of Western Tibet, the region explored by Dr. Thomson.

Among the discoveries of our traveller is that of the locality whence the borax imported from Tibet is procured. The plain of Pugha is the result of the drying up or drainage of an ancient lake. It is covered to the depth of several feet with white salt, principally borax. By digging below the superficial layer, the borax is obtained in a tolerably pure state.

CRYSTALLINE FORM OF THE GLOBE.

M. de Hauslab in a recent publication, after discussing the direction of mountains, and of dykes and of cleavages among rocks, deduces some general principles with regard to their direction, and then explains his hypothesis that the surface of the globe presents approximately the faces of the great octahedron. In an octahedron there are three axial planes intersecting one another at right angles; and the positions of the circles on the earth's surface which he lays down as the limits of these planes (or their intersection with the surface) are as follows. The *first* circle is that of *Himalaya and Chimborazo*, passing from Cape Finisterre to the Himalaya, Borneo, eastern chain of New Holland, (leaving on its sides a parallel line in Mallacca, Java and Sumatra,) to New Zealand, thence to South America near Chimborazo, the chain of Carracas, the Azores to Cape Finisterre. The *second*, passes along the South American coast and the north and south ranges of the Andes, the mountains of Mexico, the Rocky mountains, Behrings' Straits, the eastern Siberian chains, going to the south of Lake Baikel, the Altai, Himalaya, the mountains of Bombay in Hindostan, a point in the northeast of Madagascar (where the summits are 12,000 feet high,) the mountains of Nieuwedfeld, 10,000 feet high, Cape Caffres, to Brazil, the rapids of La Plata, Paraguay, Parana, the elevated basin of Titicaca, the Andes, Illimani and the defile of Maranova. The *third* circle cuts the two preceding at right angles, and passes by the Alps, the Islands of Corsica and Sardina, along the basin of the Mediterranean, the mountains of Fezzen, Lake Tchad, the Caffre mountains of Nieuwedfeld, the Southern Ocean near Kerguelen's Land, the eastern or Blue mountains of New Holland, straits of Behring, Spitsbergen, Scandinavia, Jutland, etc.

These three great circles point out the limits of the faces of the great hypothetical octahedron. Each of the faces may be divided into eight others by means of line of accidents of minor importance, so as to make in all forty-eight irregular triangles, a form of the diamond. At the intersections, M. de Hauslab observes that there are nodes of dykes, and along the lines or near them, all the mountains of the globe occur. The author gives an extended illustration of his subject and afterwards considers the particular history of the configuration of the earth's surface in accordance with his hypothesis.

M. Boue who adopts similar views adds as a note, that we should remember in this connection that the metals crystallize either in the tesserel or rhombohedral system, and that native iron, the most common constituent of meteorities, is octahedral in its crystals.

ON THE STABILITY OF THE EARTH'S AXIS OF ROTATION.

THE following is a communication read before the Royal Society, by Henry Hennessy, Feb., 1852.

The author refers to a communication to the Geological Society, by Sir John Lubbuck, in which he appeals in support of the possibility of a change in the earth's axis, to the influence of two disturbing causes, which appear to have almost entirely escaped the notice of Laplace and Poisson, in their investigations on the stability of the earth's axis of rotation; — 1. The necessary displacement of the earth's interior strata, arising from chemical and physical actions during the process of solidification. 2. The friction of the resisting medium in which the earth is supposed to move. With reference to the first of these disturbing causes, the author states, that he has been led to conclusions which may assist in clearing up the question. From an inquiry into the process of the earth's solidification, which appears to him most in accordance with mechanical and physical laws, he has deduced results respecting the earth's structure which throws some light on the changes which may take place in the relation which is capable of being expressed by means of a function which depends on the arrangement of the earth's interior strata. He then states that he has found strong confirmation of his peculiar views respecting the theory of the earth's figure in the experiments of Bischof of Bonn on the contraction of granite and other rocks or passing from the fluid to the solid crystalline state. From the results of these experiments, he has been led to assign a new form to the function expressing the relation of the earths' principal moments of inertia. Referring to his paper for the mathematical processes by which he has arrived at this result, he states that from the theory he has ventured to adopt, it follows, that as solidification advances, the strata of equal pressure in the fluid spheroidal nucleus of the earth, acquires increased ellipticity, and each stratum of equal density, successively added to the inner surface of the solid crust, is more oblate than the solid strata previously formed.

From these considerations alone, he remarks, it is evident that the difference between the greatest and least moment of inertia of the earth, would progressively increase during the process of solidification.

It follows, therefore, that if the earth's axis of rotation were at any time stable, it would continue so forever. But, from the laws of fluid equilibrium, the axis must have been stable from the epoch of the first formation of the earth's crust; consequently, it continued undisturbed, as the thickness of the crust increased during the several geological formations. Thus it appears that the displacement of the earth's interior strata, instead of having a tendency to change its axis of rotation, tends to increase the stability of that axis. With reference to inequalities arising from the friction of a resisting medium at the earth's surface, the author observes that this could not exist, if, as in the manner here shown, the axis of rotation coincided from the origin with the axis of the figure. In conclusion, he remarks, that if we could assume for the planets a similarity of physical constitution to that of the earth, the theorem as to the greatest and least moments of inertia of the earth would be applicable to all the planets; and thus we should be as well assured of the stability of our system, with respect to the motion of rotation of its several members, as we are already respecting their motion of translation.

In reference to a third cause of disturbance in the place of the earth's axis of rotation, namely, the effects of local elevations and depressions at the earth's surface, the author says: — If with Humboldt, we regard the numbers expressing the mean heights of the several continents, as indicators of the plutonic forces by which they have been upheaved, we shall readily see that these forces are of an inferior order, to those affecting the general forms and structure of the earth. If the second class of forces acted, so as not to influence in any way the stability of the earth's axis of rotation, the former class might, under certain conditions, produce a sensible change in the position of the axis. But when the tendency of the second class of forces is to increase the stability of the earth's axis, it would not be easy to show the possibility of such conditions, as to render the operation of the other forces, not only effective in counteracting that tendency, but also producing a sensible change in the place of the axis of rotation. — *Proc. Royal Society.*

SHOWERS OF SAND IN CHINA.

The following account of sand showers in China is given by Dr. D. J. Macgowan, of Ningpo :—

The Phenomenon of falling sand is occasionally observed through a great extent, if not the entire portion, of the vast Plain of China. It is of such frequent occurrence that the Chinese regard it with no more surprise than they do the flitting meteor. Probably no year passes without several of these showers, though frequently so minute as to escape general observation. Perhaps as often as once in three years they are very heavy, but it is seldom that sand falls in such a large quantity as during the last shower. The phenomenon was witnessed three times during the present year, within a period of five weeks; the last and greatest commenced on the 26th of March, and continued four days without intermission, varying however, in intensity. The wind blew from the north, northeast, and northwest, frequently shifting between these points, and varying in strength from a perfect calm to a brisk breeze. The altitude of the barometer was from 29.40 to 30.00 (rather lower than before and after the shower.) The thermometer ranged from 36° to 81° Fahr. No rain had fallen for six weeks, and the hygrometric state of the atmosphere was very high. Neither cloud, fog, nor mist obscured the heavens, yet the sun and moon were scarcely visible, the orb of day appeared as if viewed through a smoked glass, the whole sky presenting a uniform rusty hue. At times this sameness was disturbed, exhibiting between the spectator and the sun the appearance of a water-spout, owing to the gyratory motions of the impalpable mineral. The sand penetrated the most secluded apartments; furniture wiped in the morning would be so covered with it in the afternoon, that one could write on it legibly. In the streets it was annoying, entering the eyes, nostrils and mouth, and grating under the teeth. My ophthalmic patients generally suffered a relapse, and an unusual number of new cases soon after presented. Were such heavy sand storms of frequent occurrence, disease of the visual organs would prevail to a destructive extent. The effect was the same when observed from the Ningpo Tower, and from the summit of the low mountains in the neighborhood of the city.

The specimens I gathered fell on a newspaper placed on the roof of a house. The whole quantity which fell was about ten grains to the square foot. It should be remarked, however, that during the four days the dust seemed suspended in the air for several hours at a time, scarcely an appreciable quantity falling during these intervals. The Chinese call it *yellow sand;* it is an impalpable powder of that color.

It was observed at sea, at Hangchau, and at Shanghai. Whence did it originate? The opinion of the Chinese on this subject may, I think, be regarded as correct. They assert that it comes from Peking. We know that the sand of Sahara is sometimes elevated by whirlwinds into the upper current of the air, and deposited in the Atlantic twelve hundred miles, sometimes directly opposite to the trade winds. Over against the vast alluvial Plain of Eastern Asia is the ocean of sand—the Desert of Gobi or Shamoh, extending from near the sea westerly 2,300 miles, and 3 to 400 broad—including the conterminous sandy districts. Like its counterpart in Africa, it is subject to whirlwinds which raise its fine dust like the waves of the sea, and doubtless at times waft it into the upper currents of air, and transport it to distant regions. I have been informed by intelligent natives of Kiangsi and Honan, that the phenomenon occurs in those provinces also. Assuming the Mongolian steppes to be the source whence these showers descend, the amount of sand which is annually conveyed hither must be prodigious to cover such an extensive area. Regarded in a meteorological and in a geological point of view, these showers possess no small interest.

GNEISS AND SURPENTINE FORMATIONS.

Leonard and Bronn's Jahrbuch state that they have observed gneiss associated with conglomerate, and great veins of gneiss traversing gneiss. These facts have been verified by the discovery of similar phenomena in other countries, and gneiss is now divided into the following formations: — 1, *Primary Gneiss*, that associated with certain granites, and forming the fundamental or oldest formation of the crust of the earth; 2, *Transition Gneiss*, that which rests upon transition rocks, as greywacke, clay slate, and old red sandstone, and even alternates with them; 3, *Secondary Gneiss*, this formation rests upon lias, and is well seen in Switzerland. We have no intimation that gneiss has been met with in the tertiary group.

Many years ago, Jameson noticed the gradual transitions from trap to serpentine, both in Germany and Scotland. Very lately the celebrated Rose, of Berlin, has illustrated this view in a very interesting manner.

ON THE EVOLUTION OF GAS IN WALLSEND COLLIERY, ENG.

Prof. Phillips at the British Association remarked that the Wallsend Colliery was one of the numerous coal mines in Yorkshire which have been rendered remarkable for the frequent explosion of the inflammable and noxious gas with which they are filled, and the loss of life which has in so many cases been the consequence. In every coal-pit there are two shafts, one of which serves to admit the pure air, whilst the foul gases are made to escape by the other. The ascent of the foul gases is frequently facilitated by creating a draft by fires placed near the bottom of one of the shafts. The coal is arranged in perpendicular layers, between which the gases exist in a highly compressed state. In order to detach these layers with the least possible danger, it is usual to cut through them endways, by which means the gases are allowed to make their escape at once from a considerable portion of the coal. A district of this colliery, covering about fifty acres, was effectually walled up, in consequence of the immense discharge of gas that was continually taking place. A pipe was led from this enclosed portion up through the mine and for forty feet above the surface, and from this pipe there has been a constant discharge of gas for the last eighteen years. This gas has been inflamed, and in the roughest and most stormy weather it has burned without intermission; and were it as rich in naphtha as ordinary carburreted hydrogen, it would illuminate the country for miles round. Two water-pressure gauges were fixed to the brick walls, one at the surface of the earth, and the other at the bottom of the mine, and the results were that, whilst the pressure in the mine was only 9-10ths of an inch on an average, that at the top of the pit was upwards of four inches. From observation in these mines, it is seen that discharges of fire-damp, governed by atmospheric pressure, take place before being indicated by the barometer, and that as an indicator that instrument cannot be relied on. A fact somewhat similar was first observed by Prof. Daniels, in his researches at the Royal Society, where the water barometer indicated the change of pressure an hour earlier than the usual mercurial standard barometers constantly used for observations.

GEOLOGY AND PALÆONTOLOGY OF A PART OF THE ROCKY MOUNTAIN REGION.

Prof. Hall, in the Report of Stansbury's Expedition to the Great Salt Lake, furnishes some notes on the Geology and Palæontology of a part of the Rocky Mountain Region, from specimens collected in the course of the Expedition.

The first specimens furnished are from the west side of the Missouri River, near and above Fort Leavenworth (39° 21′ N., 94° 44′ W.) They are all from limestone of the Carboniferous period, and apparently from the upper of the two great limestones of this period in the West. The most conspicuous fossils are *Productus* and *Terrebratula.* The route from the Missouri westward, shows a continuation of this limestone as far as the Big Blue river. Here it disappears, and is soon succeeded by strata of the *Cretaceous* age, which extends for a considerable distance on the route. Among the cretaceous fossils are a species of Pholadomya, and the Inoceranaus, which is so abundant in numerous localities in this region.

It would appear that the character of the country from near Fort Kearney to near Fort Laramie is uniform, and no deposites of older date than the Tertiary were observed. Of the specimens collected, there is but a single individual indicating the character of a marine formation. From the condition of the bones it may even be questioned, whether the deposit containing them is not of post tertiary age. The specimens from the vicinity of Fort Laramie are all from limestone of the carboniferous period. Some of the fossils are identical with species collected between the Missouri and the Big Blue, and we can only suppose, from the great similarity of the specimens, that it is a continuation of the same formation. The specimens collected two days' march north-west of Fort Laramie, (105° W.,) are a feldspathic granite with little quartz or mica. The rocks in this locality are doubtless of metamorphic origin, probably rocks of the Silurian age. The specimens collected three days' march in advance of this place, (105° 25′ W.,) are shaly sandstones and thinly laminated sandstones containing fossils. These beds are recorded as dipping at the rate of 15° to the N. E., and are probably Devonian. The specimens collected at 105° 50′ W., are precisely like those collected at Fort Laramie and contain the same species of fossils; red and gray sandstones were also seen here. On the following day, (near 106° W.,) is recorded a bed of coal, three or four feet thick, with *Sigellaria* and *Calamites.* The specimens collected here are those of bituminous coal, and soft shale, without any well marked vegetable remains. From the proximity of limestone of the age of the coals, and the records ot sigillaria and calamites occurring in the same connection, it may be presumed that this coal belongs to the true coal measures; and this locality is probably an exposure indicating the existence of a great basin. This point itself, and the surrounding country are well worthy of a more extended examination, since the discovery of workable beds of coal in this region would be a matter of national importance. From the Wind River Mountain to Fort Bridget, (in 41° 18′ N., 110° 32′ W.,) the collections are all *marine tertiary*, including many specimens of nautilus and other marine shells. West of Fort Hall are chert and limestone of the carboniferous period.

The specimens collected in the islands and shores of the Great Salt Lake, are sufficient to give a very good idea of the general geological features. The specimens are of metamorphic rocks, consisting of talcose and mica slates, hornblende rocks, and a few specimens of granitic and syenitic character. From the facts in my possession, it would appear that these metamorphic rocks are distinctly stratified and highly inclined, but do not attain any great elevation. The direction of the ranges, corresponding to that of the elevating forces, appears nearly to conform to north by west, and south by east. From the form of the lake and the different localities at which rocks of this character occur, we may infer that there were two lines of elevation, corresponding with the divisions of the lake. The more elevated portions of the lake shore, and the mountain ranges consist of carboniferous limestone. In some localities this limestone is partially altered, losing its granular character, and becoming sub-crystalline, or threaded by numerous veins of calcareous spar. In most localities the limestone abounds in fossils, particularly corals of the Cyathophillidæ.

It will be seen from these facts that we have very satisfactory information that the *limestone of the carboniferous period* is widely distributed in the region around the Great Salt Lake. Its position relative to the coal bed on the north fork of Platte River has not been determined; but since no beds of coal have been observed on the slopes of the mountains in the region of the Salt Lake, we are left to infer that the coal is to be sought (as elsewhere) above the limestone. Since the existence of coal is proved at one point (admitting the evidence in favor of its age being that of the carboniferous period,) we are warranted that it once existed over a much wider area, and can be sought with success in the proper situations. The importance of coal in that distant region cannot be too highly estimated, and the geographical position and extent of the beds, should be one of the first points ascertained in thelocation of any route of communication between the east and the west.

RESEARCHES IN NEW ZEALAND.

According to recent accounts from this interesting country, true palæozoic coal has been discovered in the north part of the Middle Island. The accounts are too vague to be entirely decisive of the important question, whether in those remotest masses of dry land, remains of the ancient carboniferous floras are buried. Fossils are stated to have been found in a white, fine sandstone grit, but their nature is not specified, except that remains of some kinds of *Pecopteris* and *Sphenophyllum* were mentioned, but the species are not named.

In the south and south-west regions of the Middle Island, Mr. Walter Mantell, in an arduous exploration for three months, as government Surveyor in the almost uninhabited and dreary tracts of that country, kept up an active search for the rare indigenous birds, and for fossils; but with the exception of a large parrot, believed to be unknown to naturalists, no additions were made to the fauna of New Zealand. A diligent hunt for vestiges of the Moas, and for a live specimen of Notornis, was unattended with success. The last accounts from Mr. Mantell stated that the servants he had sent out to the localities which native traditions pointed out as the habitat of the Notornis, had returned birdless, and reported that the wild dogs occupied the country to such a degree, that it was hopeless to expect the wingless birds could escape. The stuffed specimen of Notornis in Dr. Mantell's possession (in London,) bids fair, therefore, like the last of the Dodos, to be the sole representative of its race.

MINNESOTA SALT REGION.

Probably there is not a richer salt region on the face of the earth, than the one in Minnesota. The territory is generally supposed to be valuable for its agricultural resources alone; nothing, however, can be more erroneous. True, its natural agricultural wealth is probably second to none in the Mississippi valley, but its mineral wealth is not less extensive and valuable. Among the latter, its salt stands preeminent. The region lies between 47° and 49° north latitude, and 97° and 99° west longitude. Its exact locality was ascertained and defined by an expedition sent out from Fort Snelling, by Major Long, in 1822 – 3. A description of that salt region, together with its locality, will be found in the Topographical department at Washington.

Our first information of that salt region was from a soldier in the expedition. He says that they had been travelling for several days over a vast rolling plain, with no trees or water; the troops and horses were almost famishing with thirst, when they came suddenly upon the shore of a beautiful lake, about half a mile in diameter, sunk down deep in the plain. It resembles more a vast sink hole. From the height above the waters a vast snow bank appeared to line its shore, but upon examination it proved to be an incrustation of salt as pure and as white as snow. The waters of the lake were like the strongest brine. So strong was it that one bathing in it, upon coming out, in a few minutes would be covered with the white crystallization of salt.

If this salt region be as rich as it is supposed to be, a railroad projected into it would prove to be the best stock in the country. There are mines of undeveloped wealth more extensive, more durable, and more important than all the gold regions beyond the Rocky Mountains. We are informed also, that a very short distance below the surface the pure rock salt lies in a strata like coal or lime rock. We hope the attention of the public and the Government will be turned to the subject. There is a region lying in our immediate neighborhood, almost unknown, containing more intrinsic wealth than any State in the Union, and which would yield an annual income probably equalling the entire revenue of the country. — *St. Louis Union.*

SALT LAKE OF UTAH.

Lt. Stansbury in his report of the " Expedition to the Valley of the Salt Lake " says: — No one, without witnessing it, can form any idea of the buoyant properties of this singular water. A man may float, stretched at full length upon his back, having his head and neck, both his legs to the knee, and both arms to the elbow, entirely out of the water. If a sitting position be assumed, with the arms extended to preserve the equilibrium, the shoulders will remain above the surface. The water is, nevertheless, extremely difficult to swim in, on account of the constant tendency of the lower extremities to rise above it. The brine, too, is so strong, that the least particle of it getting into the eyes produces the most acute pain, and if accidentally swallowed rapid strangulation must ensue. I doubt whether the most expert swimmer could long preserve himself from drowning, if exposed to the action of a rough sea.

Upon one occasion a man of our party fell overboard into the lake, and, although a good swimmer, the sudden immersion caused him to take in a few mouthfuls of water before rising to the surface. The effect was a violent paroxysm of strangling and vomiting, and the man was unfit for duty for a day or two afterwards. He would inevitably have been drowned, had he not received immediate assistance. After bathing it is necessary to wash the skin with fresh water, to prevent the deposition of salt arising from evaporation of the brine. Yet a bath in the water is delightfully refreshing and invigorating. The analysis of this water by Dr. L. D. Gale, has shown that it contains rather more than 20 per cent. of pure chloride of sodium, and not more than 2 per cent. of other salts, forming one of the purest and most concentrated brines known in the world. Its specific gravity was 1.17, but this will slightly vary with the seasons, being doubtless affected by the immense floods of fresh water which come rushing down into it from the mountains in the spring, caused by the melting of the snows in the gorges. The ancient extent of the lake must have been far greater than its present limits indicate. As many as thirteen distinct marks of ancient levels, successive terraces formed by ancient beaches, the highest as much as two hundred feet above the plain, were counted in one place. These appearances, comparable with the famous " parallel roads " of Glenroy, in Scotland, would lead to the inference that the Great Salt Lake was formerly vastly more extensive, stretching for hundreds of miles, studded with huge island, now forming the isolated mountains that rise amid the surrounding plains. The immense miry flats, consisting of soft mud, traversed by rills of salt and sulphurous water, that bound its western shores, would themselves, if submerged for a few feet, convert the lake into a far-extending inland sea. At present they glisten with salt-crystals, whose brilliant glare is interrupted occassionally by oases of artemisa and greasewood. The two valleys that lie at the southern end of the lake are the only parts of its shores adapted for human habitation.

Although not directly stated, several facts are given, in the report of the expedition which seem to imply that there are no fish in the lake itself. A curious feature in its zoology is the immense accumulation on its shores of the larva-cases and other exuviæ of dipterous insects, probably preserved in such quantities through the peculiar qualities of the water. No mention is made of molluscous animals or their shells. The mammals collected from the neighborhood are stated to belong to the Rocky Mountain series. The most interesting is the great-tailed fox, *Vulpes Marcrourus*, described for the first time. Several interesting new plants were gathered. The difficulty of finding fresh water around its shores, the necessity of carrying with them all their provisions, the barren and savage character of a great part of the region traversed, rendered the survey unusually arduous and protracted, and would have proved fatal to its progress had not the climate been one of exceeding salubrity, so that, with all their trials and fatigues, the members of the exploring party enjoyed uninterrupted good health.

EARTHQUAKES OF 1852.

THE following is a record of the various earthquake phenomena which we find reported through different sources, as having occurred during the year 1852.—*Editor.*

January 10. In Massachusetts. In this instance, which has not been generally noticed, the shock was sensibly felt throughout the whole length of the State, from New Bedford to Springfield, on the Connecticut River. Shock, very slight.

Jan. 17. Slight shock at Galveston, Texas.

Jan. 26. Throughout the State of Mississippi, and in the south of France. At Bordeaux, the shocks were very severe, though momentary. On the same day, also at Messina, Sicily, and at this latter place throughout the month, shocks were frequent.

March 31. Throughout northern India.

April. 10. At St. Michaels, Azores, at 2 A. M., producing great devastation.

April 14. At the Sandwich Islands. Severe shocks, followed on the fifteenth by a volcanic eruption.

April 27. At Valparaiso.

April 28. At the Azores.

April 29. Smart shocks experienced in Maryland, Virginia and North Carolina.

May 9. In South Wales.

May 11. At Apalachicola, Florida.

May 26. In the province of Shookingah, China; 300 persons killed, and property to a great amount destroyed.

June 19. In Berne and Friburg, and throughout Switzerland generally.

June 20. At the Bermudas.

June 30. In New Hampshire and Vermont, slight shock.

July 7. At Jamaica, several severe shocks, continuing three minutes, and causing much damage.

July 17. At St. Jago de Cuba. This shock was also felt at sea by the ship Tropic, 70 miles west of Jamaica.

August 1. At Groton, Connecticut.

August 2. At Bathurst, Canada. Shock sufficient to break glass, etc. etc.

August 4. In Northern India.

August 14. At Spezzio, Italy.

August 17 and 18. At Port au Prince; severe shocks.

August 18. Throughout St. Domingo.

August 20. Great earthquake in St. Jago de Cuba. This earthquake was one of great violence and occasioned great loss of property and life. The same day occurred the great eruption of Mount Etna.

August 21. At Jamaica. Also at Ezeroum, Asia Minor. Loss, 300 houses and 17 lives.

August 25. At Augusta, Georgia, and in various parts of the United States.

August 27. In Turkey.

August 28. At St. Domingo; also at St. Jago de Cuba.

August —. In the province of Kalsuch, China; a terrific earthquake.

September 16 to 21. At the Phillipine Islands; severe and repeated shocks, causing great damage and alarm. These earthquakes were also felt at sea for a great distance.

October 1. At Malaga, Spain.

October 9. South of England; slight shock.

October 11 and 12. At Manilla and the Phillipine Islands; severe.

October 15. In the North of Hungary; a series of shocks.

October 22. At St. Lucia.

November 8. In Sicily; particularly at Reggio.

November 19. At Valparaiso, Chili.

November 22. At Lima, Peru.

November 26. At St. Jago de Cuba; severe.

December 4. Throughout Mexico.

December 9. At Acapulco, and the whole west coast of Central America; shocks in many places severe, and accompanied with volcanic eruptions.

December 17. At St. Jago de Cuba.

GREAT ERUPTION OF MOUNT ETNA.

Mount Etna, which for some years has remained dormant, experienced a very violent and long continued eruption during the past year. The eruption commenced on the 20th of August, the same day on which the terrific earthquake of St. Jago de Cuba occurred, and continued with greater or less activity until the 17th of November following.

The indications of its approaching activity were, as usual, the drying up of wells in the neighborhood, the duration of most dense clouds of white smoke which rose like a vast pine tree, hollow rumbling sounds, and three violent shocks, as of an earthquake. Shortly after, towards the east, two new mouths were opened in the site which is known under the name of the Valle del Leone. At first only clouds of a very fine ash were thrown up; which completely covered all the land near the mountain, and quantities of which being taken up still higher by an impetuous wind, were carried far off into the sea. These, however, were but a small instalment of what was to follow. Immediately afterwards an immense body of lava was vomited forth; which precipitating itself down the mountain with the violence of a torrent, divided into three streams. One of these flowed in the direction of Zaffarana — another in the direction of the Comune of Giarra, more particularly on an estate called Milo, near Giarra. To give an idea of the immense quantity of liquid fire that was thrown out, official statements describe this river of lava as being two miles in breadth at the greatest, and ten palms in depth, whilst the rapidity with which it moved was such as to cover in one hour a space of not less than 160 palms in extent. It seems, that in a very short time, in consequence of the increasing strength of the eruption, the new mouths were broken up so as to form one only; from which masses of rock and cinder were thrown into the air to a great height, and falling on the wide extent of country round, carried with them the most fearful ruin. The utmost intensity of the eruption perhaps took place on the 25th, 29th, and 30th of August, and on the 4th of September. The rumbling subterraneous thunders were then incessant, as was also the shaking of the ground. To this add the clouds of smoke and flame which rested like an imperial diadem on the summit — and we may form some faint idea of the magnificent and awful spectacle which Etna on those days presented.

The accidents of the land, and the greater or less quantity of materials thrown out of the mountain, produced a great variety in the course of the streams of lava. Sometimes they appeared to drag their slow length along, sometimes to precipitate themselves with threatening violence, expanding widely till they covered vast spaces of land, or twisting and twining into the most capricious sinuosities, and according to the varying rapidity of their movements varying their depth and extent. On the 22d of August the running lava is stated to have been 18 palms deep, whilst on the 30th it had increased to 240 palms in some places. On the 31st of August the eruption still continued very violent. The lava advancing on the village of Ballo, completely swallowed up several houses on that day, as also the road which divides it from Zaffarana. During the next two days it diminished in power, and hopes were entertained that one or two neighboring villages might be saved. On the 4th of September, however, it again burst forth with unusual fury, thundering, shaking, and vomiting forth new matter in the direction of Milo. Thus the mountain continued its activity with greater or less violence throughout the whole month. If the lava flowed in smaller quantity, denser clouds of smoke arose, and a greater quantity of ashes and sand were thrown out. During the month of October much activity was manifested, though greater hopes were entertained that the eruptions might soon cease.

A correspondent of the London Athenæum says, the damage which has been inflicted is difficult to estimate, for the course of the lava lay through a country of extraordinary fertility, and abounding in every species of vegetation. Had nothing but ashes been thrown out, all the saints in the callender would have been *festeggiati*, for nothing is so propuctive of fertility as volcanic ashes, but what can make any impression on large masses of indurated lava but the slow operation of the elements, or what root for centuries will ever be able to pierce it except the prickly pear?

An extraordinary feature of the eruption was the vomiting forth from the crater of a large quantity of sal ammoniac, rendering the air so impure as to threaten the lives of seamen on the coast. Vessels in the vicinity of the mountain were covered with cinders, and ashes and volcanic dust were wafted by the wind as far as Malta.

GREAT VOLCANIC ERUPTION AT THE SANDWICH ISLANDS.

One of the greatest volcanic eruptions on record, — that of the volcano of Mauna Loa, at the Sandwich Islands, took place in February, 1852, commencing on the 17th of the month. The eruption appears to have been somewhat unexpected, and was not heralded by any of the accustomed premonitory signs. The current seems to have broken out through an old fissure, about one-third down the side of Mauna Loa, on the north-west side, and not from the old crater on the summit, called Mokuoweoweo. The altitude of the eruption was about 10,000 feet above the level of the sea, and at a distance from the Bay of Hilo, of about 60 miles. A writer who witnessed the eruption from Hilo, thus describes some features of it:

" By an accurate measurement of the enormous jet of glowing lava, where it first broke forth on the side of Mauna Loa, it was ascertained to be five hundred feet high! This was upon the supposition that it was thirty miles distant. We are of the opinion that it was a greater distance, say from forty to sixty miles. With a glass, the play of this jet, at night, was distinctly observed, and a more sublime sight can scarcely be imagined. A column of molten lava, glowing with the most intense heat, and projecting into the air to a distance of five hundred feet, was a sight so rare and at the same time so awfully grand, as to excite the most lively feelings of awe and admiration, even when viewed at a distance of forty or fifty miles. How much more awe-inspiring would it have been at a distance of one or two miles, where the sounds accompanying such an eruption could have been heard. The fall of such a column would doubtless cause the earth to tremble; and the roar of the rushing mass would have been like the mighty waves of the ocean beating upon a rock-bound coast. The diameter of this jet is supposed to be over one hundred feet, and this we can easily believe, when we reflect that from it proceeded the river of lava that flowed off from it toward the sea. In some places this river is a mile wide, and in others more contracted. At some points it has filled up ravines one hundred, two hundred, and three hundred feet in depth, and still it flowed on."

Mr. Coan, a missionary, residing at Hilo furnishes another graphic description. He says: "On the 17th instant, at twenty minutes past 3, A. M., a small beacon light appeared on the summit of Mauna Loa. This light increased until it looked like a rising moon. In half an hour, brilliant columns of lava shot up against the heavens, and a general burst of blood red fusion poured out of the same orifice apparently, which disgorged such awful floods in 1843. We were awakened at about 4 o'clock, and saw a glare of light streaming through our windows. Our first thought was that some building near us was on fire, but on rising we soon perceived that the whole summit of the mountain was irradiated, and that a vast furnace was there glaring with vehement heat. The molten flood rolled down the side of the mountain so rapidly that in two hours we judged its progress to have been fifteen miles, the whole lava glaring with great brilliancy. This flow continued through the day, but with decreasing energy. It became sluggish at night, and the next day, or after twenty-four hours, no traces of it were visible from the station; no smoke by day and no fire by night. At six o'clock, A. M., on the 20th, yesterday, we perceived fire issuing from the side of the mountain toward Hilo, and about half way down the mount. This lateral crater soon became intensively active, pouring out a gory flood which soon reached the base of the mount. At first the stream shot directly down towards Hilo; but meeting some obstacle near the foot of the mount its direction was changed to the north, and it is still flowing towards Mauna Loa. A vast area between the mountains is already filled with fire, and the scene by night is one of terrible sublimity. The red hot lava still rolls out of the side of the mountain in awful floods. It seems as if the bowels of Pluto were being disgorged. While I write, our whole atmosphere is filled with lurid smoke, through which the sun looks down upon us with a yellow and baleful light. The horizon is hung in murky drapery; detonations, like distant thunder, are heard from the mountain, and capilliform filaceous vitrifactions are filling our streets."

On the 6th of March the lava was still flowing, and the light emitted by the stream was so intense, that small objects could be most clearly seen at midnight in Hilo.

It must be noticed as one of the incidents of this eruption, that the most striking display of the Aurora, witnessed in the United States during the year 1852, took place on the 20th of February, during the progress of this great eruption.

A letter from Mr. Fuller published in Silliman's Journal, September, gives the following picture of the intensity of the eruption. There played a fountain of liquid fire of such dimensions and such awful sublimity, shaking the earth with such a constant and deafening roar, that no picture can give any adequate conception of its grandeur. A few figures may assist the imagination in its attempts to paint the scene. I made the following calculations, after careful observations during nearly twenty-four hours, from different points within a mile of the crater. The diameter of the crater, which has been entirely formed by this eruption is about 1,000 feet, its height from 100 to 150. One part of the crater was raised fifty feet during our presence on the spot. The height of the column of red hot liquid lava, constantly sustained above the crater, varied from 200 to 700 feet, seldom falling below 300. Its diameter was from 100 to 300 feet, rarely perhaps reaching 400 feet. The motions of this immense jet of fire were beautiful in the extreme, far surpassing all the possible beauties of any water fountain which can be conceived; constantly varying in form, in dimensions, in color and intensity; sometimes shooting up and tapering off like a symmetrical Gothic spire, 700 feet high; then rising in one grand mass, 300 feet in diameter, and varied on the top and sides by points and jets, like the ornaments of Gothic architecture. The New Yorker, as he gazes on the spire of Trinity Church, can imagine its dimensions increased three-fold, and its substance converted into red hot lava, in constant agitation, may obtain a tolerable idea of one aspect of this terrific fire fountain. But he should stand at the foot of Niagara Falls, or on the rocky shore of the Atlantic when the sea is lashed by a tempest, in order to get the most terrific element in this sublime composition of the great artist. For you may easily conjecture that the dynamical force necessary to raise 200,000 to 500,000 tons of lava at once into the air, would not be silent in its operations.

A NEW MINERAL AND EARTH.

Dr. D. D. Owen, U S. Geologist, gives the following communication respecting a supposed new mineral and a new earth, discovered by him, in Silliman's Journal, May, 1852.

While examining, in the summer of 1848, the north shore of Lake Superior, situated in Minnesota, particularly in the vicinity of Baptism River, I observed a peculiar, soft green mineral diffused in the amygdaloidal traps. Though not in large masses, the mineral was so abundantly disseminated in some of these rocks, that the least blow of the hammer indented the rock, and left a whitish-green mark from the easily crushed particles of the soft green mineral in question. Chemical analysis of the mineral showed it to be essentially a hydrated silicate of magnesia, and what appeared to be a new earth, intermediate in its properties between magnesia and manganese. The color of the mineral when pure, is of a pale yellowish-green, consistence and hardness about that of wax. Specific gravity, 2.548. It has not been found crystallized. Treated with hydrochloric acid, chlorine is evolved, and the greater part of the constituents, except silica, dissolved. About 10 per cent. of the mineral is made up of the supposed new earth, which when separated has the following properties and reactions with re-agents: — It dissolves either in hydrochloric or nitric acid evolving chlorine from the former acid. The solution in hydrochloric acid, when concentrated, has a beautiful pea-green color, and the salt crystallizes either of a slightly paler green, or a light chrome yellow, depending on the degree of heat at which the evaporation is completed. The peculiar color of its salts, together with the appearance of the residue left in the analytical process after treating with caustic potash to separate the alumina, was what first attracted my attention to this earth. When separated. and still slightly contaminated with magnesia, the earth has a pale, flesh color, not unlike yttria. When freed from magnesia, it has more the appearance of powdered dried albumen. The earth differs from alumina and glucina in being insoluble in caustic potash. From magnesia in producing colored salts ; in being only slightly soluble in ammoniacal salts ; in the peculiar vesicular character of the precipitate with phosphate of soda ; in being precipitated with oxalate of ammonia. From yttria it differs in not giving a precipitate with oxalic acid in slightly acid solutions ; in being precipitated by succinate of ammonia, even before the solution is quite neutral, which prevents this re-agent being applied to separate iron from it, as is recommended by Berzelius for separating oxide of iron from yttria. It differs from zirconium in being soluble in nitric and muriatic acids after ignition. From cerium, in not turning a brick-red after ignition, and in the color of its salts which are not amethystine, but shades of green and yellow, except the nitrate, which is almost colorless. The nitrate crystallizes in prisms, which seem to be right-rhombic. Its salts, like the corresponding ones of magnesia seem to be deliquescent. From the quantity of chlorine evolved during the solution of the mineral and earth in hydrochloric acid, it appears that this earth must exist in at least two degrees of oxidation ; the chlorine being disengaged, just as in the case of the solution of the higher oxides of manganese when treated with hydrochloric acid. From these and other consideration Dr. Owen concludes, that the earth contained in the mineral, which is nearly insoluble in sal-ammoniac, insoluble in caustic potassa, and producing the above reactions with re-agents, and green and yellow salts, must be either a new earth or else a modification of some known earth not previously known. The name Thalium is proposed for the base of this earth, Thalio for the earth itself, aud Thalite for the mineral from which it is extracted.

The new metal Donarium,* the discovery of which was announced last year by Bergemann, proves to be nothing but Thorina.

* See Annual of Scientific Discovery, 1852, p 176.

OBSERVATIONS ON THE DIAMOND.

Sir David Brewster at the Belfast meeting of the British Association stated that his opinion had been requested by Prince Albert respecting different forms into which it was proposed to reduce the Koh-i-noor diamond, in order to make it an ornamental gem. In the state in which it then was, it exhibited an inferior display of colors to its glass model, and it was only by surrounding it with a number of vivid lights that its colored refractions could be developed. Having had occasion to observe some remarkable phenomena in small portions of *diamond*, I was desirous of examining so large a mass of diamond as the Koh-i-noor before it was reduced in size, and covered with facets which would not permit it to be examined. His Royal Highness readily granted my request, and I had thus an oppportunity of submitting it to the scrutiny of polarized light. In place of producing no action upon this species of light, as might have been expected from its octahedral structure, it exhibited streaks of polarized tints, generally parallel to one another, but in some places of an irregular form, and rising to the *yellow* of the *first order* of colors. These tints and portions of polarized light were exactly the same as those which I had long ago found in many other diamonds. In placing the Koh-i-noor under a microscope of considerable power, I observed in it, and also in each of the two small diamonds which accompanied it, several minute and irregular cavities, surrounded with sectors of polarized light, which could only have been produced by the expansive action of a compressed gas, or fluid, that had existed in the cavities when the diamond was in a soft state. In an external cavity, shown in the model, and which had been used for fixing the gold setting, I observed, with common light, a portion of yellow light, indicating a yellow substance. Mr. Garrard and others considered it as gold rubbed off the gold setting; but as gold is never yellow by transmitted light, I considered the color as produced by a yellow solid substance of unknown origin. Sir De la Beche having suggested to me that it would be desirable to make a general examination of the principal diamonds in London, I went next day to the British Museum, and found there an interesting specimen, which threw some light on the yellow solid to which I have referred. This specimen was a piece of colorless diamond, uncut, and without any crystalline faces, about three or four tenths of an inch broad, and about the twelfth of an inch thick, and on its surface there lay a crystal of yellow diamond, with the four planes of semi-octahedron. This singular fact was illustrated by a large model placed beside it. Upon examining the original, I noticed a pretty large cavity in the thickness of the specimen, with the extremity of which the yellow octahedron was connected; and finding a portion of amorphous yellow diamond in the other end of the cavity, I had no doubt that the yellow crystal had emerged, in a fluid state, from the cavity when it was accidentally opened, and had immediately crystallized on the surface of cleavage. I am well aware that such an opinion makes a good demand upon the faith of the mineralogist; but to those who have seen, as I have done, the contents of fluid cavities in crystals solidifying and even crystallizing on the face of cleavage, while another portion of the contents of the cavity escaped in gas — to those who have seen in topaz cavities numbers of regularly formed crystals, some of which, after being fused by heat, instantly re-crystallized—the conclusion I have drawn will be stripped of much of its apparent extravagance. In examining a number of diamonds in the Museum of the East India Company, and about forty or fifty in the possession of Messrs. Hunt & Roskill, I found many containing large and irregular cavities of the most fantastic shapes, and all of them surrounded with irregular patches of polarized light, of high tint, produced undoubtedly, by a pressure from within the cavities, and modified by their form. Among these specimens I found one or two black diamonds, not black from a dark coloring matter, like that in smoky quartz, but black from the immense number of cavities which they contain. Tavernier has described a large and curious diamond which throws some light on the subject of this notice. It contained, in its very centre, a large black cavity. The diamond merchants refused to purchase it. At last a Dutchman bought it, and, by cutting it in two, obtained two very fine diamonds. The black cavity through which he cut was found to contain eight or nine carats of what Tavernier calls black vegetable mud! Mr. Tennant, the celebrated geologist, stated that at the last meeting of the British Association, Dr. Beke read a paper " On the Diamond Slab supposed to have been cut from Koh-i-noor." He stated: — " At the capture of Coochan there was found among the jewels of the harem of Reeza Kooli Khan, the chief of that place, a large diamond slab, supposed to have been cut from one side of the Koh-i-noor, the great Indian diamond now in the possession of Her Majesty. It weighed about 130 carats, showed the marks of cutting on the flat and largest side, and appeared to correspond in size with the Koh-i-noor." Prof. Tennant was induced to record his opinion of the probability of this being correct. He had made models in fluor spar, and afterwards broken them, and obtained specimens which would correspond in cleavage, weight, and size with the Koh-i-noor. By this means he was enabled to include the piece described by Dr. Beke, and probably the large Russian diamond, as forming altogether but portions of one large diamond. The diamond belongs to the tesselar crystalline system; it yields readily to cleavage in four directions, parallel to the planes of the regular octahedron. Two of the largest planes of the Koh-i-noor, when exhibited in the Crystal Palace, were cleavage planes — one of them had not been polished. This proved the specimen to be not a third of the weight of the original crystal, which he believed to have been a rhombic dodecahedron; and if slightly elongated, which is a common form of the diamond, would agree with Tavernier's description of it, bearing some resemblance to an egg. Referring to the diamonds procured in the Brazils, he related a fact which, he said, was told to him by a gentleman from Brazil. A slave in that country was one day wading in a river in search of the precious gems to be found imbedded in the strand, when he struck his crow bar in a spot which surprised him by its hollow sound. He repeated its blows, and soon struck the iron through a crust of siliceous particles cemented together by oxide of iron. On removing the concrete mass, the slave discovered a bed of diamonds, which were afterwards disposed of for £300,000. Such an immense number of diamonds being thrown upon market, so overstocked it that nearly all the dealers became bankrupt, and upon the diamonds being introduced into England, the glut was so great that the results to the trade were equally disastrous, only three English houses being able to stand up against it. One of these persons was a gentleman in Leadenhall street, who was so largely engaged in the trade, that he had actually shown him (Mr. Tennant) a peck full of diamonds.

A London journal furnishes the following account of the re-cutting of the famous Koh-i-noor diamond: —

This precious stone, which was the synosure of the World's Exhibition of 1851, attracted, from the multitudes who last year gazed upon it, expressions of disappointment at the somewhat dim radiance of its lustre, not fulfilling the expectations entertained from the high flown descriptions which had been given of the Mountain Light — a title which many beholders held to be a misnomer. This disappointment having come to the knowledge of those into whose possession it had passed, suggested the desirability, if practical, of effecting such alteration in the shape of the diamond as would remove the admitted defects of the oriental cutting, to which it had been subjected by its original proprietors. With this view, the opinions of various scientific gentlemen were taken, and some doubts having been expressed as to the possibility of cutting the gem without incurring, a great risk of its destruction, Professor Tennant and Mr. Mitchell were especially requested to examine and report upon the practicability of the suggested improvement. These scientific gentlemen accordingly prepared a report, wherein they admitted the improvement which the proposed alteration in shape would effect upon the Koh-i-noor, but expressed fears that any lateral cutting would endanger its integrity. It was then determined to submit the matter to the opinions of practical lapidaries; and with that view the Crown jewellers, Messrs. Garrard, were instructed to obtain a report from competent persons versed in diamond cutting. Those gentlemen thereupon consulted Messrs. M. & E. Coster, of Amsterdam, (the diamond cutting trade having been entirely lost to this country,) who, while admitting the accuracy of the fears expressed in the report of Professor Tennant and Mr. Mitchell, nevertheless were of opinion that the dangers were not so formidable as to prevent the intended operation from being safely effected, provided the necessary skill of superior artists was employed. This opinion was sufficiently encouraging to induce an order for the preparation of the requisite machinery to be erected on the premises of Messrs. Garrard, and accordingly a small steam-engine of from two to four-horse power was erected, and put in operation. As this is the largest diamond which has been cut in Europe for a long period, the commencement of the work was personally undertaken by the Duke of Wellington, in the fellowing manner: — The Koh-i-noor having been embedded in lead, with the exception of one small salient angle intended to be first submitted to the cutting operation, his Grace placed the gem upon the *soaife* — an horizontal wheel revolving with almost incalculable velocity — whereby the exposed angle was removed by the friction, and the first facet of the new cutting was effected. This, the first step in the operation, forms but a small item of progress, as it is expected that the work, under the hands of the two Dutch artists to whom it has been entrusted, will occupy a period of some months, it being, as may be conceived, a work of great delicacy, involving an equal amount of skill and care. The Koh-i-noor is intended to be converted into an oval brilliant, and the two smaller diamonds which accompany it, are to be similarly treated as pendants. The present weight of the principal gem is 186 carats, and the process now in course of progress will not, it is anticipated, diminish in any material degree its weight, while it will largely increase its value, and develope its beauty. Some conversation has occurred respecting the doubts imputed to have been cast by Sir D. Brewster upon the identity of the Koh-i-noor; but the general opinion amongst those best acquainted with the subject appeared to be, that it was impossible for Dhuleep Singh to have palmed off a fictitious diamond, when his constantly wearing it on state occasions must have rendered it perfectly familiar to thousands who would instantly have detected any attempt at substitution. The more probable assumption was stated to be, that the weight of the Mountain of Light had been *more Orientale* somewhat exaggerated.

The business of cutting diamonds is now chiefly confined to Amsterdam, and is thus described in a late number of the London News: —

It was on a Sunday, in the early part of 1847, that, being at Amsterdam, we wandered out from our hotel on a chance excursion through the town. Before we had gone far the noise of machinery arrested our attention, and, on making inquiries, we found that it proceeded from the celebrated diamond-cutting establishment of the place. Let not the reader picture to himself a clean, neat, well-looking establishment, such as one of our paper or cotton mills, but as an old lumbering shed, in which, impelled by the labor of four or five sorry horses, revolved a horizontal wheel. This was the only source of motion by which the grinding machinery was kept at work; and its primitive nature in a century when the steam-engine is made to spin cotton, grind corn, and weave cloth, could not but suggest to the looker-on how remote from ordinary wealth — wealth self-developing and expansive — was the conventional wealth represented by the diamond trade. The operation of cutting is performed in several dilapidated rooms up stairs. There are seen in rapid revolution some scores of horizontal metal wheels, each about a foot and a half in diameter. Their surfaces being smeared from time to time with a mixture of diamond dust and olive oil, and set in revolution, the diamond to be ground is brought in contact with the revolving metallic surface. It need hardly be said, that the task of holding a diamond to be ground firmly against the revolving wheel for so long a period of time as is necessary, would be impossible. Continuous pressure is effected in another and very simple manner: the diamonds are imbedded, all except the parts to be ground, in a heavy mass of very fusible solder shaped like a hammer, the handle of which being fixed as to horizontal motion, but free by means of a hinge to move up and down, and the face of the hammer being brought flat upon the side of the horizontal wheel, the operation of grinding, cutting as it is called, proceeds without further trouble.

ARGENTIFEROUS LEAD MINES OF MIDDLETOWN, CONN.

About two miles below the city of Middletown, Connecticut, on the banks of the Connecticut river, are several excavations, some 18 to 30 feet deep, made during the Revolutionary war by a company, for the purpose of procuring lead ore, so as to supply the American troops with lead. It was worked for some time, the ore smelted, and the lead separated from the rock in which it was found imbedded. Not being found sufficiently profitable to make it an object, the working of the mines was discontinued. A recent examination having been made of these old workings, a considerable quantity of silver was found associated with the lead, and the persons interested became satisfied, that it could be worked profitably, and that the quantity of silver would fully pay the whole expenses of working the mines, leaving the large quantity of lead obtained to form the profit of the mining operations. Thus far, although they have worked but a few months, with a small force, and cannot be supposed to have but tested the richness of the veins of silver—yet it is paying its way, and even more than that. Lately, some rich veins of silver ore have been discovered—and some pure native silver—the former being nearly free from the lead mixture. The ore is broken up and then fed to a mill, where it is pounded fine—the pounders, of which there are four, being operated by an overshot water wheel, which is carried by water from a dam, with a fall of some 15 or 25 feet. As fast as the ore is pounded sufficiently fine, a stream of water carries it into troughs, where it is washed. From these troughs it is taken out, and sent to New York, where the metals are separated.

MINERALOGICAL NOTICES.

The following mineralogical notices have been communicated to Silliman's Journal, July, by Mr. W. T. Blake.

Apatite.—During the past winter a shaft has been sunk upon the vein of crystalline phosphate of lime at Hurdstown, Essex Co., N. Y., and large blocks of massive apatite have been raised; some of the largest of these masses weighed not less than 200 pounds, and were nearly pure apatite,—the specimens have very little color, portions of the masses being translucent and nearly transparent, and resembling the "asparagus-stone" variety of the mineral. The more compact and opaque masses frequently cleave into hexagonal prisms, some of them having lateral planes three inches wide. Rhombohedrons resulting from cleavage are not uncommon.

Brown Tourmaline—Beautiful transparent crystals of brown tourmaline occur disseminated in the massive and concretionary phosphorite at the "eupyrchroite" locality, Crown-point, Essex Co., N. Y.; terminated crystals are rare, but the few found are highly modified, and are crystallographically similar to the crystals from Gouverneur, N. Y., described and figured by Rose. (See Dana's Mineralogy, p. 136.) The color is a light clove-brown, and the crystals exhibit dichroism. Specimens cut and polished have much beauty as gems.

Red Zinc Oxide.—Fine cabinet specimens of lamellar red zinc oxide can be obtained at the zinc mine, Stirling Hill, Sussex Co., N. Y. The lamellar masses are disseminated in the highly crystalline limestone which has frequently a delicate pink hue and translucent,—cleaving readily into large rhombohedrons; the contrast between the red zinc and the gangue adds greatly to the beauty and mineralogical value of these specimens. These distinct nodules of oxide are found at the junction of the vein of red zinc ore and the limestone, but the oxide is free from any admixture with Franklinite crystals; good crystalline specimens of Franklinite are now very rare at the mine.

Fluor-Spar Locality.—Shawneetown, Gallatin Co., Ill., has long enjoyed a reputation among American mineralogists as a locality for fluor-spar. Having had occasion, a few months since, to visit the southern portion of Illinois, I explored this locality. It was found, however, that the fluor-spar did not occur, as reputed, at Shawneetown, but ten to fifteen miles farther down the Ohio, and a half a mile to a mile north of the river.

The fluor occurs in the carboniferous limestone, it forms numerous veins, many of which are from ten to twenty feet in thickness. It is highly crystalline, and often very fetid; beautiful crystallized specimens are found in pockets in the veins, which are sometimes entirely colorless, frequently of a blue, a violet, or a pink tint, and more rarely of an emerald-green. The localities have been quite extensively worked for lead, which, under the form of galena, is associated with the fluor. The amount of galena is quite considerable, although no regular vein has as yet been found; it is somewhat argentiferous, yielding, on an average of several specimens examined, about four ounces of silver to the ton. The mining of these veins has developed, besides some fine crystallizations of fluor, as a compact variety in which the associated galena also has the compact structure. An immense amount of a remarkably fine quality of fluor-spar could be obtained from these veins should there be a demand for it in the arts. —*Com. to Silliman's Journal by S. J. Brush.*

Platinum in Canada.—This metal was detected last summer, in the gold washings of the Riviere du Loup, where it is found sparingly mixed with the gold, in minute scales and grains. Associated with it there was another metal which resisted completely the action of the acid. It formed small plates of a tin-white, generally hexagonal, and so hard as to resist steel; these characters show it to be *iridosmine*, the native alloy of the rare metals iridium and osmium, which is found with the gold of South America, and is from its extreme hardness, employed to form the points of gold pens.—*Report Canadian Geologists.*

LARGE DEPOSITE OF GRAPHITE.

At St. Johns, N. B., near the new suspension bridge over the St. John's river, a very extensive deposite of graphite has been opened and explored to a considerable extent. The vein, or bed as it might more properly be called, is nearly vertical, and inclosed between beds of highly metamorphic schists. It is entered near the water on the face of a precipitate cliff about seventy feet high, the walls of the lode being in the main parallel to the graphite deposite. This bed has been explored by a gallery or adit level over a hundred feet, and by cross cuts at right angles to this some twenty or more feet. All these are in the graphite mass, and of course the floor and roof of the levels are of the same mineral. The quartzose walls have occasionally approached, and in some cases masses of quartz, or schist, have been included in the graphite. The course of this deposite is about northeast and southwest, or nearly in the direction of the strike of the strata of schist. The graphite is not of a very superior quality as a mass, though portions of it are quite pure. As yet no solid and perfectly homogenous masses have been taken out. It has a foliated structure more or less highly marked. Iron pyrites is too abundantly diffused in it to admit of its use for crucibles. The chief economical use made of it has been in facing the sand moulds for iron castings, for which purpose it is ground to a fine powder. Some of the finer parts are also used to manufacture pencils. Many hundred tons of graphite from this deposite have already been taken out since the mine was opened two years ago, and the supply may be esteemed inexhaustible. The vein or bed re-appears on the opposite side of the St. John's river, and on the side now opened it has been traced over a mile. The position of the deposite in conformable metamorphic schists, suggests the conjecture that this deposite of graphite may represent a former coal bed.

LAKE SUPERIOR COPPER MINES.

The National Intelligencer publishes a few facts to show the advantage of a judicious prosecution of the copper mining business. The Intelligencer says: —

The mine which has thus far been the most productive is called the Boston and Pittsburg Mining Company. Work was commenced in 1848. A capital of $110,000 was paid in, or about $18 50 per share on

6,000 shares. In 1849, $60,000 was divided among the shareholders; in 1850, $84,000; in 1851, $60,000, and in 1852, $60,000 more will be divided. In another view, shares which cost $18½ have received back in dividends $34 and are worth $100 in the market.

The Northwest Mining Company ranks next in value. Mining was here commenced in earnest in 1849. About $80,000 have been paid in. In 1849 the net proceeds from the sale of copper amounted to some $5,000; in 1850 to about $32,000; and in 1851 to something over $50,000. This company owns a large tract of mineral territory, upon which two valuable veins have been opened and a number of others discovered. The property owned by this company is of immense value, and magnificent fortunes will in a few years doubtless be realized from it.

The Minnesota Mining Company is located near the Ontonogon River, some forty miles westward of the two preceding. Immense blocks of pure copper are taken from this mine. It commenced in the autumn of 1848, and has a capital paid in of some $90,000, or $30 on a share — there being but three thousand shares. They command $150 in the market. A large dividend will, we think, be paid from the earnings this year.

The gain reaped from the workings of a successful mine is freequently 500 per cent. Shares in the Boston and Pittsburg Company, which cost $18 50, sell for $100. In the Minnesota for $30 the owner can now receive $150. The Northwest shares will probably increase 100 per cent. in value in a year.

NEW METEORITES.

Professor Shepard, of Amherst College, has recently added to his collection of meteorites a very valuable specimen, which is described as a mass of compact malleable iron weighing 178 pounds, of an elongated ovoidal form, covered with the usual indentations, and exhibiting the characteristic crystalline figures. It was discovered on the Great Lion River, in the Nemaqua Land, in South Africa, and, having beeen transported several hundred miles in wagons to the Cape of Good Hope, was shipped to London. Prof. Shepard, being fortunately in that city at the time of its arrival, immediately entered into negotiations to obtain it, and with considerable difficulty, succeeded. He also has another specimen from Newberry, South Carolina, weighing fifty-eight pounds. His collection of extra terrestrial substances weighs more than 350 pounds, and includes two hundred specimens from more than a hundred different localities.

Prof. Root in a communication to Silliman's Journal, November, 1852, states, that a mass of malleable iron weighing nine pounds, was found last fall in digging a ditch on a farm near the free bridge on the Cayuga side of the Seneca River. It was drop shaped, about four inches in diameter and seven inches in length. When found it was coated with oxide of iron. The surface was uneven, and some of the prominent parts were terminated by planes of octahedral crystals. It may be an interesting fact, that the locality where this iron was found is only a few miles from Waterloo, in Seneca county, where a meteorite fell in 1827, as has been stated by Prof. Shepard.

GOLD DISTRICTS OF CANADA.

From the recent reports of the Provincial Geologists, we derive the following facts relative to the existence and production of gold in Canada: — The auriferous district has been found by examination to spread over an area probably comprising between 3,000 and 4,000 square miles. It appears to occupy nearly the whole of that part of the Province which lies on the southeast side of the prolongation of the Green Mountains into Canada, and extends to the boundary between the Colony and the United States. Two general lines of exploration were followed, one of them up the Chaudiere and Riviere du Loup and the other from Lake Etchemin to Sherbrooke on the St. Francis. The former, running transverse to the rock ranges measured about forty-five miles, and the latter with them about ninety miles. The transverse line was more closely examined than the other, and traces of the precious metal were met with at moderate intervals throughout the whole distance. They were not confined to the channels of the main streams merely, but those of various tributaries furnished indications sometimes for a considerable distance up. It is not supposed that the limits of the auriferous district have been ascertained, but that it very probably extends much farther to the northeast, and attains the valley of the river St. John, while to the southwest it is known to reach Vermont, and to be traceable at intervals through the United States, even, it is said, as far as Mexico. In its breadth, however, it does not appear to cross the range of mountains with which it runs parallel, and no traces of it have been met with on their northwestern flank. The deposite in which the gold occurs is part of an ancient drift, probably marine, and supposed to be of higher antiquity than that which occupies the valley of the St. Lawrence and some of its tributaries. In this, alluded to in various reports as tertiary and post-tertiary, the remains of whales, seals, and two species of fish, and many marine shells of those species still inhabiting the Gulf of St. Lawrence, are found. These shells on the Mountain of Montreal attain a height of about 470 feet above tide level in Lake St. Peter, which is the greatest altitude known; none of the remains have yet been found in the Canadian gold drift, and as this appears in its lowest undisturbed parts to be at a height of about 500 feet above the sea, it is probable what is now exposed of it, had emerged from the ocean before the Laurentian drift was placed, while in lower levels it would be covered up by it.

During the five months of the summer of 1851, the whole amount of gold collected by fifteen men at the washings on the River de Loup at its junction with the Chaudiere, was about 1,900 penny-weights. From among a few ounces of fine gold obtained, there were collected small grains both of platinum and iridosmine, the value of the former being below, and of the latter double that of gold; almost all of this fine gold was at first of so white a color that it was considered probable the circumstance might be owing to the presence of a very large proportion of silver; some of the larger pieces also obtained were spotted white from the same supposed cause; but, Mr. Hunt, on heating this white gold, found that it quickly turned to a good golden yellow, and that the discoloration was occasioned by a thin coating of mercurial amalgam. As the spots were perceived on some of the larger pieces immediately on their being first obtained on the shovel, it is supposed they must have been spotted with the mercury while still undisturbed in the drift; and as no mercury had been used on the ground, it leads to the supposition that some ore of mercury may possibly be one of the mineral products of the country, though not a grain of cinnabar, the commonest form of the ores of mercury, has been observed in the gravel. Among the substances obtained in separating the gold, lead shot of various sizes, from partridge to swan shot, has been nearly as abundant as the gold. Not a vanning was made of the concentrated material without obtaining some of it; its presence is no doubt due to the operations of those who have followed the chase, and to judge from the quantity of the shot the place must have been one of favorite resort. Whether the hunters may at any time have brought quicksilver with them and spilt it, is a question that cannot be determined.

The Geologist concludes, from the evidence collected, that the deposites are not generally sufficiently rich to render their working remunerative to unskilled labor; and that the agriculturist and others engaged in ordinary occupations of the country, would only lose their time and labor by turning gold hunters.

GOLD AND ITS PRODUCTION.

Five years have hardly elapsed since the gold yield in California became a fixed fact, and within that short period of time between a hundred and ninety and two hundred millions worth of gold dust has been added to the wealth of the world, and a trade has sprung up between the Atlantic States and San Francisco of the greatness of which some idea may be indirectly formed, from the fact that the imports from all other parts of the world to that port have increased from three and a half millions in 1851, to ten and a half millions in 1852. The California movement has made its influence felt all over the world; but now even California itself seemes to be eclipsed and outstripped in its productiveness by the more recent and more magnificent discoveries of gold fields in Australia. They completely throw into the shade all the mines of Peru, Mexico, or California. So extensive are the gold deposites distributed in Australia, that the very streets of Melbourne are found, in a manner, to be paved with them. The broken quartz rocks which have been used to MacAdamize the streets are found to contain gold.

While Melbourne is thus favored, mines of immense value have been opened at Mount Ballaret and Mount Alexander, about eighty to one hundred miles north of the city. The treasure taken from these two deposites alone, from the 1st of December, 1851, to the 1st of April, 1852, amounted to about $9,000,000.

The first discovery of gold was made near Bathurst, in New South Wales, on the 22d May, 1851, from 150 to 164 miles west of Sidney. The localities first worked were at Summerville Creek, Abercrombie river, from whence further discoveries have been made over a vast mountain region of country. From May to the 6th September the shipments reached $750,000, and on the 8th November about $1,000,000. Lumps were occasionally found weighing from twenty to twenty-seven pounds. In December, 1851, the parties at the diggings in Victoria were estimated at from eight to ten thousand, and near Bathurst, at four thousand. The whole amount sent to England since the discovery in May, 1851, is estimated at twenty millions. The gold region already discovered in Australia promises to yield double and triple the quantity of gold, by the same number of laborers, over that obtained in California. Good observers suppose it to extend over an area of not less than 15 to 20,000 square miles, the whole area of the island being estimated at about three million square miles.

Accounts from Australia to November, 1852, state that the production of gold is on the increase, and many of the stories which are received would seem almost incredible, were they not fully corroborated by actual receipts. Not only do the old diggings yield abundantly, but new ones are found daily of wide extent. To show that the recent accounts must be founded in truth, it is said that the receipts from Mount Alexander and Ballarat diggings alone, are given in the Australia papers at one million seven hundred thousand nine hundred and seventy-four ounces, or between seventy-three and seventy-four tons, in ten months. From the entire Victoria gold fields, in the same period, the receipts had been one hundred and five tons. The amount of gold actually exported from the country from October, 1851, to September, 1852, amounted to over forty millions of dollars.

The assays made of the Australian gold show that it is somewhat purer than that obtained in California. The assays of the United States Mint, at Philidelphia, give a fineness of 966 thousandths. Making an allowance for melting, this gives a value to the native grains of about $19 60 per ounce. Assays that have been made in England are reported to have given the result of 938 thousandths fine. Upon these facts, it is presumed that Australian gold is better than California or, in other words, that it contains less silver by six or seven per cent. on the average.

Gold in Australia. — A report has been presented to the Imperial Geological Society of Vienna relative to the production of gold in Austria. Austria produces the most gold of any European State. It amounts yearly to 7,500 marks, which promises a sum of 603,000 ducats. Much of this is obtained by the Gipseys by sand-washing in Hungary and Siebenburgen. There are two ways in which the gold is found — one is in the deposites of sand and soil; the other in the strata of ore. The latter is the most common method of finding it in Hungary and Siebenburgen.

Gold in Vermont. — Specimens of gold have been found during the past season in Bridgewater, Vermont, by Mr. Mathew Kennedy, of Plymouth, Vt. They were taken from a quartz vein in mica and talcose slate, and the gold is associated and intermingled with the white quartz, ferruginous quartz, galena, and iron and copper pyrites. In occurs in scales and grains of various sizes, and is of a beautiful clear yellow. The vein has been traced some 50 or 100 rods, and farther explorations will soon be made to prove it at other points. The gold formation is known to extend nearly the whole length of the State, and this discovery may lead to a fair examination of the formation.

Gold in Demerara. — Advices from Demerara state, that gold has been discovered in that colony up the Cuyuni river, and that about £200 had already been brought in. It is alleged to be remarkably pure and to consist of small lumps, and also of scales and dust. The locality is said to be not more than two or three days' journey into the interior.

In addition to the gold discoveries made within a recent period in Australia and California, it is stated that valuable deposites have been found on the St. John's river, near Liberia, in Africa; howéver this may be, it is undoubtedly true, that the exportation of gold from the west coast of Africa has greatly increased within the last two years. The amount received in Liverpool alone from this source, was estimated for the year 1851, to exceed £300,000.

Consumption of Gold. — The following curious statistics relative to the consumption of gold were stated in a lecture lately delivered at the Geological Society at London. The entire amount in circulation is said to be £48,000,000; of which the wear and waste is stated to be 3½ per cent., annually £1,680,000. The consumption of gold in arts and manufactures is as follows: —

In the United Kingdom,	£2,500,000
France,	1,000,000
Switzerland.	450,000
Other parts of Europe,	1,600,000
United States,	500,000
	£6,050,000

In Birmingham alone there is a weekly consumption of gold for chains only amounting to 1,000 ounces. The weekly consumption for gold leaf in London is 400 ounces; in other places in Great Britain, 184 ounces.

One of the potteries in Staffordshire consumes $3,500 worth of gold annually in gilding; and the whole consumption for gilding porcelain in England is estimated at about 500 ounces annually.

The London Times gives some elaborate tables concerning the comparative production of gold and silver, for the last few years.

From these tables it appears that the produce of gold in the world rose from 114,674 pounds in 1846, to 365,950 pounds in 1850. In those five years the increase was at the rate of 219 per cent., while silver only increased from 1,979,084 pounds in 1846, to 2,663,386 pounds in 1850, or 34½ (34.5) per cent. The former metal was in 1850, therefore, apparently increasing at the rate of 44 (43.8) per cent. per annum, and the latter at 7 (6.9) per cent.

The following is the estimated produce of the precious metals, in tons, in 1801, 1846, 1850, 1851, and the probable amount of 1852 :— 1801, gold, 19 tons; silver, 856 tons, or 1 lb. of gold to 45 lbs. of silver. 1846, gold, 42 tons; silver, 727 tons, or 1 lb. of gold to 17 lbs. of silver. 1850, gold, 134 tons; silver, 978 tons, or 1 lb. of gold to 7 lbs. of silver. 1851, gold, 180 tons; silver, 1,002 tons, or 1 lb. of gold to 5 lbs. of silver. 1852, gold, 242 tons; silver, 1,027 tons, or 1 lb. of gold to 4 lbs. of silver.

ON THE FOOT TRACKS IN THE POTSDAM SANDSTONE OF LOWER CANADA.

Mr. Logan, the Canadian Geologist, in his report on the progress of the Survey for 1851 – 2, furnishes the following facts relative to the foot tracks of the Potsdam Sandstone of Lower Canada.* The results of the survey have shown, that a geological trough exists between the Ottawa and the St. Lawrence on the north and south, and between Mt. Calvaire and the Johnson District on the east and west; — that the Potsdam sandstone, resting on the gneiss, encircles this trough, and that zones of higher and more fossiliferous formations follow this in succession, the Utica slates occupying the centre; — that the Potsdam sandstone is characterized by *Scolithus linearis* around the perimeter, associated, in some parts, with *Lingula antiqua*, and with the tracks in every locality in which the latter occur. These localities are six in number. At one locality, on the *Riviere du Nord*, where the tracks are abundant, in the space of a mile and three-quarters, the Gneiss, the Potsdam sandstone, the Calciferous sand-rock, (the last containing characteristic fossils,) are found supporting one another. The surfaces on which the tracks of these animals are impressed, are sometimes smooth and sometimes beautifully ripple-marked. On the ripple-marked surfaces the tracks have often beat down the ripple, and the sand of the ridge has been dragged into the furrow, in such a way as to show the direction in which the animal was progressing.

In the most abundant locality of these tracks, there are four exposed areas in the space of four chains. The first shows ten tracks, running in different directions and sometimes intersecting one another; they vary in breadth from four inches and a-quarter to five inches and a-half, and, added to one another, measure 108 feet in length; the second displays eleven tracks of five to six inches wide, and measuring about 108 feet; the third shows five tracks of from four to six

* See Annual of Scientific Discovery for 1851, pp. 314–15.

inches wide, and altogether sixty-one feet long; the fourth, five tracks from three-quarters of an inch to five and a-half inches wide, and giving an aggregate length of eighteen feet; and another area in the next field has ten tracks of four to six and a-half inches wide, with a total length of fifty-six feet.

Prof. Owen, of London, in a recent communication to the Geological Society, stated that he had been enabled to distinguish five well-marked varieties of imprints, to which, for the sake of convenience, he has given the following appellations: — *Protichnites septemnotatus*, *P. octonotatus*, *P. multinotatus*, *P. lineatus*, and *P. alternans*. After an elaborate detailed description of the several tracks, (which have certain characters in common, such as a more or less regularly marked longitudinal furrow, accompanied on either side by numerous closely set imprints,) the Professor proceeded to observe, that, from their peculiar arrangements, neither to a quadrupedal creature nor a fish-like animal could these imprints be assigned; and yet, said the Professor, with respect to the hypothesis, that each imprint was made by its independent limb, I confess to much difficulty in conceiving how seven or eight pairs of jointed limbs could be aggregated in so short a space of the sides of the animal; so that I incline to adopt as the most probable hypothesis, that the creatures which have left these tracks and impressions on the most ancient of known sea shores belonged to an articulate, and probably crustaceous, genus, either with three pairs of limbs employed in locomotion, each limb having its extremity either divided into three or more processes, or bifurcate merely, some of the imprints, described as "supplementary," and usually of smaller size, being made by a small and simple fourth, or fourth and fifth, pair of limbs. The shape of the pits in one of the slabs accords best with the hard, sub-obtuse, and sub-angular terminations of a crustaceous ambulatory limb, such as may be seen in the blunted legs of a large Palinurus or Birgus; and it is evident that the animal of the Potsdam sandstone moved directly forwards, after the manner of the Macrura, and not sideways, like the Brachyurous crustaceans. One specimen favors the supposition of the median groove having been formed by a caudal appendage, rather than by a prominent part of the under surface of the trunk. With reference to the conjectures that might be formed respecting the creatures that have left these tracks, the Professor observed, that the imagination is baffled in the attempt to realize the extent of time passed since the period when these creatures were in being that moved upon the sandy shores of the Silurian sea, and we know that, with the exception of the most microscopic forms, all the actual species of living beings disappear at a period geologically very recent in comparison with the Silurian epoch. The forms of animals present modifications more and more strange and diverse from actual exemplars as we descend into the depths of time past. Of this the Plesiosaur and the Ichthyosaur are instances in the reptilian class, and the Pterichtnys, Coccosteus, and Cephalaspis in the class of fishes. If then the vertebrate type has undergone such inconceivable modifications during the secondary and Devonian periods, what may not have been the modifications of the articulate type during a period probably more remote from the secondary period than this is from the present time? In all probability there is no living form of animal, bearing such a resemblance to that which the Potsdam sandstone foot-prints indicate, as to enable us to illustrate its shape or its precise instruments and mode of locomotion.

The ripple-marks, which occur on surfaces so close in succession among the track beds, run in a different direction on each surface, as if they had been caused not by a current in deep water, running in one general direction, but by a tide ebbing and flowing, and obeying the influence of varying local accidental causes. On one surface was observed the natural edge or termination of the ripple-ridges, with a track coming up to it and there ceasing, as if the wave had reached no farther, and one part of the surface had been dry while the water, operating on another close by, had obliterated the track in producing the ripple-mark.

In connection with the discovery of these footprints, another singular discovery has been made, viz., the existence of phosphatic nodules (containing between 36 and 67 per cent. of phosphate of lime, giving off ammonia and an odor of burnt horn,) at the summit of the Hudson River Group, at the base of the Chazy Limestone, and a little lower in the calciferous sand-rock, where Lingulæ and Pleurotomariæ are sometimes imbedded in the nodules. These nodules have also been found in a conglomerate, which, from its position, is considered to be older than the Cambrian, that constitutes the copper rocks of Lake Huron, and also crystals of phosphate of lime, (apatite,) have been noticed in a highly crystalline limestone interstratified with the gneiss, which is the base rock of the country.

Mr. Hunt, the chemist of the Survey, gives some additional facts relative to those interesting discoveries. He states, that while recently examining a coarse grained silicious sandstone and conglomerate, which occurs near the river Ouelle, I detected several hollow cylindrical bodies which I supposed to be some hitherto unknown fossils, and which you from their form, suggested to be possibly bones. A chemical examination shows them to consist in great part of phosphate of lime, and thus gives countenance to the idea that they are the remains of vertebrate animals. The longest fragment found is about an inch and a-half long, and one-fourth of an inch in diameter. It is hollow throughout, and filled with the earthy matter in which it is obliquely imbedded, the disintegration of which by the weather, has exposed the larger extremity of the foreign body, and a portion of its interior. The smaller extremity is cylindrical and thin, but it gradually enlarges from the thickening of the substance, and at the other extremity becomes externally somewhat triangulariform; the cavity remains nearly cylindrical, but its sides are somewhat rough and irregular. Two other fragments, presenting horizontal sections of similar cylinders, were detected, having their other extremities in the rock. The texture of these substances is compact, and the fracture earthy. Their color is dark brown, but exhibits a yellowish-brown translucency in thin layers; the powder is light ash-grey, becoming reddish by ignition; when exposed to heat in a tube, ammoniacal water is evolved, with a strong odor of animal matter, like that of burning horn. A fragment of one of the cylindrical bodies was freed as much as possible from the sandstone which adhered to the interior, pulverized, dried and submitted to analysis. It dissolved in hydrochloric acid with slight effervescence, from the presence of carbonate of lime, derived in part from the adherent rock which is calcareous, and left a considerable residue of quartzose sand. The analysis gave in 100 parts, 87.53 phosphate of lime, 2.15 volatile matter, with a little carbonate of lime, magnesia, and oxide of iron.

Many of the cylindrical bodies found in this locality have an axis of foreign matter, and others have a singular resemblance to different bones; others again from their form and homogenous texture resemble coprolites. They are generally very compact, with a fine grained conchoidal fracture; their color is dark blackish-brown, or bluish-black, and that of the powder ash-grey, becoming reddish-brown by heat. Heated in a tube, a strong odor of burning horn is evolved. Sections of these substances have been made, and submitted to microscopic examination. The hollow cylindrical mass appears homogeneous and finely granular in its texture, while a fragment from the conglomerate bed, consisted of a finely granular matrix, in which are imbedded angular grains, apparently of quartz. Throughout the mass of the latter specimen are found imbedded small transparent cylinders, which are almost colorless, and appear to be silicious. Some are nearly uniform in diameter, with hemispherical extremities; others are thicker in the middle, and taper to the ends, which are either rounded or conical; they are generally more or less curved, and are from 1-100 to 2-100 of an inch in length. Some of them exhibit traces of a longitudinal cylindrical axis, which appears to be a canal filled up with some granular matter. According to Dr. Bacon, of Boston, they resemble the silicious spiculæ which occur in some of the sponges and other zoophytes, but he regards his examination as yet incomplete. The results are conclusive as to the absence of any bony structure in the specimens. At the same time the external form, connected with their peculiar composition, which is identical with that of fossil bones, prompts the inquiry whether any metamorphic agencies could not have so far acted upon the animal remains as to induce an incipient crystallization of the phosphate of lime, thus obliterating the organic structure. Such a change is well known to take place in fossils consisting of carbonate of lime, as the stems of crinoids, which are often highly crystalline in their texture.

Further examinations have also enabled Mr. Hunt to detect these phosphatic nodules and cylinders in various other localities, in the ancient palæozoic sandstones. Although the presence of these peculiar animalized phosphatic masses, in different parts of the Lower Silurian rocks, points to the existence of vertebrate animals at that geological epoch, as the only hypothesis which in the present state of our knowledge, can account for the origin of such substances, it will be felt that a suggestion, so novel and so much at variance with hitherto established facts and recognized ideas in geology, is not to be received without great hesitation, nor until further investigations shall have thrown more light upon the subject than is afforded by the preceding observations and experiments.

GEOLOGY OF THE SHEEP.

THE recent progress of palæontology adds a new element to the elucidation of this question, which was so ably discussed by Buffon and the naturalists of the last century. At present, however, the evidence which palæontology yields is of the negative kind. No unequivocal fossil remains of the sheep have yet been found in the bone caves, the drift, or the more tranquil stratified newer pliocene deposites, so associated with the fossil bones of oxen, wild-boar, wolves, foxes, otters, &c., as to indicate the coevality of the sheep with those species, or in such an altered state as to indicate them to have been of equal antiquity. I have had my attention particularly directed to this point, in collecting evidence for a history of British Fossil Manmalia. Whenever the truly characteristic parts, viz., the bony cores of the horns, have been found associated with jaws, teeth, and other parts of the skeleton of a ruminant, corresponding in size and other characters with those of the goat and sheep, in the formations of the newer pliocene period, such supports of the horns have proved to be those of the goat. No fossil core-horns of the sheep have yet been any where discovered; and so far as this negative evidence goes, we may infer that the sheep is not geologically more ancient than man; that it is not a native of Europe, but has been introduced by the tribes who carried hither the germs of civilization in their migrations westward from Asia. — *Prof. Owen.*

ARTIC FOSSILS FROM ESCHSCHOLTZ BAY.

IN 1816, Kotzebue, in the course of his voyage round the world, visited a bay situated a short way southwards of the Arctic circle, which afterwards excited great interest on account of the remarkable character of the cliffs by which it was surrounded. This bay was named after Eschscholtz, one of the naturalists of the Russian Expedition. The cliffs were described as consisting entirely of masses of ice, covered by the soil in which flourished an Arctic vegetation. To add to the interest which such an account was likely to create, it was stated that the cliffs abounded with the remains of mammoths, horses, oxen, and reindeer. This remarkable bay was visited by Capt. Beechey in conjunction with Mr. Collie in the year 1836: their attention was directed to these iceberg cliffs; but, on digging into them, they came to the conclusion that the cliff was composed of mud and gravel in a frozen state, and that the ice formed only a casing above it. In the recent voyage of H. M. S. Herald, under the command of Capt. Kellett, this district was again visited; and this intelligent commannder knowing the different conclusions arrived at by those who had seen the spot before, determined to make a thorough investigation of the matter. The result has been, the confirmation of the original view of Kotzebue, Eschscholtz, and their companion Chamisso, — that the foundations of these cliffs are truly ice. They have undergone considerable alteration since the time when they were visited by Kotzebue and Capt. Beechey. M. Seeman, the naturalist of the expedition, describes them as being from 40 to 90 feet high, — and consisting of three distinct layers, the lower one being ice, the middle one clay containing fossil bones, and the upper one peat. The icy basis is from 20 to 60 feet in height; and Capt. Kellett states that on digging into the soil at a distance of a quarter of a mile from the edge of the cliff, he found pure ice at a depth of not more than 3 or 4 feet. The data are at present insufficient for obtaining an idea of the extent of this mass of ice; but sufficient is known to afford interesting materials for estimating the influence of such a formation on the conditions of the earth's surface of which it forms a part. Eschscholtz Bay possesses an additional interest, apart from the physical structure of its cliffs, in the vast number of fossil bones found in this locality. These remains, M. Seeman states, were in no instance found imbedded in the ice; but they generally lay upon the surface — the huge tusks and horns not unfrequently showing through the soil, — whilst many were gathered from the sand at the base of the cliffs where they were exposed to the wash of the tide. The animals to which these remains belong seemed to have formed part of that great mass of which so many indications exist in extreme Northern latitudes. The discovery of the entire carcass of a rhinoceros and of those of two mammoths in Arctic Siberia is a fact familiar to most persons, — while inexhaustible deposites of organic remains are known to exist in the Kotelnoi, or New Siberian Archipelago. The remains from Eschscholtz Bay have not their soft parts so well preserved as many of the other specimens; but when dug out of the soil in which they are contained, they exhaled "a strong and disagreeable odor of decomposing animal matter, like that of a well-filled cemetery."

The history of the creatures that have left these remains forms an interesting problem. They belong to families which now inhabit tropical and sub-tropical regions. Are we, then, to conclude that they have been brought from warmer parts of the earth by some great flood? Their perfect state of preservation in some instances forbids this conclusion, for they could not have been brought from tropical regions preserved in ice. Can we suppose that the Arctic regions were once warmer than now, and actually produced a vegetation sufficient to support a vast creation of herbiverous animals such as we now find entombed therein? This is the conclusion to which we are driven; and without supposing that the temperature of these regions was tropical, it was probably yet warm enough to encourage a vegetation on which these creatures could live. By some catastrophe — some vast deluge, or wave of succession — we must suppose that they were suddenly engulphed on the shores of a sea wherein they had their pasture-grounds. Such is the theory to which Sir J. Richardson gives his adhesion, — and which must be adopted as the most probable till further light shall be thrown upon the subject.

The number of species of animals brought from Eschscholtz Bay are not numerous, — but they belong chiefly to an order of the Mammalia — the Ruminantina — whose identity it is more difficult to determine by the structure of their skeletons. The principal animals to which the remains are supposed to belong are the Mammoth (*Elphas primigenius*), the Horse (*Equus fossilis*), the Moose-deer (*Cervus alces*), the Reindeer (*Cervus tarandus*), the Musk-ox (*Ovibos moschatus*), several species of Bison, the Big-horn Ram (*Ovis montana*), and some Cetaceans.

FOSSIL REMAINS OF THE MASTODON GIGANTEUS.

The fossil remains of a mastodon have recently been discovered in a gravel bank near Zanesville, Ohio, making the third of this species taken from the same locality within a comparatively recent period. The one last discovered, was in a state of preservation much better than the former two, and may, when completely exhumed, show almost the entire bones and frame of animal. The molar teeth, four in number, all that the species possess, were found in the jaws sound and unbroken; two of them weigh twenty pounds each. The tusks were not in as good condition, one only being sound enough to bear moving. This one, eight feet in length, measures at its base, 26½ inches in circumference, and at the point eight feet distant, where it is broken off, 16½ inches in circumference, the whole length of which was probably 12 feet more.

During the past year, a nearly entire skeleton of a mastodon has been found near Easton, Pennsylvania. The bones belonged to an animal of advanced age, as is shown by the condition of the grinders;— the surfaces of these being nearly smooth and even. Many portions of this skeleton were in an excellent state of preservation, and the tusks especially are among the finest that have yet been discovered. These remains are to be deposited in the cabinet of Williams College, Massachusetts.

Bones of the mastodon were also discovered in New Britain, Conn., in October last. They were discovered on the land of a Mr. Churchill, not far from the main street of the village. The skeleton in this case was quite imperfect.

REMAINS OF REPTILES IN THE OLD RED, OR DEVONIAN FORMATION OF SCOTLAND.

Considerable interest has been excited among British geologists, by the announcement of the occurrence of the remains of two or more orders of reptiles, in the old red sandstone of Scotland, inasmuch as no vestiges of animals of a higher order than fishes had been observed hitherto in the Devonian formation, in any part of the world. The communication by Capt. Brickendon, with descriptions of the fossils by Dr. Mantell, read before the Geological Society of London, gives the following particulars respecting a discovery of the highest interest in a palæontological point of view. The old red sandstone strata are largely developed along the coast of Morayshire, and the yellowish crystalline sandstone is extensively quarried in several localities near Elgin Spynie, &c. These strata, although for years dilligently explored by several competent local observers, had yielded but a solitary specimen of organic remains, viz., the impressions of a series of large scales of a new genus of ganoid fishes. In the summer of 1850, Capt. Brickendon, obtained from the yellow sandstone near Elgin, a slab bearing the distinct impressions of Chelonian footsteps. These are thirty-four in number, and extend several feet across the stone. The impressions of the right feet alternate with those of the left, from which they are separated laterally by an interval of three inches, the length of each space or stride being about four inches. The imprints of the fore and hind feet are nearly in contact; the size of the former in relation to the latter, is as three to four. The hinder prints are an inch in diameter. The foot-prints are obtuse and rounded, and indicate a close connection of the articulations, for no distinct markings of the joints are shown. The discovery of these foot-prints, which in every respect resemble those from the Triassic, and other rocks, that are ascribed by palæontologists, to turtles or tortoises, is alone an important fact, since it demonstrates the probability, if not certainty, that reptiles existed during the Devonian epoch; hence the attention of those collectors who were aware of the discovery, was especially directed to the rocks of Morayshire, in the hope of obtaining other vestiges of reptilians, but without success, until in November, 1851, Mr. Duff, of Elgin, procured from the sandstone a most extraordinary fossil. This fossil consists of the impression of a great part of the skeleton of a four-footed reptile, about six inches long, in a block of crystalline sandstone which is broken into three pieces. Fortunately the stone is split in a direction parallel with the plane of the spinal column, so that one piece exposes the imprints of the vertebræ and ribs, and hinder extremities, and the other, the corresponding mould of the upper part. Dr. Mantell, by a careful investigation, has been enabled to give restored figures of the vertebræ, ribs, femora, &c.; but the original contains no remains of osseous substance, except of the cranium, and that part of the skeleton is crushed, and in a great measure concealed by the investing stone. The skull appears to have been of an oval form, resembling that of a small lizard, or aquatic salamander; but the true outline cannot be determined. There are remains of two or three very minute and smooth conical teeth, but their mode of implantation in the jaw is not obvious. The spinal column from the occiput to the pelvis, appears to have consisted of twenty-four vertebræ, each vertebra having a pair of very slender ribs; there are no remains of the scapular arch, but there are imprints of the left humerus, radius and ulna; and of the right and left femur, tibia and

27*

fibula. There are ten or twelve caudal vertebræ exposed, the remainder of the series being buried in the stone; the length of the tail did not probably exceed an inch and a half. Dr. Mantell considers that the original animal was a peculiar type of air breathing oviparous quadruped, presenting in its osteology certain characters that are found in Lacertians, combined with others that occur in the skeleton of Batrachians. From the evidence afforded by a mere impression of part of the skeleton, and in the absence of any knowledge of the structure of the feet, scapular arch, bones of the cranium, &c., the natural affinities of the original cannot be precisely determined. Dr. Mantell therefore distinguishes this most ancient reptile hitherto discovered by a name simply expressive of its remote antiquity, viz., Telerpeton.

The original reptile appears to have had a general resemblance in its physiognomy to an acquatic salamander, with broad dorsal region and longer limbs than the ordinary Tritons, fit alike for progression on land, or through the water; the tail appears to have been wide. The entire length of the animal did not exceed six or seven inches. By the discovery of these remains, and the impressions before described, we have thus, for the first time, obtained unquestionable evidence that two orders of the class Reptilia existed during the Devonian epoch.

ON THE SUPPOSED FOSSIL OVA OF BATRACHIANS OF THE LOWER DEVONIAN.

In connection with the discoveries above referred to, Dr. Mantell has recently brought to notice certain fossils which abound in the lower Devonian shales of Forfarshire, and are figured and described by Sir. Charles Lyell, as probably the ova of gasteropodous mollusca. These are clusters of small roundish carbonized bodies, which generally occur with remains of aquatic plants. With the exception of the Cephalaspis and other ganoid fishes peculiar to the old red, no other fossils but the ova have been found in these beds. The resemblance of these organic remains to the carbonized spawn of recent frogs, which Dr. Mantell had found in the inspissated mud of a dried up pond, led him to suspect that they might be the fossil ova of Batrachians; and for reasons detailed at length in his recent memoir, he is of the opinion, that if the fossil bodies of Forfarshire be of animal origin, they are unquestionably referable to Batrachians, allied to the *Ranidæ* or frog family, and not to Gasteropoda; larger ova occur singly or in pairs, and often attached to the foliage, (in like manner as the eggs of our Tritons,) and these in all probability belong to aquatic salamanders. In confirmation of his conjecture, Dr. M. particularly dwells upon the fact that in the numberless strata of shales, limestones, clays, &c., abounding in shells often in a state of great perfection, with the ligament, epidermis, and even the soft parts preserved in the state of molluskite, no ova had ever been detected; while in the shales of Forfarshire, which swarm with these eggs, neither shells, or even casts of shells, had been discovered. An important geological inference was supported by Dr. M., as deducible from these facts. Here we have ova with aquatic plants, (apparently fluviatile,) and the remains of ganoid fishes, which, for aught we know to the contrary, may, like the recent Lepidostei, have been inhabitants of rivers; and with no vestiges of shells or other marine organisms; phenomena which lead us to inquire whether the lower Devonian strata of Forfarshire may not be of fluviatile, or fluvio-marine origin; whether, in fact, we have not here indications of the intercalation of a series of fresh water deposites in the marine formation, called the old red-sandstone of Scotland? Future observations will determine the solidity of this novel, but highly probable, suggestion. Should this view be established by future discoveries, Dr. Mantell will have the singular good fortune to be the first geologist who predicated the presence of fresh water deposites in the palæozoic formations of Scotland, as he established by his own researches the fluviatile character of the Wealden of the south-east of England.—*Silliman's Journal.*

FLORA OF THE TERTIARY FORMATION.

The Flora of the tertiary formation has been hitherto, comparatively speaking, far less known than that of the coal formation which is of a far older date: and even in Silesia, notwithstanding its numerous and important deposites of brown coal, the entire amount of leaves, blossoms and fruits belonging to this formation exclusive of stems of trees, did not exceed forty-three species up to the close of last year. Since then, however, a discovery has been made which in a few months has already brought more treasures to light, than Monte Bolca in Italy, and the celebrated deposit of Oeningen in Germany, have done in a century. This new deposite was discovered by the Superior Councillor of Mines, Von Oeynhausen, near the end of January, of this year, in the immediate neighborhood of Breslau, at Schossnitz near Kauth on the railroad: it is a bed of fossil plants in tertiary clay, and is unique in richness, variety and admirable preservation. From the end of January up to the beginning of March, there were already discovered no less than 130 species in about six cwt. of clay, and every fresh quantity examined gave additional results. Dr. Goppert has read a very interesting paper upon the results of the examination thus far made before the natural history section of the Breslau Society. The clay is of a whitish color; the plants seldom preserve their original texture, but usually occur as impressions of a pale brown color, in which, however, they are displayed with such precision that even the delicate anthers of the catkins of the willow tribe are readily distinguished. These anthers, as well as those of the male catkins of the plane tribe, occasionally exhibit the pollen. With respect to the families and genera, it may be said that they agree, speaking in a general way, with those of the other local floras of the brown coal formation. The species are, for the most part different, only one species has been hitherto observed. Libocedrites Salicornioides, that is met with in Silesia in amber, and in the brown coal formation. Of the 130 species that have been found at Schossnitz, up to the beginning of March, there are no less than 118 which are new. As a peculiarity in this tertary flora, may be cited the considerable number of oaks, of which already 25 varieties have been observed, whereas at present, only 13 are known to occur in Europe, and for most part, the species discovered, belong to those with incised leaves. There are, morever, no less than 17 varieties of elm, some unquestionably planes and varieties of maple perfectly distinct from any hitherto discovered. It need hardly be observed that our acquaintance with the riches of this recently discovered deposite is as yet, necessarily very imperfect. Palms, which are not within other tertiary deposits in the immediate neighborhood, have not thus far, been found; indeed, no monocotylidons have been observed with the exception of a few leaves of grass. The origin of the deposite has been explained on the supposition that there existed here formerly an inland lake, into which, the leaves and blossoms of the trees that perished on the banks were carried by the wind and became subsequently, imbedded in the clayey mud. This recently discovered deposite bears out the idea, that although the majority of the genera of the plants occurring in the tertiary formation are similar to those now met with in Europe, although the species are different and agree rather with African forms than ours, yet that this formation, speaking generally, contains a flora distinct from that of the actual flora of the districts mentioned, and analagous rather to that of countries, situated several degrees more to the South; the flora of the deposite at Schossuitz, answering, it will be seen, to that of the vegetation in the Southern portion of the United States or to that of the North of Mexico.

OBSERVATIONS ON THE COAL FORMATION OF THE UNITED STATES.

Prof. Rogers, at the Boston Society of Natural History, 1852, presented some observations of Dr. Les Quereux on the coal formation of the United States.

The coal deposites of the central, southern, and western portions of the United States are found to rest on the same foundation rock, which is usually a coarse sandstone, with occasional pebbles, some siliceous gravel and igneous quartz. Such an extensive deposit cannot be accounted for by the theory that it is a bed of ancient estuary. Some of its materials must have come from a source a least one thousand miles distant. It is of great value to geologists from its extent, as giving a fixed period in geological time. In two localities — in Ohio and the western part of Pennsylvania — several beds of coal are found beneath this formation, indicating a condition of things favorable to the production of coal anterior to the rush of waters from the north, over which the rest is built up.

Dr Jackson remarked that it would be very interesting to trace such a wide-spread deposite to its original source. In New Bunswick, on the Peticodiac River, he had found a hard green slate, with pieces of syenite, quartz, and occasionally of trap rock, the pebbles being but partially rounded; he had traced this deposite to a mountain of syenite and green slate, fourteen miles to the west of north, known as Caledonia Mountain. The coal basin of that region is made up of sandstone, with limestone and white gypsum. Above this lies a richly bituminons shale, soft, even flexible, filled with remains of fishes. Dr. Jackson inquired if, in the widely-spread formation spoken of by Prof. Rogers, there was any gradation of fineness in the materials, their fineness increasing in proportion to the distance from their probable source, indicating the action of the water rather than ice in their distribution.

Prof. Rogers replied that such is the case.

Dr. Jackson referred to the opinion of some geologists that the Stigmaria are the roots of Sigillaria. From his own study of them he still had his doubts of this. At the New Brunswick coal mines he had seen the trunks of sigillaria imbedded in the rocks; he had even passed beneath them in the coal mines, and seen their roots branching over his head, and they certainly were not Stigmaria. He had noticed, also, in the centre of the markings of Stigmaria one and sometimes two little points. In the Mansfield coal mines he had seen similar points in the adjacent rock. He was, therefore, inclined to the belief that these markings are leaf scars. If the Stigmaria are roots, then their rootlets must have been deciduous.

Dr. Jackson mentioned the curious fact that, at the South Joggings, immediately beneath the Sigillaria and coal, there are myriads of fossil marine shells of a mytiliform character.

ORIGIN AND COMPOSITION OF COAL.

Mr. Teschemacher, has presented to the Boston Natural History Society, some additional observations* on the origin and composition of coal, with a view of showing the existence of coniferous plants in the carboniferous period, as well as the general resinous nature of coal of all descriptions. For this purpose he submitted the following specimens.

1st. A slice of Southern pine (pinus australis) in which, owing to its resinous nature, the glandular vessels of the coniferous tribe are very clearly visible. 2d. A slice of the same carbonized, in order to show the appearance of these glands when changed by this action. 3d. A specimen of anthracite and one of Cumberland coal, in which these glandular vessels are extremely distinct. Such specimens are quite common in Pictou coal. 4th. Impressions in the shale from Carbondale, Pa., of the leaves of a species of pinus. 5th. A specimen of the same shale showing an impression of the base of a bunch of leaves and its sheath at the junction with the stem.

On comparing the latter with the accompanying specimen of the pinus australis of the present day, its close resemblanee is very evident; it fitting the impression almost as if moulded from it. On the side of the recent specimen adjacent to the axis of the branch is a

---

* See Annual of Scientific Discovery, 1852, pp. 308-9.

protuberance formed by the vessels which penetrate the bark, and depressions on each side thereof, to which the impressions of these in the Shale, although faint, bear a close resemblance. In many of the leaves of the recent fir tribe, there are rows of glands extending from the base to the summit, and in some, very minute spines on each edge. It cannot be expected that these microscopic characters should be visible in impressions on so coarse a material as the Shale, but no doubt they will be found when similar impressions are discovered in the coal itself.

Other impressions of leaves of coniferæ are in my collection, some in the anthracite; but although I have no doubt of their being leaves, they are not so undeniable as to be exhibited as proofs. I pass on to the chemical evidence. Lehmann states that *formic acid* is found in coal during the process of decay (eremacausis), and also that is found in the berries of the Juniperus and the cones of several of the fir tribe. Redtenbacher finds formic acid in the leaves and twigs of the fir tribe during fermentation (incipient eremacausis.) A few years ago, Pelletier and Walther examined the tar produced by the distillation of resin, and found therein two substances which they named *retinnaptha* and *retinnyle*, and then the well-known napthaline. The progress of organic chemistry has since shown the two former substances to be the Toluole and the Cumole of the present day. I will now simply advert to the opinion of Goppert, in his prize essay. He supposes the origin of the coal to be from a fermentation and consequent eremacausis of vegetable matter. Others suppose this vegetable matter to have been chiefly mosses, such as form the large accumulations of peat.

My view is that coal, is chiefly composed of resinous trees, (Conifers) and oleaginous trees, (Palms) the latter being in excess in the Cannel coal. I now wish to show that all coal has been formed from nearly the same original materials, and probably nearly under the same circumstances, from the anthracite to the most bituminous. This I propose to do by exhibiting these specimens, selected from many hundreds in my possession, of anthracite coal from Pennsylvania, of bituminous coal from Cumberland basin, and from Hillsboro'; specimens from Pictou and other localities might have been added. The comparison of these, their exact similarity in their structure, marks of organisms, and peculiar fracture, can leave but little doubt on the subject. They exhibit, however, but a small portion of the resemblances manifest on a minute and extended investigation.

From what cause, then, can arise the difference in various coals? At present only three characters of diversity are apparent: specific gravity, quantity of Carbon, and quantity of hydrogen. To show this, the descending scale may be used thus:

	Hydrogen.	Carbon.	Specific Gravity.
Asphaltum	9 per ct.	78.10	1.063
Hillsboro' Coal	———	———	1.09 to 1.12
Cannel	5.66 to 6.00	81.00	1.20
Bituminous	4.80 to 5.60	81 to 86	1.29 to 1.32
Anthracite	2.40 to 4.20	89 to 92	1.34 to 1.47
Graphite	none	99	2.27

The difference in specific gravity and carbon would seem to depend on the diminution of the hydrogen. How this has been separated, whether by the process of time, of pressure, of heat, or, as is most probable, by a process of which we are entirely ignorant, must be a subject for future investigations.

It must be obvious that the foregoing is but a very faint outline of some of the result of my yet imperfect examination of this subject — imperfect mainly because the means of a more perfect one are yet out of reach. The chemical analysis of coal have hitherto been undertaken chiefly with commercial views, and altogether to obtain ultimate principles. But the daily operations of the gas works exhibit products showing that yet much has to be done in these analyses to satisfy the increased progress in the science of organic chemistry. My own experience has also led me to the conclusion, that much more remains yet to be accomplished in the study of the internal structure and contents of coal,* and that the vast and varied coal formations of this immense Continent are chiefly to be relied on as the fields for their study.

*On the application of heat many anthracites separate into laminæ as thin as paper. These are alternate layers of hardened resinous hydro-carbon, and of vegetable matter, often retaining in its state of ashes its original forms ; this last is the first burned out, leaving the laminæ of the former exposed.

BOTANY.

ON THE RELATIONS BETWEEN THE VITAL FUNCTIONS OF THE ANIMAL AND VEGETABLE KINGDOMS.

The Journal of the Chemical Society, of London, contains a detailed account of some investigations by Robert Warington, Esq., which illustrate in a marked degree, that beautiful and wonderful provision which we see displayed throughout the animal and vegetable kingdoms, whereby their continued existence and stability are so admirably sustained, and by which they are made mutually to subserve, each for the other's nutriment, and even for its indispensible wants and vital existence. The experiments have reference to the healthy life of fish preserved in a limited and confined portion of water, and were continued for nearly twelve months. Two gold fishes were placed in a large glass receiver, about half filled with ordinary spring water and supplied at the bottom with sand and mud, together with some loose stones, so arranged that the fish could get below them if they wished. At the same time that the fish were placed in this miniature pond, a small plant, *vallis neria spiralis*, was introduced, its roots being inserted in the mud and sand, and covered by one of the loose stones, so as to retain the plant in its position. The vallis neria is a delicate aquatic plant, which throws out an abundance of long, wiry, strap-like leaves, about a quarter of an inch in breadth, and from one to three feet in length; these, when the sun shines on them, evolve a continued stream of oxygen gas, which rises in a current of minute bubbles, particularly from any part of the leaf which may have received an injury. The materials being thus arranged, all appeared to go on well for a time, until circumstances occurred which showed that another very material agent was wanting to perfect the adjustment. The circumstances alluded to arose from the internal decay of the leaves of the *vallis neria*, which became yellow from having lost their vitality, and began to decompose; this rendered the waters turbid, and caused a growth of green, slimy matter, on the surface of the water, and on the sides of the receiver. To remove this decaying matter, recourse was had to a very useful little scavenger, whose beneficial functions have been too much over-looked in the economy of animal life, viz., the water snail. The natural food of these animals is the very green mucus and decaying vegetable matter, which threatened to destroy the object of the experiment. Five or six of these creatures, the *Himnœa stagnalis*, were consequently introduced, and by their rapid and continued locomotion, and extraordinary velocity, soon removed the cause of interference, and restored the whole to a healthy state, thus perfecting the balance between the animal and vegetable inhabitants, and enabling both to perform their functions with health and energy. The *vallis neria* attained to a luxuriant and healthy growth, the fish appeared lively and bright in color, while the snails, judging from the enormous quantities of eggs deposited by them, appeared to thrive wonderfully, and besides their functions in sustaining the perfect adjustment of the series, afforded large quantities of food to the fish in the form of young snails, which are devoured as soon as they exhibit signs of vitality, and before their shell has become hardened. Thus we have that admirable balance sustained between the animal and vegetable kingdoms, and that in a liquid element. The fish, in its respiration, consumes the oxygen held in solution by the water as atmospheric air; furnishes carbonic acid; feeds on the young snails, and excretes materials well adapted for the food and growth of the plant. The plant, by its respiration, consumes the carbonic acid produced by the fish, appropriating the carbon to the construction of its tissues and fibres, and liberates oxygen in its gaseous state to sustain the healthy functions of animal life, at the same time that it feeds on the rejected matter, which has fulfilled its purposes in the nourishment of the fish and snail, preserving the water in a clear and healthy condition. The slimy snail, finding its proper nutriment in the decomposing vegetable matter, prevents its accumulation by removal from the field, and by its vital powers, converts what would otherwise act as a poison, into a rich and fruitful nutriment, again to constitute a pabulum for the vegetable growth, whilst it also acts the important part of a purveyor to its finny neighbor.

INFLUENCE OF SOLAR RADIATIONS ON PLANTS.

At the British Association, Belfast, Dr. J. H. Gladstone made a report on the influence of the solar radiations on the vital powers of plants growing under different atmospheric conditions. As a preliminary matter of inquiry, the mere effect of colored media in accelerating or retailing the growth of various kinds of plants was tried. Hyacinths were chosen as the sample of bulbous-rooted plants. Roots of as nearly as possible the same size and description in every respect were grown under the various bell glasses. Certain differences were described, both in the rootlets and the leaves, which might fairly be attributed to the character of the light; the time of flowering, and the flowers themselves, were not affected by it; and the greatest growth, (estimated quantitatively in each instance,) took place in the plant exposed to all the rays of the solar spectrum; the next greatest was under the blue glass. Wheat was also grown in a similar manner; the method of arrangement of apparatus being minutely detailed, and the character of the corn plants which appeared under the various glasses. Those under the yellow were the most sturdy in their growth; those under the blue the least healthy; whilst some grown under a nearly darkened shade grew quickly nine inches long, put forth no secondary leaves, and died in a month. Mallows were grown in a similar manner. The detailed observations were of much the same purport as in the preceding instance. As it had been formerly observed by the author and his brother, that plants kept in an unchanged atmosphere appear to enter into a sort of lethargic condition, experiments were instituted for the purpose of ascertaining whether the alteration in light produced by colored media made any marked variation in this matter. The pansy and the *Poa annua* were the plants selected; and comparative experiments were made with a darkened shade, and with no covering at all. The results were various,—but scarcely conclusive, unless in reference to the fact that plants survive much longer for being in unchanged air. The colorless and yellow media appeared most favorable to the healthiness of the plants. As experiments on growing plants must stretch over a considerable time, the author's observations were not put forth as foundations for any generalization, but just as samples of his preliminary attempts.

ON THE MORPHOLOGICAL ANALOGY BETWEEN THE DISPOSITION OF THE BRANCHES OF EXOGENOUS PLANTS AND THE VENATION OF THEIR LEAVES.

PROF. McCOSH, at the British Association, brought forward an interesting communication on this subject, and endeavored with great ingenuity to generalize and reduce to a common law the peculiarities which are manifested in the branching of exogenous plants, starting with the theory propounded by Goethe, that all the appendages of plants, whether leaves, bracts, sepals, petals, or stamens, are formed after a common type, and that that type is the leaf. Prof. McCosh attempted to show that this theory might be extended further, and that the type of the leaf is not only that of all the appendicular organs, but of the buds and of the branches, and therefore eventually of the whole plant itself. The leaf is to the plant as the microcosm to the macrocosm — it is the plant in miniature — a common law governs the two, and therefore whatever disposition we find in the parts of the leaf, we may expect to find in the parts of the plant, and *vice versa*. Now, the veins of the leaf are the analogue of the branches of the plant, and therefore the venation and the ramification must essentially harmonize with one another. In illustration of the law, the Professor pointed out that in reticulated leaved plants (to which alone he referred) there is a correspondence between the distribution of the branches along the axis, and the distribution of the venation of the leaf. In some plants the lateral branches are disposed pretty equally along the axis, whereas in others a number are gathered together at one point, and the plant becomes in consequence verticillate or whorled. The Professor stated, that wherever the branches are whorled, the leaves of the plant, as in the rhododendron, or the veins of the individual leaf, as in the common sycamore and lady's mantle, are also whorled. When the leaf has a petiole the tree has its trunk unbranched near the base, as in the case of the sycamore, apple, &c.; and when the leaf has no petiole the trunk is branched from the root, as in the common ornamental low shrubs, the bay, laurel, holly, box, &c. Prof. McCosh exhibited an instrument for the measurement of the angles at which branches, &c., go off, and in 210 species of plants he found the angles of the branches with the stem and those of the veins with the midrib to coincide. The Professor stated in conclusion, that he believed there was a similar unity running through linear-leaved plants and monocotyledons. If substantiated, these views will give greater exactness to our distinctions of genera and species, and will lend more exactness to our ideas of the physiognomy of plants; they will at the same time exhibit an unity of design in the skeleton of the plant, similar to that which exists in the animal world, and so subserve the purpose of the natural theologian.

SLEEP OF PLANTS IN THE ARCTIC REGIONS.

Mr. Seemann, the naturalist of Kellett's Arctic expedition, states a curious fact respecting the condition of the vegetable world during the long day of the Arctic summer. Although the sun never sets whilst it lasts, plants make no mistake about the time, when, if it be not night, it ought to be; but regularly as the evening hours approach, and when a midnight sun is several degrees above the horizon, droop their leaves, and sleep even as they do at sunset in more favored climes. "If man," observes Mr. Seemann, "should ever reach the Pole, and be undecided which way to turn, when his compass has become sluggish, his timepiece out of order, the plants which he may happen to meet will show him the way; their sleeping leaves tell him that midnight is at hand, and that at that time the sun is standing in the north."

THE POTATO NOT INDIGENOUS TO SOUTH AMERICA.

A correspondent of the New England Cultivator, states that Col. Mure, of Caldwell, county of Renfrew, Scotland, has raised potatoes from the germ, obtained from clay thrown up from a depth of forty feet, while digging for water. The clay, it is said, was placed under a glass, and in due time signs of vegetation began to manifest themselves. These were various in character. Among them a few were taken, when strong enough to withstand the process, and transplanted. One, in particular, presented indications showing it to be a specimen of the *solanum* tribe. After careful cultivation, it finally produced a series of tubers. The following year these tubers were planted, and produced their kind, but the size was larger. Succeeding years' cultivation improved both bulk and quality; and now the produce is regularly grown in the vicinity of Col. Mure's residence, and prized as first class potatoes.

CHINESE RICE PAPER PLANT.

It was long thought that the beautiful and well known "rice-paper" of China was made from the pith of an *Æschynomene:* but this has been shown to be incorrect. Two years ago Sir Wm. Hooker published, in his Journal of Botany, some selections from a series of Chinese drawings, respecting its manufacture from a strange looking vegetable, which, it now appears, must have been a hoax upon Europeans. For at length Sir Wm. Hooker has obtained, from the island of Formosa, where alone it is known to grow, some imperfect specimens (stems and foliage) of the true plant; from which is made a figure, published in the January number of his Journal; and an account is given in the February number. Enough is now known to render it most probable that the plant is Araliaceous; and it is provisionally named *Aralia? papyrifera*, Hook. The stems are arborescent or frutescent, and are filled with a very large and beautifully white pith, from which the paper is made.

ON THE TALLOW TREE AND INSECT WAX OF CHINA.

In an account of the tallow tree (*styllingia sebifera*) and the insect wax of China, given in the June number of Hooker's Journal of Botany, it is stated, as exhibiting the vast commercial importance of these two vegetable substances, that in a single stearine candle factory of London, nine hundred hands are employed, producing one hundred tons of candles weekly, valued at £7,000, from the wax and tallow of vegetable origin.

The insect wax is obtained from three different species of trees or shrubs, being an exudation, caused by the puncture of an insect belonging to the cicada family, and known in entomology as flata limbata. In time, this exudation becomes dry and powdery, resembling, "hoar frost," in which state it is scraped off, and "the crude material freed from impurities by spreading it on a strainer covering a cylindrical vessel of boiling water. The wax is received in the former vessel, and on congealing is ready for market." It is worth from 22 to 25 cents per pound, and the total product is estimated at 400,000 pounds, worth more than 1,000,000 Spanish dollars. It seems to be yet undetermined whether the waxy matter is yielded by the animal, or exuded by the plant in consequence of its puncture.

The vegetable tallow is obtained from the *styllingia sebifera*, a native of China, but which is now fully acclimated in South Carolina, and grows abundantly in the neighborhood of Charleston. Indeed, so hardy is it, and so well pleased in its new situation, that it has taken possession, in a great measure, of the road-side banks and hedges, for two or three miles in the environs of the city. It seems to delight in the vicinity of the saline atmosphere, having extended but sparingly upwards in the country. This may be owing, however, in part, to its meeting the more robust forest growth, which it is unable to exclude.

It is chiefly from the two proximate principles which are the constituents of animal tallow, the *stearine* and *elaine* contained in the fruit, that the plant is so much valued. The nuts or capsules, when ripe, are gently pounded in a mortar, to loosen the seeds from the shells, from which they are separated by sifting. To facilitate the separation of the white sebaceous matter enveloping the seeds, they are steamed in tubs, with convex open wicker bottoms, placed over cauldrons of boiling water. When thoroughly heated, they are reduced to a mash in a mortar, and thence transferred to bamboo sieves, kept at a uniform temperature over hot ashes. This operation of steaming and sifting is repeated, as the first does not deprive the seeds of all their tallow. The article thus obtained becomes a solid mass, on falling through the sieve, and, to purify it, it is melted and formed into cakes for the press. These receive their form from bamboo hoops, a foot in diameter and three inches deep, which are laid on the ground over a little straw. On being filled with the hot liquid, the ends of the straw beneath are drawn up and spread over the top, and when of sufficient consistence are placed, with their rings, in the press. This apparatus is of the rudest description, constructed of two large beams, placed horizontally, so as to form a trough capable of containing about fifty of the rings, with their sebaceous cakes; at one end it is closed, and at the other adapted for receiving wedges, which are successively driven into it by ponderous sledge-hammers, wielded by athletic men. The tallow oozes, in a melted state, into the receptacle below, where it cools. It is again melted, and poured into tubs smeared with mud, to prevent its adhering. It is now marketable, in masses of about eighty pounds each, hard, brittle, white, opaque, tasteless, and without the odor of animal tallow. Under high pressure it scarcely stains bibulous paper, and melts at 104° Fahr.

The process of pressing the oil, (*elaine*,) which is carried on at the same time, is as follows. This is contained in the *kernel* of the nut, the sebaceous matter which lies between the shell and the husk having been removed in the manner described. The kernel, and the husk covering it, are ground between two stones, which are heated, to prevent cloging from the sebaceous matter still adhering. The mass is then placed in a winnowing machine, when the chaff being separated, the white oleaginous kernels, after being steamed, are placed in a mill to be mashed. The machine is formed of a circular stone groove, in which a solid stone wheel revolves perpendicularly, by the aid of an ox. Under this ponderous weight the seeds are reduced to a mealy state, steamed in the tubs, formed into cakes, and pressed by wedges in the manner already described; the process of washing, steaming and pressing being repeated with the kernels likewise. The kernels yield about 30 per cent. of oil. The cakes which remain after the oil is pressed out are used as manure. The Chinese color their candles red by a minute quantity of *akanet* root, (*anchusa tinctoria*, brought from Shangtung.) Verdigris is employed to dye them green. Their stearine candles are worth about eight cents per pound.

THE SNAKE PLANT OF SOUTH AMERICA.

A CORRESPONDENT of Chambers' Edinburgh Journal gives the following account of the "*guaco*" of Central, and South America, and its efficacy as an antidote against the bites of venomous reptiles. The guaco is a species of willow. Its root is fibrous, the stem straight and cylindrical when young; but as it approaches maturity, it assumes a pentagonal form, having five salient angles. The leaves grow lengthwise from the stem, opposite, and cordate. They are of a dark-green color mixed with violet, smooth on the under surface, but on the upper rough with a slight down. The flowers are of a yellow color, and grow in clusters — each calyx holding four. The corolla is monopetalous infundibuliform, and contains five stamens uniting at their anthers into a cylinder which embraces the style with its stigma much broken. The guaco is a strong healthy plant, but grows only in the hot regions, and flourishes best in the shade of other trees, along the banks of the streams. It is not found in the colder uplands (*tierras frias;*) and in this disposal nature again beautifully exhibits her design, as here exist not the venomous creatures against whose poisons the guaco seems intended as an antidote. That part of the plant which is used for the snake-bite is a sap or tea distilled from its leaves. It may be taken either as a preventive or cure; in the former case, enabling him who has drunk of it to handle the most dangerous serpents with impunity.

The writer of the communication says: —

Being at Margarita some time ago, I heard of this singular plant, and was desirous of witnessing the test of its virtues. Among the slaves of the place there was one noted as a skilful snake-doctor; and as I enjoyed the acquaintance of his master, I was not long in obtaining a promise that my curiosity should be gratified. A few days after, the negro entered my room, carrying in his hands a pair of coral-snakes, of that species known as the most beautiful and venomous. The negro's hands and arms were completely naked; and he manipulated the reptiles, turning them about, and twisting them over his wrists with the greatest apparent confidence. I was for a while under the suspicion that their fangs had been previously drawn; but I soon found that I had been mistaken. The man convinced me of this by opening the mouths of both, and showing me the interior. There, sure enough, were both teeth and fangs in their perfect state; and yet the animals did not make the least attempt to use them. On the contrary, they seemed to exhibit no anger, although the negro handled them roughly. They appeared perfectly innocuous, and rather afraid of him I thought. Determined to assure myself beyond the shadow of a doubt, I ordered a large mastiff to be brought into the room and placed so that the snakes could reach him. The dog was sufficiently frightened, but being tied he could not retreat; and after a short while one of the serpents "struck," and bit him on the back of the neck. The dog was now set loose, but did not at first appear to notice the wound he had received. In two or three minutes, however, he began to limp and howl most fearfully. In five minutes more he fell, and struggled over the ground in violent convulsions, similar to those occasioned by hydrophobia. Blood and viscous matter gushed from his mouth and nostrils, and at the end of a quarter of an hour by the watch he was dead.

Witnessing all this, I became extremely desirous of possessing the important secret — which, by the way, was not so generally known. I offered a good round sum; and the negro, promising to meet my wishes, took his departure.

On the following day he returned, bringing with him a handful of heart-shaped leaves, which I recognized as those of the *bejuco de guaco* or snake-plant. These he placed in a bowl, having first crushed them between two stones. He next poured a little water into the vessel. In a few minutes maceration took place, and the "tea" was ready. I was instructed to swallow two small spoonfuls of it, which I did. The negro then made three incisions in each of my hands at the forking of my fingers, and three similar ones on each foot between the toes. Through these he inoculated me with the extract of the guaco. He next punctured my breast, both on the right and left side, and performed a similar inoculation. I was now ready for the snakes, several of which, both of the coral and cascabel species, the negro had brought along with him. With all my wish to become a snake-charmer, I must confess that at sight of the hideous reptiles I felt my courage oozing through my nails. The negro, however, continued to assure, and as I took great pains to convince him that my death would cost him his life, and I saw that he still entreated me to go ahead, I came at length to the determination to run the risk. With a somewhat shaky hand I took up one of the corals, and passed it delicately through my fingers. All right. The animal showed no disposition to bite, but twisted itself through my hands, apparently cowering and frightened. I soon grew bolder, and took up another and another, until I had three of the reptiles in my grasp at one time. I then put them down and caught a snake of the cascabel species — the rattlesnake of the north. This fellow behaved in a more lively manner, but did not show any symptoms of irritation. After I had handled the reptile for some minutes, I was holding it near the middle, when, to my horror, I saw it suddenly elevate its head, and strike at my left arm! I felt that I was bitten, and, flinging the snake from me, I turned to my companion with a shudder of despair. The negro, who with his arms folded had stood all the while calmly looking on, now answered my quick and terrified inquiries with repeated assurances that there was no danger whatever, and that nothing serious would result from the bite. This he did with as much coolness and composure as if it had been only the sting of a mosquito. I was more comforted by the manner of my companion than by his words; but to make assurance doubly sure, I took a fresh sup of the guaco tea, and waited tremblingly the result. A slight inflammatory swelling soon appeared about the orifice of the wound, but at the expiration of a few hours it had completely subsided, and I felt that I was all right again.

On many occasions afterwards I repeated the experiment of dandling serpents I had myself taken in the woods, and some of them of the most poisonous species. On these occasions I adopted no farther precaution than to swallow a dose of the guaco sap, and even chewing the leaves of the plant itself was sufficient. This precaution is also taken by those — such as hunters and wood-choppers — whose calling carries them into the thick jungles of the southern forest, where dangerous reptiles abound.

ZOOLOGY.

ON THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS IN CONNECTION WITH THE PROGRESS OF HUMAN CIVILIZATION.

THE above formed the subject of a communication read at the last meeting of the British Association, by Mr. Ogilby, who took the ground that the less civilized nations of the world, were so, from the absence of animals capable of domestication. America and Australia, were the great types of this deficiency. The following conclusion of his paper will give an idea of the general argument and style. "Let us now examine the facilities which the natives of Europe, Asia, and Africa possessed for developing civilization, compared with those of America and Australia. The former had those great *collaborateurs* in their social progress, they had the horse, the ass, and the camel, for beasts of burden; and they had the sheep, the ox, and the goat, for food and a thousand other useful purposes. The consequence of this was, that at a very early period—at a period of which there are few authentic historical documents extant—the nations of Western Asia had advanced in civilization to an extent which is now only beginning to be thoroughly understood and appreciated. The researches of such eminent men as Dr. Layard into the antiquity of Assyria and Egypt, prove this beyond question; and show that those nations had advanced to a power which, in modern times, has scarcely been equalled, and that we are only now in the same state with regard to civilization that they were three or four thousand years ago, whilst the less fortunate inhabitants of America and Australia would be obliged, by want of those facilities possessed by the former, to remain in their original condition for eternity."

Prince Canino said, that there were some points on which he coincided with the author, but there were others also on which he differed. He did not consider that it was the animals who were to be blamed for the backward state of the aborigines of America and New Holland, but the people themselves. As a beast of burden, he thought the American bison might be tamed, and made to serve that purpose as well as the ox, for it was a stronger animal, and possessed many useful qualities which the ox did not. As another example of what the people of those countries might do in this way, he would refer to the American grapes, which at one time were thought so useless that there was a proverb to that effect; but now it was found that a good wine can be made from them. In confirmation of Mr. Ogilby's opinions as to the origin of domestic animals, he might say that the prototype of the common cat was that kept in the temples of Egypt

ON THE ADAPTATION OF COLOR TO THE WANTS OF THE ANIMAL.

We take the following remarks upon the adaptation of color to the wants of the animal, from a recent scientific publication by Mr. Broderip, of England: — "Throughout the animal creation, the adaptation of the color of the creature to its haunts is worthy of admiration, as tending to its preservation. The colors of insects, and of a multitude of the smaller animals, contribute to their concealment. Caterpillars which feed on leaves are generally either green, or have a large proportion of that hue in the color of their coats. As long as they remain still, how difficult it is to distinguish a grasshopper or young locust from the herbage or leaf on which it rests. The butterflies that flit about among flowers are colored like them. The small birds which frequent hedges have backs of a greenish or brownish green hue, and their bellies are generally whitish, or light-colored, so as to harmonize with the sky. Thus they become less visible to the hawk or cat that passes above or below them. The wayfarer across the fields almost treads upon the skylark before he sees it rise warbling to heaven's gate. The goldfinch or thistlefinch passes much of its time among flowers, and is vividly colored accordingly. The partridge can hardly be distinguished from the fallow or stubble upon or among which it crouches, and it is considered an accomplishment among sportsmen to have a good eye for finding a hare sitting. In northern countries, the winter dress of the hares and ptarmigans is white, to prevent detection among the snows of those inclement regions.

"If we turn to the waters, the same design is evident. Frogs even vary their color according to that of the mud or sand that forms the bottom of the ponds or streams which they frequent — nay, the tree-frog (*Hyla viridis*) takes its specific name from the color, which renders it so difficult to see it among the leaves, where it adheres by the cupping-glass-like processes at the end of its toes. It is the same with fish, especially those which inhabit the fresh waters. Their backs, with the exception of gold and silver fish, and a few others, are comparatively dark; and some practice is required before they are satisfactorily made out, as they come like shadows, and so depart, under the eye of the spectator. A little boy once called out to a friend to 'come and see, for the bottom of the brook was moving along.' The friend came, and saw that a thick shoal of gudgeons, and roach, and dace, was passing. It is difficult to detect 'the ravenous luce,' as old Izaak calls the pike, with its dark green and mottled back and sides, from the similarly tinted weeds among which that fresh water shark lies at the watch, as motionless as they. Even when a tearing old trout, a six or seven-pounder, sails in his wantonness, leisurely up stream, with his back-fin partly above the surface, on the look out for a fly, few, except a well entered fisherman, can tell what shadowy form it is that ripples the wimpling water. But the bellies of fish are white, or nearly so; thus imitating in a degree the color of the sky, to deceive the otter, which generally takes its prey from below, swimming under its intended victim. Nor is this design less manifest in the color and appearance of some of the largest terrestrial animals; for the same principle seems to be kept in view, whether regard be had to the smallest insects, or the quadrupedal giants of the land."

Prof. Agassiz has stated that the coloration of the lower animals living in water depend upon the condition, and particularly upon the depth and transparency of the water in which they live; that the coloration of the higher types of animals is intimately related to their structure; and that the change of color which is produced by age in many animals is connected with structural changes. Coloration is valuable as an indication of structure; and it is a law universally true of vertebrated animals, that they have the color of the back darker than that of the sides; and that the same system of coloration prevails in all the species of a genus, partially developed in some, but recognizable when a large number of species is examined.

MICROSCOPIC LIFE.

PROFESSOR EHRENBURG, of Germany, lays down the following positions as the result of his long and laborious researches: —

1. That microscopic life, in the forms constituting earth and rock, appears to exist in the same manner over the whole earth.

2. That everywhere, in all climates, zones, elevations, depths, and in the smallest particles of *humus*, microscopic life not only exists but abounds.

3. That there is such a relation between European microscopic organism, and those of other parts of the earth, that new orders, classes, and families, are nowhere found, but the forms all belong to the generally silicious and non-silicious.

4. There are also found in soil and calcareous strata everywhere, undecomposed parts of larger organisms, either silicious or calcareous, of vegetable and animal origin, closely resembling in character the flora or fauna of the localities.

5. There are peculiar local genera, not numerous, and also numerous peculiar species of widely distributed genera.

6. Certain geographical latitudes have their characteristic forms of minute animal life.

7. All over the earth there is distributed a considerable number of perfectly identical forms.

8. The so-called inorganic constituents of the body and shells ot

animalcules are chiefly carbon, silica, lime and iron, with traces of alumina and manganese. Magnesia and other substances are only present as mechanical mixtures.

9. The quantity of iron in the minutest organisms is sometimes surprisingly great. It is never united with the lime, but only with the silica; and then rather mechanically than chemically, and as an organic deposite of the metal in closed silicious cells.

10. In consequence of the uniform and excessive development of minute organic life, it exerts a great influence on other conditions of the surface of the earth, and on the formation of humas in the valleys of rivers.

ON THE FORCES INFLUENCING THE CIRCULATION OF THE BLOOD.

THE following fact brought before the British Association by Mr. Wharton Jones, contains a physiological discovery of great importance. In the wing of the bat, the main impulse to the circulating fluid is, as in other animals, given by the heart, but in addition, Mr. Jones has discovered that the walls of the veins in this animal contract rhythmically like those of the heart, and any regurgitation being prevented by numerous and appropriately placed valves, they thus assist very materially in forcing the blood onwards. The existence of this rhythmical contractility in the walls of the veins is a fact new to physiological science.

THE SPIRAL .STRUCTURE OF MUSCLE, AND THE MUSCULAR STRUCTURE OF CILIA.

IN the year 1842, Dr. Barry, of England, in a memoir published in the transactions of the Royal Society, recorded his discovery of the spiral structure of muscle. By many the truth of this statement was doubted, and by some it was flatly denied. The celebrated German physiologist Purkinje, however, has recently shown that not only has muscle a spiral structure, but that *cilia also are no other than little muscles.* This is a confirmation of Dr. Barry's observations made nine years ago. That cilia also have a truly muscular character and structure is demonstrable, not only in cilia from the gill of the oyster and the common sea-mussel, but in those of the Infusoria.—*Jameson's Journal.*

ON THE ORIGIN OF SPECIES.

MR ARTHUR HENFREY in his recent work on "The Vegetation of Europe, its conditions and causes," thus speaks of the original creation of a one or a number of individuals. "Some naturalists contend that the original creation must have consisted of a number of individuals; but it seems more in accordance with the simplicity of nature, to suppose that a single parent or pair of parents alone was produced for each species. A more weighty difference of opinion arises from a series of facts, exceptional to those above announced of the *endemic* or local distribution of plants, namely, the instances, which are numerous, of what is called a *sporadic* or *universal* distribution of a species, as, for instance, of the sea sedge (*Scirpus maritimus*,) which occurs in similar situations nearly all over the world; as is the case almost to an equal extent with *Samolus Valerandi*, and in a less degree with many others. Such very wide distribution of certain plants has led to the opinion that species were created in different places, at different centres, either simultaneously or at different epochs, and that thus different families or stocks of the same species co-exist and share in populating the area inhabited by the species. The instances, however, on which this hypothesis rests, and the almost unlimited powers of diffusion that exist, together with our ignorance of the steps of the migration of plants and the absence of chronological data of the distribution of plants, appear to me to render this view unsatisfactory, and like the preceding to involve supererogatory creative acts, not according with the simplicity so characteristic of the laws under which the natural forces are made to act. Admitting, then, this hypothesis of creation at specific centres, let us see what are the consequences to be deduced from it. We may suppose the species to have been pretty equally apportioned to equal latitudes over the globe, and located in the different regions according to their physiological characters. As they spread they would become mingled together like the circles from rain-drops in a pond, and complex conditions at any particular point after the lapse of a long space of time would be explicable by the influence of external agencies upon the individual species, and their influence upon one another, as exerted by those of more vigorous growth bearing down and repressing the growth and dissemination of the more tender. How far the facts we meet with agree with such a view is the test by which the hypothesis must be tried, and the researches of botanical geographers appear to give a favorable verdict in the present state of the inquiry. It is necessary, however to be very comprehensive in our examination of the phenomena, since the interfering causes are so numerous that false conclusions may readily be drawn from the investigation of small areas, or from too little weight being attributed to what often seem to be very trivial external agencies. It would naturally be supposed that the dissemination of species would go on most freely and copiously over large continents, and that the present condition of nature would exhibit more instances of peculiarity in the floras of given regions in proportion as those regions were cut off by some natural barrier, such as mountain ranges, oceans, &c., from other lands; moreover, that islands would present a more characteristic vegetation than tracts of equal extent on a continent, and would approximate in their characters most closely to the main lands nearest to which they were situated. Such is actually the case. The continents lying in the northern hemisphere are almost continuous in their most northern regions, and we find the greatest agreement in their vegetation at those points. In proportion as we pass south, the Old and New Worlds become more and more unlike, while the great continent of Australia, lying off, in such different parallels, from the tropical and sub-tropical parts of Asia, is eminently singular and peculiar in the character of the plants which inhabit it. The opposite sides of large continents, even where there is continuity of land between the regions, display great diversity of vegetation under almost similar climates, while mountain ranges interposing climatal barriers, cut off closely adjacent countries. Islands lying in the Atlantic exhibit peculiar plants intermixed with others which have come from Africa, Europe, or America, and in proportions agreeing with the contiguity and the identity of climate, modified perhaps by peculiarly constituted diffusing agencies of winds, ocean currents, or birds, in particular cases."

ON THE ANALOGY BETWEEN THE LIFE OF AN INDIVIDUAL AND THE DURATION OF A SPECIES.

The following paper was recently read by Prof. Edward Forbes before the Royal Institution, England.

In natural history and geology, a clear understanding of the relations of individual, species, and genus to geological time and geograpical space is of essential importance. Much, however, of what is generally received concerning these relations will scarcely bear close investigation. Among questionable, though popular notions upon this subject, the lecturer would place the belief that the term of duration of a species is comparable, and of the same kind, with that of the life of an individual. The successive phases in the complete existence of an individual are birth, youth, maturity, decline, and decay, terminating in death. Whether we regard an individual as a single self-existing organism, however produced, or extend it to the series of organisms, combined or independent, all being products of a single ovum, its term of duration can be abbreviated but not prolonged indefinitely, nor can the several phases of its existence be repeated. Conditions may arrest or hasten maturity, or prematurely destroy, but cannot, however favorable, reproduce a second maturity after decline has commenced. Now, it is believed by many, that a species, (using the term in the sense of an assemblage of individuals, presenting certain constant characters in common, and derived from one original protoplast or stock) passes through a series of phases, comparable with those which succeed each other in definite order during the life of a single individual,—that it has its epochs of origin, of maturity, of decline, and of extinction, dependent upon the laws of an inherent vitality. If this notion be true, the theory of geology will be proportionately affected; since, in this case, the duration of species must be regarded as only influenced, not determined, by the physical conditions among which they are placed;—and thus species should characterize epochs or sections of time, independent of all physical changes and modifying influences short of those which are absolutely destrúctive. Now, geological epochs, as at present understood, are defined by peculiar assemblages of species, and the amount of change in the organic contents of proximate formations or strata is usually accepted as a measure of the extent of the disturbances that affect them. Yet this latter inference, involving as it does the supposition that the spread and continuity of species in time is dependent upon physical influences, is adverse to the notion of a life of a species as stated above. If we seek for the origin of this notion we shall find that it has two sources, the one direct, the other indirect. It is not an induction, nor pretended to be, but an hypothesis assumed through apparent analogies. Its first and principal source may be discovered in the comparison suggested by certain necessary phases in the duration of the species with others in the life of an individual, such as each has its commencement, and each has its cessation. Geological research has made known to us that prior to certain points in time, certain species did not exist, and that after certain points in time, certain species ceased to be. The commencement of a species has been compared with birth, the extinction with death. Again, many species can be shown to have had an epoch of maximum development in time. This has been compared with the maturity of the individual. Between the birth of an individual and the commencement of a species in the first appearance of its protoplast, the analogy is more apparent than real. We know how the former phenomenon takes place, but we have no knowledge of the latter. Between the maturity of the individual and the maximum development of a species there is no true analogy, since the latter can easily be proved to be entirely dependent on the combination of favoring conditions, and during the period of duration of a species, there may be two or more epochs of great or even equal development, and two or more epochs of decline alternating with epochs of prosperity. The epoch of maximum of a species may also occur during any period in its history short of the first stage. Geological and geographical research equally show that the flourishing of a species is invariably coincident with the presence of favoring, and its decline with that of unfavorable conditions. Hence, there is no analogy between the single and definite phase of maturity of the individual, and the variable and sometimes often-repeated epochs of luxuriant development in the duration of a species. Between the death of the individual and the extinction of a species, there is an analogy only when the former event occurs prematurely through the influence of destroying conditions. But in their absence, an individual, after its period of vitality has been completed, must necessarily die; whereas, we have no right to assume that such would be the fate of a species so circumstanced, since in every case where we can either geologically or geographically trace a species to its local or general extinction, we can connect the fact of its disappearance with the evidences of physical changes. The second and more indirect source of the notion of the life of a species may be traced in apparent analogies, half-perceived, between the centralization of generic groups in time and space, and the limited duration of both species and individual. But in this case ideas are compared which are altogether and essentially distinct. The nature of this distinction is expressed among the following propositions, in which an attempt is made to contrast the respective relations of individual, species, and genus to geological time and geographical space. A. The individual, whether we restrict the word to the single organism, however produced—or extend it to the series of organisms, combined or independent, all being products of a single ovum—has but a limited and unique existence in time, which, short as it must be, can be shortened by the influence of unfavorable conditions, but which no combination of favoring circumstances can prolong beyond the term of life allotted to it according to its kind. B. The species, whether we restrict the term to assemblages of individuals resembling each other in certain constant characters, or hold, in addition, the hypothesis, (warranted, as might be shown from experience and experiment,) that between all the members of such an assemblage there is in the relationship of family, the relationship of descent, and consequently that they are all the descendants of one first stock or protoplast—(how that protoplast appeared, is not part of the question)—is like the individual in so much as its relations to time are unique: once destroyed, it never reappears. But, (and this is the point of the view now advocated,) unlike the individual, it is continued indefinitely so long as conditions favorable to its diffusion and prosperity—that is to say, so long as conditions favorable to the production and sustenance of the individual representatives or elements are continued coincidently with its existence. [No amount of favoring conditions can recall a species once destroyed—on this conclusion, founded upon all facts hitherto observed in palæontology, the value of the application of natural history to geological science mainly depends.] C. The genus, in whatever degree of extension we use the term, so long as we apply it to an assemblage of species intimately related to each other in common and important features of organization, appears distinctly to exhibit the phenomenon of centralization in both time and space, though with a difference, since it would seem that each genus has a unique centre or area of development in time, but in geographical space may present more centres than one. a. An individual is a positive reality. b. A species is a relative reality. c. A genus is an abstraction—an idea—but an idea impressed on nature, and not arbitrarily dependant on man's conceptions. *α*. An individual is one. *β*. A species consists of many resulting from one. *γ*. A genus consists of more or fewer of these manies resulting from one linked together not by a relationship of descent but by an affinity dependent on a divine idea. And, lastly, *a*. An individual cannot manifest itself in two places at once; it has no extension in space; its relations are entirely with time, but the possible duration of its existence is regulated by the law of its inherent vitality. *b*. A species has correspondent and exactly analogous relations with time and space,—the duration of its existence as well as its geographical extension is entirely regulated by physical conditions. *c*. A genus has dissimilar or only partially comparable relations with time and space, and occupies areas in both, having only partial relations to physical conditions. The investigation of these distinctions and relations form the subject of a great chapter in the philosophy of natural history. That philosophy contemplates the laws that regulate the manifestation of life exhibited in organized nature, and their dependence upon and connection with the inorganic world and its phenomena. None teaches more emphatically the difficulties with which man's mind must contend, when attempting to comprehend the wisdom embodied in the universe, and none holds out a more cheering prospect of future discovery in fresh and unexpected fields of delightful research.

ON THE STATE OF THE MIND DURING SLEEP.

At the British Association, Dr. Fowler read a paper on the question, "what is the state of the mind and vitality during perfect sleep and the sleep in which we dream;" the object of the paper was to show that mind was a force similar to light, heat, and electricity, — and that the body was the means by which it made itself apparent.

Prof. M'Cosh said that he should like to see the Section divided, so that the speculative or transcendental portion of it might be distinct from the rest. He was of opinion that Dr. Fowler had gone far beyond the facts of physiology. It was, of course, quite true that mind has a power over matter, and in that respect it might be described as a force, but it is a force very different from the physical forces with which it had been compared. Mental power did not require a 'coil,' and in this sense it was very different from electricity or gravitation. Sir D. Brewster said that a friend of his was at present busy investigating on the subject of Dr. Fowler's paper. He fixed his attention on a certain object; and, by marking the time with a watch, recorded his sensations between the period of perfect wakefulness and profonnd sleep. It might be mentioned, as a fact, that different parts of the body fall asleep at different times; and it might, perhaps, be argued by analogy that different parts of the brain fall asleep at different times. It was a fact equally well known, that different parts of the body get intoxicated sooner than others. First, the eyes begin to glaze, then the tongue to get flabby, then the muscles begin to give way in the arms, then in the limbs, and so on. Experiments had also recently been made to ascertain the different sensitiveness of various parts of the human body, by means of a pair of compasses. At a distance of only one-eight of an inch between the legs of the compasses, the two points will be distinguished on some parts of the body, whilst on the back the effect will be that of only one point, unless the compass is stretched several inches.

ON THE INFLUENCE OF SUGGESTION IN MODIFYING AND DIRECTING MUSCULAR MOVEMENT, INDEPENDANTLY OF VOLITION.

The following paper on the above subject was recently read before the Royal Institution, England, by Dr. Carpenter, the well-known physiologist.

Public attention has recently been so much attracted to a class of phenomena which have received the very inappropriate designation of *Electro-Biological* or simply *Biological*, and so much misapprehension prevails regarding their true nature and import, that it becomes the physiologist to make known the results of scientific investigation, directed in the first place towards the determination of their genuineness, and in the second to the elucidation of the peculiar state of the nervous system on which their production depends. With regard to the genuineness of the phenomena themselves, the lecturer stated that he could entertain no doubt whatever; since they had been presented to himself and to other scientific enquirers, by numerous individuals, on whose honesty and freedom from all tendency to deceive themselves or others implicit reliance could be placed. But from the account commonly given of these phenomena — to the effect that the *will* of the "biologized" subject is entirely subjected to that of the operator, he entirely dissented. All the phenomena of the "biologized" state when attentively examined, will be found to consist in the occupation of the mind by the ideas which have been suggested to it, and in the influence which those ideas exert upon the actions of the body. Thus, the operator asserts, that the "subject" cannot rise from his chair, or open his eyes, or continue to hold a stick; and the "subject" thereby becomes so completely possessed with the fixed belief of the impossibility of the act, that he is incapacitated from executing it, not because his will is controlled by that of another, but because his will is in abeyance, and his muscles are entirely under the guidance of his ideas. So again, when he is made to drink a glass of water, and is assured that it is coffee, or wine, or milk, that assurance, delivered in a decided tone, makes a stronger impression on his mind than that which he receives through his taste, smell, or sight; and not being able to judge and compare, he yields himself up to the "dominant idea." The same with what has been designated as "control over the memory." The subject is assured that he cannot remember the most familiar thing, his own name for example; and he is prevented from doing so, not by the will of the operator, but by the conviction of the impossibility of the mental act, which engrosses his own mind, and by the want of that voluntary control over the direction of his thoughts which alone can enable him to recall the desiderated impression. The same with the abolition of the sense of personal identity. Now, almost every one of these peculiar phenomena has its parallel in states of mind whose existence is universally admitted. Thus, the complete subjection of the muscular power to the "dominant idea" is precisely what is experienced in nightmare; in which we are prevented from moving so much as a finger, notwithstanding a strong desire to do so, by the conviction that the least movement is impossible. The misinterpretation of sensory impressions is continually seen in persons who are subject to absence of mind, who make the most absurd mistakes as to what they see or hear, taste or feel, in consequence of the pre-occupation of the mind by some train of thought which renders them unable rightly to appreciate the objects around them. In such persons, too, the memory of the most familiar things — as the absent man's own name, for example, or that of his most intimate friend — is often in abeyance for a time; and it requires but a more complete obliteration of the consciousness of the past, through the entire possession of the mind by the intense consciousness of the present, to destroy the sense of personal identity. This, indeed, we often do in effect lose in ordinary dreaming and reverie. The essential characteristic of both these states, as of the "biological" condition, is, the suspension of voluntary control over the current of thought, so that the ideas follow one another suggestively; and however strange or incongruous their combinatious or sequences may appear, we are never surprised at them, because we have lost the power of referring to our ordinary experience. There is one phenomenon of the "biological" state, which has been considered pre-eminently to indicate the power of the operator's will over his subject; namely, the induction of sleep, and its spontaneous determination at a given time previously ordained, or by the sound of the operator's voice, and that only. It is well known that the expectation of sleep is one of the most powerful means of inducing it, especially when combined with the withdrawal of the mind from everything else which could keep its attention awake; both these conditions are united in an eminent degree in the state of the biologized subject whose mind has been possessed with the conviction that sleep is about to supervene, and is closed to every source of distraction. The waking at a particular time may also be explained by the influence of expectation. Thus, however strange the phenomenon of the "biological" state may at first sight appear, there is not one of them which, when closely scrutinized, is not found to be essentially conformable to facts whose genuineness every physiologist and psychologist is ready to admit. It is not, however, in any large proportion of individuals that this state can be induced; probably not more than one in twenty, or at most one in twelve. Males appear equally susceptible of it with females; so that it cannot be fairly set down as a variety of "hysterical" disorder. The lecturer proceeded to inquire, whether any such physiological account can be given of this state as shall enable us to refer it to any of the admitted laws of action of the nervous system; and in order to prepare his auditors for the reception of his views, he gave a brief explanation of those phenomena of "reflux" action (now universally recognized by physiologists) in which impressions made upon the nervous system are followed by respondent automatic movements. The movements which we term voluntary or volitional differ from the emotional and automatic, in being guided by a distinct conception of the object to be attained, and by a rational choice of the means employed. And so long as the voluntary power asserts its due predominance, so long can it keep in check all tendency to any other kind of action save such as ministers directly to the bodily wants, as the automatic movements of breathing and swallowing. The cerebrum is universally admitted to be the portion of the nervous system which is instrumentally concerned in the formation of ideas, the excitement of the emotions, and the operations of the intellect; and there seems no reason why it should be exempted from the law of "reflex action," which applies to every other part of the nervous system. And as the emotions may act directly upon the muscular system through the motor nerves, there is no *a priori* difficulty in believing that ideas may become the sources of muscular movement, independantly either of volitions or of emotions. Now, if the ordinary course of external impressions — whereby they successively produce sensations, ideas, emotions, and intellectual processes, the will giving the final decision upon the action to which they prompt — be anywhere interrupted, the impression will then exert its power in another direction, and a "reflex" action will be the result. This is well seen in cases of injury to the spinal cord, which disconnects its lower portion from the sensorium without destroying its own power; for impressions made upon the lower extremities then excite violent reflex actions, to which there would have been no tendency if the current of nervous force could have passed upwards to the cerebrum. So, if sensations be prevented by the state of the cerebrum from calling forth ideas through its instrumentality, they may react upon the motor apparatus in a manner which they would never do in its state of complete functional activity. This the lecturer maintained to be the true account of the mode in which the locomotive movements are maintained and guided in states of profound abstraction, when the whole attention of the individual is so completely concentrated upon his own train of thought, that he does not perceive the objects around him, although his movements are obviously guided by the impressions which they make upon his sensorium. On the same grounds, it seems reasonable to suppose that when ideas do not go on to be developed into emotions, or to excite intellectual operations, they, too, may act (so to speak) in the tranverse direction, and may produce respondent movement, through the instrutality of the cerebrum; and this will of course be most likely to happen when the power of the will is in abeyance, as has been shown to be the case in regard to the direction of the thoughts in the states of electro-biology, somnambulism, and all forms of dreaming and reverie. Thus the *ideo-motor* principle of action, as contrasted with the excito-motor and sensorio-motor, finds its appropirate place in the physiological scale, which would, indeed, be incomplete without it. And when it is once recognized, it may be applied to the explanation of numerous phenomena which have been a source of perplexity to many who have been convinced of their genuineness, and who could not see any mode of reconciling them with the known laws of nervous action. The phenomena in question are those which have been recently set down to the action of an "od-force," such, for example, as the movements of the "divining-rod," and vibration of bodies suspended from the finger; both which have been clearly proved to depend on the state of expectant attention on the part of the performer, his will being temporially withdrawn from control over his muscles by the state of abstraction to which his mind is given up, and the anticipation of a given result being the stimulus which directly and involuntarily prompts the muscular movements that produce it.

INFLUENCE OF THE NERVOUS ACTION UPON HEAT.

The following is an abstract of a paper read before the French Academy, by M. Bernard, taken from the Comptes Rendus, xxxiv.

"When we cut in the region of the neck of a mammiferous animal, a dog, a cat, a horse, or a hare, for example, the nervous thread of communication which connects the cervical superior, and the cervical inferior ganglion, we will find, immediately, an increase of temperature on the corresponding side of the face of the animal. This elevation of temperature makes its appearance instantaneously, and is developed so quickly, that in a few moments, and under certain circumstances, we shall find a difference of temperature between the two sides of the face of 3° or 4° Centigrade, (5° or 7° Fahr.) This difference of heat is perfectly appreciable by the hand, though determined more conveniently by introducing, for the purpose of comparison, a small thermometer into the nostrils or auditory conduits of the animal.

This difference of 3° or 4° of temperature, is remarkable as a relative difference of heat between the two sides of the face. If, however, we compare the heat of the nostril or auditory conduit, (although warmed by the section of the nerve,) with the heat of the rectum, or central parts of the body, the thorax or the abdomen, we see that it is almost the same. Thus the section of the cervical fillet of the sympathetic nerve of the hare, elevates the temperature of the corresponding ear as high as 40°, while the normal temperature of the rectum of the same animal, does not vary much from 38° or 39° Centigrade.

The whole of the side of the face warmed by the section of the nerve, becomes the seat of a very active circulation of the blood, the arteries become much more full, and appear to pulsate stronger, as may be distinctly observed in the vessels of the ear of the hare. But in a few days, sometimes the next day, this vascular turgescense is considerably diminished, or disappears entirely, although the heat of the cut side of the face, continues as at first. This circumstance leads us to infer that the elevation of temperature, is not altogether an effect of the increased activity in the circulation of the blood. Still, after observing, for a long time, the animals which present this phenomena, (and I have observed during twelve or fourteen days in the hare, and for many more in the dog,) I have never seen it happen, after the experiment, that the parts became more warm without congestion, and those morbid phenomena we are accustomed to associate with what we call inflammation."

Upon placing the animal, after the experiment, in a temperature elevated considerably above the normal temperature of the body, Bernard found that the side already warmed did not appear to exhibit any effect of the increased heat, like the rest of the body, so that finally, both sides of the face exhibited the same temperature. The opposite happened upon placing the animal in a medium considerably cooler than the normal temperature, the cut side retained its heat, while the other side and the rest of the body became cooler, until finally there was a difference of 3° or 4° Centigrade as already mentioned.

This singular phenomenon of resistance to cold, appears connected with an exhaltation of the vitality of the part. Thus, upon causing death to happen in a manner that should not affect the nerves of sense, poisoning in a certain manner, for example, or by section of the pneumogastric nerve, in proportion as the end of the animal approached, the temperature of the body became lower and lower, though the cut side still remained sensibly warmer, and at last, when the normal side of the face presented the cold and immobility of death, the other half, that on which the sympathetic nerve was cut, was still sensibly warm, and repeatedly exhibited that species of involuntary movements, dependant upon sensation without will, and to which we give the name of reflected motions.

ON THE GEOGRAPHICAL DISTRIBUTION OF MARINE LIFE.

Among the most important and novel communications brought before the last meeting of the British Association, that which combined the most elaborate research into details with the broadest generalization, and which must be considered to be the first attempt to reduce all the facts of the distribution of living creatures upon the surface of the earth to general laws, was the explanation of "A New Map of the Geographical Distribution of Marine Life," by Prof. Edward Forbes. Two modes of classifying facts of distribution have been hitherto adopted; either the geographical areas to which peculiar assemblages of animals and plants are confined have been marked out as "provinces," the classification in this case being natural, but purely biological; or certain parallels of latitude, or certain isothermals, being taken as boundary lines, animals and plants have been considered to be distributed according to the "zones" thus marked out, — a convenient, but hitherto an artificial arrangement, though, since the distribution of life must greatly depend upon the climatal conditions indicated by latitudinal and isothermal lines, it had a certain broad and loose correspondence with nature.

The great problem has been to unite these two methods, to ascertain what is the common condition by which the limits both of the "provinces" and of the "zones" are governed; for since the distribution of life in provinces is governed by climatal conditions, and since the climatal phenomena of any one portion of the earth's surface are continuous (approximatively) in a zone round its surface, it is clear that there must be some such general agreement.

Now, Prof. Forbes finds that if we lay down the marine provinces according to the knowledge we have of the distribution of species, the lines bounding such provinces latitudinally may be connected across the land by lines which, in the main, correspond with the great features of the arrangement of terrestrial vegetation and animal life. In general the lines on land are drawn in accordance with the isothermal of the month in which the greatest development of animal and vegetable life taken together is manifested within the region. By "greatest development" of life, Prof. Forbes means that the greatest number of vertebrata and articulata are out and active at the same time, and the greatest number of plants are in flower — phenomena which are co-existent. To the zones included between the lines thus drawn the Professor gives the name of homoiozoic belts. From north to south such a belt corresponds with only a single province, but from east to west it may include several. The various provinces included within any given belt, if they are geographically approximated, resemble one another in consequence of the identity of many of their species; but if they are geographically distant, the resemblance consists in the representation of species of the one by species of the other. Nine homoiozoic belts are to be distinguished, one of which is central and equatorial, and the other eight are contained, four in the northern, and four in the southern hemisphere. These belts are: — 1. The north polar homoiozoic belt; its southern limit corresponds very nearly with the isotherm of 54° 5′ in the month of June in Dove's map. It includes only the arctic province. 2. The north circumpolar homoiozoic belt; its southern limit (exclusive of the British area) answers nearly to the isotherm of 59° in June. It contains the Boreal, Sitchian, and Ochotyian provinces, which are wholly representative, any identical species being derived from the arctic province. 3. The northern neutral homoiozoic belt, whose southern limit is the isotherm of 63° in June, and 68° in July. It comprehends the Celtic and Virginian, and the Mantchourian and Oregonian provinces. The Celtic and Virginian provinces represent one another, as also probably do the Mantchourian and Oregonian. 4. The northern circumcentral homoiozoic belt has the isotherm of 68° in May for its southern limit. It contains six provinces, the Lusitanian, Carolinian, Mediterranean, Japonian, Californian, and Aralo-Caspian. 5. The central homoiozoic belt contains the West African, Caribbean, and Panamian areas, besides the largest of all marine provinces, the Indo-Pacific. 6. The southern circumcentral homoiozoic belt is limited northward by the isotherm of 68° in October, though this does not quite exactly coincide with its marine boundary. It represents very forcibly the northern circumcentral belt, and contains the Peruvian, Urugavian, South African, and Australian marine provinces. 7. The southern neutral homoiozoic belt, limited by the isotherm of 59° in January, contains the east Patagonian and Araucanian provinces. 8. The southern circumpolar homoiozoic belt has for its northern limit the

December isotherm of 50°, and contains the Fuegian province. 9. The southern polar homoiozoic belt consists of the antarctic province. Its limit is the isotherm of 41° for December.

The provinces which are referred to were also defined by the learned Professor, but we can here merely enumerate them. They are 25 in number: — 1. Arctic; 2. Boreal; 3. Celtic; 4. Lusitanian; 5. Mediterranean; 6. West African; 7. South African; 8. Indo-Pacific; 9. Australian; 10. Japonian; 11. Mantchourian; 12. Ochotyian; 13. Sitchian; 14. Oregonian; 15. Californian; 16. Panamian; 17. Peruvian; 18. Araucanian; 19. Fuegian; 20. Antarctic; 21. East Patagonian; 22. Urugavian; 23. Caribbean; 24. Carolinian; 25. Virginian. Full reference was made to the authorities from whom the data for the establishment of these provinces were taken.

The Professor further laid before the Association, a new nomenclature and re-arrangement of the facts ascertained with regard to the distribution of marine creatures in depth. He now divides the regions of depth into five bathymetrical zones: — 1. The littoral zone, characterized by *Littorinæ* and *Purpuræ*, and occupying the whole space between high and low water marks. In the Celtic province this zone is clearly divided into four sub-regions. 2. The circumlittoral zone, between low water mark and a depth of about fifteen fathoms. It is the zone of *Laminariæ* in the Northern Atlantic, of *Zostera* and *Caulerpa* in the Mediterranean, and of the reef-building corals in the Indo-Pacific province. 3. The median zone, between fifteen fathoms and fifty. This is the coralline zone of the Celtic seas. 4. The inframedian zone ranges from fifty fathoms to a hundred. It is the region of the deep-sea corals in the Celtic seas, and of the red coral of the Mediterranean. 5. The abyssal zone extends from one hundred fathoms downwards. It contains no plants, and animal life seems gradually to disappear in it. In the Celtic seas this region has not yet been properly explored. As a general law it may be said, that as we descend in the sea the regions of depth become of greater extent, and the range of species is greater.

EFFECTS OF SWALLOWING VIRULENT MATTERS IN THE DIGESTIVE ORGANS OF MAN AND ANIMAL.

THE following conclusions have been arrived at by M. Renault, director of the veterinary school of Alfort: —

"That the dog and the pig may eat, without danger to their health, all the products of secretion, whatever they may be, all remains, cooked or uncooked, of animals affected with contagious diseases referred to in these investigations, namely, glanders, the pestilential diseases called blood of the spleen, madness, contagious typhus, and the pneumonia of cattle, and the contagious epizootia of gallinacious animals.

"That it is the same with what follows with regard to the same diseases, with the exception of that which is proper to themselves, and on which it could be necessary to experiment out of the epizooticatmo sphere, which I have not been able to do, before coming to a conclusion on this point.

"That the virulent matter of glanders and acute farcy, which completely lose their contagious properties in the digestive organs of the dog, the pig, and the fowl, retain them, although much diminished in energy in those of the horse.

"That the virulent matter of the blood of the spleen, which the dog, the pig, and the fowl may eat without inconvenience, often give rise to carbuncular symptoms when it is swallowed by the herbivora, such as the sheep, the goat, and the horse.

"That this immunity, as regards contagion, which the carnivora and omnivora fed with virulent matters enjoy, whilst the latter may produce all their effects when they are swallowed by the herbivora, might be owing to the virus being evidently from their origin, principles of animal nature, would undergo, in organs destined for digesting animal food, modifications which by altering them profoundly, would make them loose their deleterious properties, which, from their organization, are capable of digesting only vegetable aliments.

"That whatever their explanation may be, it is proved, indeed, that pigs and fowls, do not undergo, either in their health or in the quality of the products which they furnish for the consumption of man, any alteration in consequence of having been fed with matter from animals which have died of glanders or farcy, carbuncle or madness, and that man may eat without danger the flesh and products of these animals thus nourished."

"That the baking and roasting of meats, and the boiling of liquids arising from animals affected with contagious diseases have the effect of annihilating the virulent properties of these meats and liquors to such an extent, that not only may the glandered matter be swallowed with impunity by the horse, the sheep, and the goat, and the remains of fowls which have died of epizootia by fowls, but also that all these matters which are so active, whose contagious power is so energetic, and so certain when they are inoculated in the fresh state, remain completely inert on every animal, even after their inoculation, when they have been cooked.

"The practical consequence of the facts explained in this memoir is therefore: —

"That there exists no sanitary reason why pigs and fowls should not be fed with the remains of the *clos d' ecarissage* whatever they may be.

"That, however comprehensible may be the repugnance of man to consume meat or milk from cattle, pigs, sheep, or fowls, affected with contagious diseases, there is in reality no danger in his eating cooked flesh or boiled milk, furnished by these animals." — *Journal de Chimie Medicale, March*, 1852.

ARTIFICIAL PRODUCTION OF FISH.

Within a comparatively recent period a discovery has been made in France, by which fish may be produced, or breed, in lakes and rivers, to an almost incalculable extent, and which is now being actively prosecuted under the direction of the French Government. The details of the process and discovery are as follows: — Some two years ago, two fishermen, named Gehlin and Remy, of La Bresse, in the department of the Vosges found that from various causes the stock of trout, for which the rivers and lakes of that department are famous, greatly declined; and they attentively studied the habits of the male and female trout at spawning time, with the view, if possible, of discovering the means of checking the evil. After long and patient observations, they found that not one in a hundred of the eggs deposited in the bed of the rivers, fecunded by the milt of the male, came to maturity — the rest being devoured by other fish, washed away or destroyed by mud. They found also that of the fish which had become excluded or hatched, the greater part were destroyed by the larger fish of their own or different species. It then struck them that if they were to collect the eggs and apply the milt themselves, instead of leaving the fish to do it, and afterwards to secure the young fish from the voracity of the larger ones, they would, in the course of a few years, obtain an inexhaustible supply.

Accordingly, they seized a female trout, just as they perceived she was about to spawn, and by pressure on her belly, caused her to deposite her eggs in a vessel containing fresh water. They afterwards took a male, and by pressing his belly in the same way, caused his milt to spurt on the eggs. It is by pressure on the belly that female and male always relieve themselves at spawning time. These two men, then, in imitation of the fish, placed the eggs on a layer of gravel, which they deposited in a box full of holes. This box was fixed in a bed of a flowing stream, and covered it with pebbles. The fish themselves in the natural way, cover the eggs with pebbles, and then leave them. In due time the eggs excluded, and almost every one was found to be good. They thus obtained from one female several hundred fish. They took precautions for keeping the little creatures in water where they were out of danger, and supplied them with fitting food. Applying this operation the year after to a great number of fish, they obtained several thousand trout; and in a year or two more the numbers had literally increased to millions. After they had stocked the rivers and streams of the Vosges, some streams in their departments, the attention of Government and of the French Academy was drawn to the discovery. The Academy declared that it was of an immense national importance, though it had been long known to scientific men as a scientific curiosity, not, however, as of practical utility. The government on its part, saw that the application of it to the rivers and streams of France would not only afford employment to a vast number of persons, but would enable an immense addition to be made at scarcely any expense, to the people's food. It accordingly took the two men into its service and made them apply the system to different waters. They have done so with the most singular success; rivers and lakes in which there were no fish are now teeming with them. Nor have they confined their operations to trout alone, but have extended them to salmon, pike, tench and perch, and in each case with complete success. Indeed, their system is applicable to all sorts of fresh water fish, and to those which after spawning in rivers, descend to the sea.

Among the rivers that they have already stocked, are those of the Isere, Haute Loire, Allier, Lozere, Meuse, Meurthe, and the Haute Saone. Several gentlemen of property have also tried the system with success on the estates in Burgundy, Brie, and Normandy. In addition to the breeding of fish, different species can be naturalized in strange waters or removed from river to river. So great is the importance which the government attaches to the plan, that it has nominated a commission of eminent scientific men to superintend the operations of Gehin and Remy. The Moniteur announces that the minister of Marine and Colonies has also ordered that experiments shall be made to apply it to salt water fish, at the mouth of rivers, and off the coasts, especially to lobsters. M. Valenciennes, an eminent ichthyologist, and member of the Institute, has been charged to examine the mouths of the rivers and the coasts from Havre to La Teste, and to state in what places the experiments may be tried with most chances of advantage. Milne Edwards and M. Coste, both members of the Institute, have been directed to make similar investigations.

From the discussions in the French Academy, and from other sources we obtain the following additional particulars relative to this subject: — "The loves of fishes," says Cuvier, "are cold like themselves, cold like their abode. As for most species, it is remarked that the stronger sex does not seek the society of the more feeble. The only object of concern with the male fish is the eggs of the female, and the spot where she has deposited them. These eggs he fecundates, without knowing their mother; nor cares he afterwards to behold the progeny they are to produce. The mother herself is equally indifferent. Unknown to her are the pleasures of maternity. The role assigned to her by nature is simply the laying of the eggs, which are often immediately devoured by a neighboring fish; and sometimes even by a famished father himself." The productive power of fishes is greater than that of any of the higher animals. In the spawn of the tench there have been counted 38,000 eggs at once; a perch of common size contains 70,000 eggs; a pike weighing 20 lbs. 166,000; in a carp weighing 2½ lbs. 167,000; in another carp weighing 10 lbs. were found 621,600 eggs. Rousseau estimates at 7,635,200 the number of eggs in a sturgeon; and Leuwenhoek has counted 9,344.000 in one codfish. The numerous causes which prevent the maturing of the greater portion of the eggs that have been laid by the female: the failure to be fecundated by the milt of the male; destruction by other fish; freshets which wash them away; droughts which leave them dry; of late years the passage of steamers on all navigable rivers, causing an unnatural agitation of the water and a washing of the banks, against which the instinct of fishes does not teach them to provide, &c.

"Artificial fecundation," says M. Quatrefages, "will remove all these causes of destruction of the eggs; and the employment of it offers no difficulty whatever." The process employed by MM. Gehin and Remy is of very simple and easy execution. In the case of the trout for example, they proceed as follows: — It is in November or the beginning of December that the reproduction of trouts takes place. To obtain the eggs intended for artificial fecundation, it suffices to press slightly, from the front towards the rear, when the moment for spawning has arrived, the abdomen of the female fish. The eggs which fall should be received in a vessel of water; and upon them should be poured the milt or soft roe, obtained in an exactly similar manner, by pressing it from the abdomen of the male fish into another vessel of water. If these products have not arrived at maturity when this operation is attempted, they will not flow out except under the application of strong pressure. In such cases the fish should be kept several days longer before operating this sort of forced accouchement; for neither the eggs nor the sperm can be profitably used in a state of immaturity, and the lives of the parent fishes would be endangered by any violent procedures. Immediately upon contact with the water into which the sperm has been ejected, the eggs change color. Prior to fecundation they are transparent, and of a yellowish color. As soon as they are fecundated they become whitish, or rather opaline. A trout of the age of two years only, and weighing about 125 grammes, (4.40 ounces avoirdupois,) may furnish say 600 eggs; a trout of three years from 700 to 800 eggs. It is to be remarked that the milt of one male suffices to fecundate the eggs supplied by half a dozen, or even a greater number of females.

MM. Gehin and Remy place the eggs thus fecundated on a bed of gravel in tin boxes pierced with holes. These boxes are say six inches broad and three inches deep, and can contain about one thousand eggs each. They are placed in some little stream whose waters are quick and clear, but not deep. They are partially interred in the bed of the stream, and so arranged that the current will be perpetually renewing the water which bathes the eggs; for the agitation of the water is necessary not only to assure the respiration of the embryos, but also to prevent the formation of byssus or hair-weed, (*conferves*,) which would rapidly appear and determine the death of the spawn if the water were allowed to become stagnant. The development of these embryos lasts about four months, and it is generally about the end of March or in April that the exclusion or hatching takes place. During the six first weeks the young trouts bear under the belly the umbilical or vitelline vesicle which contains the remains of the nutritive substance, analogous to the yolk of the eggs of birds; and it is at first by the consumption of this substance that the fry is nourished. But when the absorption of this is completed, the little fish requires other ailment; and he must then be made to quit the box which has served as his cradle, and allowed to swim about freely in the stream or pond which it is intended to stock. Finally, in order to supply these little animals with an abundant aliment suited to their wants, it suffices to allow to remain or to introduce into the stream or pond where the fish are placed a number of frogs. The spawn of these batrachians is a food which the fish seek with avidity; and the tadpoles constitute also an excellent aliment for the trouts of a more advanced age. When the small trouts which have been bred in this way are destined to be used for stocking a river, they should be placed in the brooks or small streams tributary to the river; and those streams should be selected in preference which flow rapidly and noisily over a pebbly or rocky bed. In proportion as the fish grow they descend spontaneously to deeper waters, but do not reach them till they are sufficiently active to escape by flight from the enemies they meet there Were they placed immediately in the midst of other voracious fish very few would escape destruction. When it is in ponds or nurseries that it is proposed to rear the fish, care must be taken to separate totally the products of each year; for the big trouts devour the little ones, and to prevent this it is necessary to keep together in the same enclosure all that are of the same age. To get up, therefore, in regular style an enterprise of this sort, one should have at least three ponds, from which the fish should be gathered alternately three years respectively after each has been stocked, and new generations placed in the pond just vacated.

M. Quatrefages states, that it is not necessary, in order to produce fecundation of eggs, that the fish employed should be alive. M. Golstein succeeded in fecundating the eggs of a trout which had been dead four days. It is probable that the spermatic liquor also preserves its virtue for a length of time after the death of the male. At any rate, this is a fact which I have often verified in the case of invertebrated animals. Small fish after their exclusion are nourished for a considerable length of time by the vitelline substance contained in their intestines. Salmon in particular seem to have no need of other aliment for a month or six weeks after exclusion.

To the other advantages presented by the process under discussion must be added that of facilitating the dissemination of the various species. Our rivers, ponds, and lakes could easily be stocked with species of fish, valuable either for the delicacy of their flesh or for their extreme fecundity. The naturalization of foreign fish has rarely been attempted, and yet the success of some attempts which have been made in this direction is of a nature to encourage experiments. The gourami of China has been naturalized in the ponds of the Isle of France and of Cayenne. China has supplied us with those red fishes (*cyprinus auratus*) so common in our ornamental fish-ponds. The carp itself, at present so generally diffused all over Europe, is very probably a native of Persia. Introduced first into Southern Europe, it was not till the middle ages that the carp was carried into Prussia, where it has become the object of an important commerce. This fish was not known in England and Denmark till some time in the sixteenth century. It was imported at a still later date into Sweden and

Russia, where, though diminished a little in size, it still supports very well the rigor of the northern winters.

The following conclusion of Milne Edwards' report to the French Government applies equally well to the United States as to France: He says: "Experiments on this subject seem to me especially desirable from the consideration of various circumstances which are tending daily to diminish the value of our river fisheries as contributing to our alimentary resources. The increasing rarity of fish in many of our rivers does not depend exclusively upon the mode in which fishing is practised. There are other causes, and among them must be mentioned the extension of our manufacturing industry. The dams which have been constructed in such great numbers for obtaining hydraulic motive power are so many hindrances to the reproduction of the various species of fish whose habits cause them to ascend to the very sources of streams in order to find there suitable places for receiving their spawn. The parent fish arriving in less numbers at the small streams, the icthyologic population of the rivers consequently suffers, for the eggs no longer encounter conditions favorable to the growth of the young, and the recruiting elements of the whole fauna rapidly decay. If, as in Scotland, and even in England, there existed in France many wealthy land owners possessing water courses of very considerable extent, we could safely leave to private enterprise the execution of all the works relative to the amelioration of river fishery, for the individual to whom these rivers belonged would have a direct interest in augmenting their products. But with us it is otherwise, and the individual who should busy himself with stocking a river with fish, could hardly hope to reap for himself any profit from his undertaking. He would augment the alimentary resources of his fellow-countrymen, and in this way would render a real service to his country, but his own share in the benefits obtained would be small, and would not constitute a sufficient motive to induce him to undertake the work. The stocking our rivers with fish would be a public benefit. It should, therefore, I think, be a public charge. Experiments upon a large scale, but conducted judiciously and by intelligent men, would not involve much expense, and might lead to important results."

NEW COCHINEAL INSECT.

At a recent meeting of the British Entomological Society, the President, Mr. Westwood presented specimens of the so called "new cochineal insect, *Coccus Fabæ*," which, it appears, feeds on the common bean, and yields a most brilliant color, in all respects resembling the cochineal of Central America. Mr. W. stated that the "cultivation of the insect had been commenced on a large scale in the south of France, where it would supply a new and profitable opening to the labor of the peasantry."

WOOL IN THE UNITED STATES.

By recent scientific researches on the part of P. A. Brown, Esq., of Pennsylvania, it has been established that the United States can out-rival the world in wool as well as in cotton. Thus, Spanish sheep, yielding naturally wool 2,000 to the inch, carried to England, degenerated to 900 to the inch, and brought to the United States recovered to 2,100, or finer than the original. The fact being once established that our climate and soil produce finer wool than other countries, will give to our manufactures inevitably the superiority in cloths, if the manufacturer is allied in his interest to the grower.

GOULD'S COLLECTION OF HUMMING BIRDS.

Mr. Gould, the distinguished British ornithologist, has exhibited, during the past summer, at the London Zoological Gardens, his collection of humming-birds, for the acquisition of which years have been spent. The collection is contained in twenty-four cases, and embraces upwards of two thousand specimens, comprising three hundred and twenty species. Ten species only were known to Linnæus. In 1824, Mr. Bullock had collected a hundred species. In 1842, Mr. Loddiges possessed a hundred and ninety-six species.

The splendor of plumage, which forms so well-distinguished a feature in this group, has probably given rise to the popular error that humming-birds are found in the East. The truth, is, however, that humming-birds exist only on the continent of America, in the West India Islands, and in two islands of the Pacific. The form, therefore, is essentially American; one beautiful little species is well known in the United States, and passes through the whole extent of that vast territory from its winter quarters in Mexico, until it reaches Canada, which is the extreme northern limit on the eastern side of America. On the western side, a similar species, but much more brilliant in color—in fact, the most intensely brilliant of the whole group—migrates from Mexico, through California, to Nootka Sound, and probably even as far as Sitka. From Bolivia, on the other side of the equator, another brilliant species migrates to the south, and penetrates as far as Terra del Fuego, where the officers of her Majesty's ship Beagle found them feeding on insects in the blossoms of the fuschia while snow was lying upon the ground; for humming-birds do not necessarily require a high temperature, and that they can support an intense degree of cold is abundantly proved by the very altitude to which several species are entirely limited in the Andes. Some species are found in the West Indian Islands; two in the Island of Juan Fernandez; one in Chiloe, in the Pacific. In the vast range of the Andes, at a height of seven or eight thousand feet, they are most abundant. They glitter even above the snow line, at an elevation of fourteen or fifteen thousand feet. Chimborazo has its peculiar bird; and so has Pichinoha. Every valley of those wild regions—each a world in itself from its prodigious depth—exhibits some variety in form or color.

The temperate regions of the Andes, from 7,000 to 10,000 feet of altitude, produce the greatest number of these birds, which for the most part are distributed throughout that mountain range in locally defined limits, which are probably marked out for the various species by the peculiar features of soil and aspect which control the production of vegetation, and consequently, of the insects which derive their existence from that source, and form, in their turn, the main sustenance of humming-birds.

SINGULAR LOCALITY FOR A BIRD'S NEST.

THE following paper was read at the Belfast meeting of the British Association, by Dr. Barry.

At the railway station in Giessen, Hesse Darmstadt, in May, 1852, it was found that a bird had built its nest on the collision spring of a third-class carriage which had remained for some time out of use. The bird was the black red-start, (*Sylvia Tithys*,) and the nest contained five eggs. The discovery was made by the "wagenmeister," who humanely desired his men to avoid as long as possible, the running of that carriage. At length, when it could no longer be dispensed with, the carriage was attached to a train, and sent to Frankfort-on-the-Maine, distant between thirty and forty English miles. At Frankfort it remained for six-and-thirty hours, and was then brought back to Giessen; from whence it went to Lollar, distant four or five English miles, and subsequently again came back to Giessen, having been kept a while at Lollar; so that four days and three nights elapsed between the bringing of the carriage into its use, and its last return to Giessen. Stephanij now finding the nest not to have been abandoned by the parent birds, and to contain young ones, which he describes as feathered, he removed it from the carriage to a secure place of rest which he had prepared, saw the parent birds visit it, and visited it from time to time himself, until at first three and then the other two young birds had flown; none remaining at the end of four or five days. Now, while the carriage was travelling, where were the parent birds? It will hardly be said that they remained at Giessen awaiting its return, having to examine by night as well as by day hundreds of passing carriages in order to recognize it; the young birds in their nests quietly awaiting food. (!) There seems little doubt that, adhering to the nest, one, at least, of the parent birds *travelled with the train*. Nor, when it is remembered how gently, and how slowly an enormous railway carriage is pushed into connection with a train,—how gradually a train is brought into full speed, and how equable the movements are upon a railway,—will it appear incredible that at such a time a parent bird should continue with its nest, that nest being quite concealed, and containing young.—Not until after the above was written, did the author of this communication become acquainted with the important fact that while the carriage in question was at Frankfort, as well as during its short stay at Friedeberg, on the way to Frankfort, the conductor of the train saw a red-tailed bird constantly flying from and to the part where the nest was situated in that particular carriage. Is further evidence required that a parent bird did indeed travel with the train?

THE SWALLOW TREE.

Dr. Thompson, of Burlington, Vt., furnishes the Boston Traveller with the following account of a curious object called the "Swallow Tree," recently found in Middlebury, Vt. He says:—At the time the first settlements were made in the western parts of Vermont, these swallow trees were quite common here, and several of them are described by Dr. Williams in his history of the State. They were usually very large elms, or sycamores, having extensive hollows within, and an opening in the side, at a considerable height from the ground, at which the swallows entered and made their egress. Early each spring, and about sunrise in the morning, myriads of swallows were seen to issue from the holes in these trees, and disperse themselves over the country, and, in the dusk of the evening, they were observed to return again to their common roosting places in the hollows of the trees. Thus they continued to disperse themselves in the morning and collect together again in the evening, till they commenced pairing and rearing their young in the spring, and the same phenomena were also observed again just before the final disappearance of the swallows in the fall; and for a long time the opinion prevailed that they passed the winter in these trees in a torpid state. But it is now, I believe, well settled that this resort to particular trees, in early times, and to particular old chimneys in modern, as common roosting places, is only a temporary arrangement attending their arrival in spring, and their migration southward in autumn.

These swallow trees, which were so common in early times, had, probably many of them, been resorted to by thousands of birds, year after year, for centuries. The natural consequence would be, for the cavities in which they roosted, to become gradually filled up with excrement, cast off feathers, exuvia of insects and rotton wood, and, accordingly, trees have been found in this condition long after the swallows had ceased to resort to them. One of this kind, in Ohio, is described in Harris' Journal, and quoted in Wilson's Ornithology. The tree was a hollow sycamore, five feet in diameter, and had been blown down. Its immense hollow was found to be filled, for the space of fifteen feet, with "a mass of decayed feathers, with a small admixture of brownish dust, and the exuvia of various insects."

The tree recently found in Middlebury resembled, in most respects, the one above mentioned. The tree had been blown down, and had, afterwards, nearly all rotted away, leaving little remaining, excepting the feathery mass, which had filled its hollow, and which was now bedded in leaves and moss. The tree was, probably, an elm, and, judging from the size of the cylindrical mass of the contents, the diameter of its hollow must have been about fifteen inches, which had been filled some six or seven feet. Of the materials which had filled it, about one-half consists of feathers, being, for the most part, the wing and the tail feathers of the chimney swallows, (*Cypselus pelasgius, Tem.*) The other half is made up of the exuvia of insects, mostly the fragments and eggs of the large wood ant, and a brownish dust, probably derived from the decayed wood of the interior of the tree.

Now, while the discovery at Middlebury is, on many accounts, an interesting one, there would be nothing very remarkable in it, were the materials which had filled the hollow of the tree jumbled promiscuously and disorderly together. It would be just what we should expect to find in a hollow tree, which had been for centuries, perhaps, the roosting place of myriads of swallows. But this is not the case. As a general thing, the large feathers have their quills pointing outward at the surface of the cylindrical mass, while the plumes, or ends containing the vanes, point inward. This arrangement might, perhaps, arise from the nesting of small quadrupeds in the hollow, making the feathers their bed. But in addition to this, we find in various portions of the mass, in some cases all the primary feathers of the wing, and in other cases all the feathers of the tail, embedded in the mass, lying in contact, and precisely in the order and position in which they are found in the living swallow. In a mass of the materials, measuring not more than 7 inches by 5, and less than 3 inches thick, I could trace at least, 5 wings and 2 tails, and in one of the wings the secondary quills were also plainly arranged in their true position with regard to the primaries. Now it is not possible to conceive that these feathers were shed by living birds in the order in which they are found. But if the birds died there, what has become of their beaks, claws and bones? We should think that these, or portions of them, would be as durable as the feathers; but I do not learn that a particle of any of these has been found in any part of the mass. How, then, have these been removed, while the wing and tail feathers remain in their true natural position? It could hardly be done by any violent means without disturbing them. But if done quietly, what did it? Would any insects devour the bones and not the quills? Does the formic, or any other acid, which might be generated within the hollow of the tree, decompose bone?

THE TSETSE, OR ZIMB, OF SOUTH AFRICA.

The following interesting facts are derived from a communication made to the American Geographical Society, by Rev. Mr. Livingston, the distinguished English missionary, and explorer of South Africa.

"The Tsetse is the name given to an insect found in the interior of Africa. In size it is between the common house-fly and the honey-bee, and is of a drab color, having some yellow bars across the hinder part of the body. They seemed to be confined to certain districts, generally along the banks of rivers, where reedy swamps, intermingled with trees, prevail. They are very numerous, and, from their devastations among domestic cattle, have been termed the scourge of

Africa. It is supposed that the "zimb," mentioned by Bruce, is the same as the Tsetse.

The most curious fact about this insect is, that while its sting is harmless to man and wild animals, it is certain destruction to horses, cattle, sheep, dogs, or any other domesticated brute, except goats and young calves. Several instances are known where all the cattle, horses and dogs of a traveller have been swept off by it. A horse was taken among them by a doubter; about fifty settled on him, and immediately he began to lose flesh; in eleven days he was dead. When an ox is bitten, at once the countenance stares, the eyes run, he loses strength, swells under the jaw, staggers, grows blind, and becomes emaciated, which continues, sometimes, for months, when death ensues. Upon removing the skin, a great many air bubbles are found on the surface of the body, under the cellular membrane. The fat is of an oily, glary consistence, and of a greenish yellow color. The heart is soft and pale, lungs and liver diseased, and the gall bladder unusually distended with bile. The muscles are flabby, the blood contains very little coloring matter, and not a pailful is found in the body.

There is no such thing as becoming accustomed to them, and the natives, in localities where they abound, are unable to raise a single domestic animal. In these same districts, elephants buffaloes, zebras, gnus, &c., live unaffected by the Tsetse. A dog fed on the meat of game, lives; one reared on milk, falls a victim to them. It is said that game meat is possessed of a peculiar acid found but sparingly in tame animals; perhaps this may be the antiseptic. But then why do calves, who subsist on milk, escape? Sometimes an entire herd of cattle is cut off excepting the calves, and these follow likewise, if kept in the region for a year or two."

FATTENING CATTLE IN STALLS AND IN SHEDS.

An experiment has been made in Scotland to try the comparative value of these two modes of fattening cattle. Ten animals having been chosen were divided as equally as possible; five were put in a sheltered court with plenty of shed room, and the others into boxes. At the beginning of October it was soon found that those in the court eat 134 pounds per day, while those in the boxes eat only 112 pounds, or 22 pounds less, thus proving that a certain degree of warmth is equivalent to food. After seven months, toward the end of April, they were all slaughtered, and the following results were found:

Cattle fed in boxes..........	Beef 3,262 lbs.	Tallow 6,678 lbs.
Cattle fed in courts..........	Beef 3,416 lbs.	Tallow 6,054 lbs.

These results show the superiority of feeding in boxes. It is thought that in a less mild winter they would have been more striking. In the course of the experiment the thermometer rose to 50 degrees, and the cattle under cover seemed to suffer from being too warm. It was found a trifling expense to comb them regularly, which speedily produced a very marked improvement.

VARIOLA AND VACCINATION.

A COMMITTEE appointed by the Medical Society of the State of Pennsylvania, has lately made a report, through Dr. Emerson, respecting the effects of vaccination. The committee was appointed to examine into the statements which had been put forth by Dr. Gregory, of London, and Dr. Caznave, of Paris, who had written and published statements respecting the growing insufficiency of vaccination as a preventative for dangerous small pox. The opinions set forth by these eminent foreign physicians were calculated to unsettle the views of physicians, and shake their confidence in the protective powers of vaccination. The principal points to be considered were, first, whether persons vaccinated lose, through lapse of time, any protective power once afforded against small pox; second, whether the prophylatic powers of vaccination, performed during infancy, are restricted to the first fifteen years of life, and of no avail afterwards; third, whether the accumulated evidence of the present day is calculated to sustain Dr. Gregory in his belief that the efficacy of cow pox as a protection against small pox, has diminished, and a large increase of small pox resulted from the extension of vaccination; fourth, whether, as asserted by Drs. Gregory and Caznave, inoculation, after the fifteenth year of age, of persons previously vaccinated, produces a specific papular eruptive disease, of a non-contagious character, unattended with danger, and giving protection in after life against small pox; fifth, whether circumstances exist which render it most advantageous to substitute inoculation for vaccination, after the fifteenth year of age, as proposed by Dr. Gregory.

It was stated that the agent for producing small pox had for a long time been kept in check, and its total extermination nearly completed, but that within a few years a new form of disease "varioloid," had arisen, and Dr. Gregory promulgated statements to show that vaccination was diminished in potency by a lapse of time, and that this small pox of late years had greatly increased.

In England, the Epidemiological Society were startled by Dr. Gregory's views, and it also appointed a committee to examine into the subject; that society has received 430 replies from practicing physicians in different parts of England, and only one expressed a doubt about the efficacy of the cow pox; they were adverse to Dr. Gregory's views. He took his cases from hospitals, where other causes were, no doubt, in operation to produce the sad results he sets forth. Previous to the introduction of vaccination in England, the annual mortality from small pox was 40,000, or one tenth of all the deaths from every other source. In 1850 the number of deaths in London by small pox was only 498, while the population was four times more than it was in 1750, when the deaths by small pox numbered 2,036.

This confutes Dr. Gregory's views entirely. In Prussia the number of deaths by small pox, in 1803, were 40,000, in a population of 10,000,000; at that time inoculation was the only protection relied on.

In 1849, when the population had increased to 16,000,000, the mortality from small pox was only 1,760, thus showing how the mortality had decreased, vaccination having come nearly into general use within the past ten years. One hundred and eighty-two practicing physicians in England state, they have never known a death from small pox after vaccination. Some deaths have taken place by small pox after vaccination, but not many, and very peculiar causes apart from the disease might have caused the mortality. In the London Small Pox Hospital, 40,000 persons were vaccinated during the past 16 years, and not one of whom had ever returned with small pox.

The committee of the Pennsylvania State Medical Society, have reported against every point advanced by Drs. Gregory and Caznave; and thus conclude their report: "Your committee have no hesitation in expressing it as their belief, that no circumstances exist to justify the general substitution of inoculation after the 15th year of age, as proposed by Dr. Gregory; and they regret that at the present time, whilst strenuous efforts are making, through individual exertions, occassionally helped forward by judicious legislation, statements calculated to lessen confidence in the protecting power of vaccination should have been promulgated by Dr. Gregory. Happily, however, abundant evidence exists to show that although the hopes of complete exemption from small pox, once fondly indulged, have not been fully realized, vaccination still offers the only dependance for protection against a disease, the fearful ravages of which have tended so much to darken the pages of history, previous to the precious discovery made by Jenner."

Some interesting statistics on the protection afforded against small pox by vaccination have been recently obtained by Dr. Balfour, Surgeon of the Royal Military Asylum, England, from an examination of the recruits of the Army and Navy. From these it appears that out of 90,092 recruits medically inspected and found fit for service, 20,132 bore marks of small pox; 60,096 had marks of vaccination, and 5,864 bore no distinct traces of either. By the rules of the service the latter would be immediately vaccinated; added to the second class, a total of 69,900, or 78 per cent. of the whole would be protected by vaccination; 22 per cent. representing the proportion of those protected by previous small pox. From further returns it appears that the proportion of cases of small pox have been 66, and the deaths 8, in every 100,000 men serving through the army. But the prevalence and mortality varied in different portions of the force. Thus the deaths had been four times as numerous among the troops in the United Kingdom as in temperate colonies, and eight times as numerous as in tropical colonies; while a still greater disproportion was found to exist in the admissions into the hospital. A comparative statement of the proportion of small pox among the black troops and Europeans serving in tropical colonies during several epidemics was furnished, by which it appears that the disease literally decimated the black troops, while not a single death occurred among the European soldiers serving in the same garrisons. The returns examined by Dr. Balfour go very far to disapprove of the hypothesis sometimes started, that the protective powers of vaccination became gradually weaker, and at length die out. The returns from the navy also give results more favorable than those from the army. From this it appears, that although absolute immunity from small pox was not attained to, yet exemption in a remarkable degree was afforded by vaccination.

SIMPLE REMEDY FOR THE ASTHMA.

Dr. Farrot in a communication published in the *Repertoire de Pharmacie*, 1852, gives the following simple remedy for the asthma. Take a strongly saturated solution of nitrate of potassa. Dip tinder into it, and then allow it to dry. Procure a wide-mouth phial, the cork of which has an aperture in the centre, so as to admit any hollow tube whatever, (a pipe closed at the end would suffice.) Light the piece of tinder, and place it in the phial. Then cause the patient to inhale the gases that are disengaged, either through the mouth or nostrils. At the end of a few respirations he will find relief which will augment. Such is a very simple process which I have for a long time used with great success, in cases of asthma. In regard to an explanation of this mode of treatment it is supposed that a small portion of oxygen, disengaged by the combustion of the nitrate of potassa, is inhaled by the patient. It is known that in asthmatic patients the sanguinous circulation is incomplete in the lungs, that the blood is imperfectly regenerated, that it is black, and does not burn its excess of carbon. By the oxygen absorbed, therefore, combustion may be facilitated.

ELECTRO PHYSIOLOGICAL RESEARCHES ON INDUCED CONTRACTION.

Prof. Mattucci, in a communication published in the Philosophical Journal, gives several new experiments on induced contraction, which he thinks lend an increasing probability to the conclusion that this phenomena is due to an electric discharge; and that muscular contraction is in some way accompanied by a development of electricity. The results of these experiments may be thus summed up. 1. The cause of induced contraction is an electrical phenomenon which is developed in the act of contraction and which consists in a different state of electricity in the different points of the contracted limb. 2. This electric phenomenon like the contraction which produces it, lasts only for an instant. 3. These electric states developed by contraction tend to produce electric currents which circulate in opposite directions across a conducting arch interposed between the two limbs which contract at the same time. 4. One of the experiments so arranged proved not only the existence of these currents, but direction; leading the author to the ultimate conclusion, that whatever the theory of these phenomena may be, it is certain that they demonstrate the production of an electrical *disequilibrium* in the act of muscular contraction. This phenomenon, Mattucci is of opinion, may consist in a species of dicharge, propagated in the direction of the ramification of the nerve possibly analogous to that of the discharge in the electric fish.

Prof. Mattucci also states, that he has failed to detect the slightest sign of a current from voluntary contraction, even when operating on a circle of thirty and forty persons, who all contraced the same arm at the same time ; the galvaniscopic frog, the nerve of which formed part of the circuit, failing to give any signs of an electric current, although extremely sensitive.

ASTRONOMY AND METEOROLOGY.

NEW PLANETS DISCOVERED IN 1852.

The number of planets belonging to the solar system has been increased during the year 1852 by the discovery of seven new ones, all belonging to the family of the asteroids.

On the night of the 17th of March, the sixteenth asteroidal planet was discovered by Prof. De Gasparis, of Naples. This planet which has the appearance of a star of the 10-11 magnitude, has received the name of Psyche. On the 17th of April, the seventeenth asteroidal planet was discovered by Mr. Luther, at the observatory of Bilk, near Duseldorf, Germany. Its light was very faint. This planet has received the name of Thetis.

On the night of the 24th of June, the eighteenth asteroidal planet was discovered by Mr. J. H. Hind, of London. It appears like a star of the ninth magnitude, with a steady yellowish light. Its period of revolution is 1,269 days, which places it between the asteroids Flora and Clio. This planet has received the name of Melpomene.

On the 20th and 21st of September, the nineteenth asteroid was discovered at Marseilles, France, by M. Chacornac, a pupil in the observatory of that place. It has the appearance of a star of the ninth magnitude, and has received the name Massilia. This planet, was also independantly discovered about the same time by M. Gasparis, of Naples.

On the 22d of August, the twentieth asteroid was discovered by Mr. Hind in the constellation Aquarius. The planet is described as equal in brightness to a fixed star of the ninth magnitude, and as having that yellowish tint which distinguishes Pallas, Melpomene, and other asteroids. Its orbit is remarkable for its inclination to the earth's path. The period of revolution is 1,393 days, the mean distance from the sun 2.44093. This planet has received the name Fortuna.

On the 15th of November, the twenty-first asteroid was discovered through a simple spy-glass by M. Goldschmit, a painter of Paris. This most singular discovery happened somewhat as follows: M. Goldschmit, who had attentively studied the various constellations through the agency of a work called the "Hours of Berlin," and had retained in his memory with great fidelity their general form and arrangements, was amusing himself on the night of the 15th of November in examining with a spy-glass the constellation Aries. His attention was attracted by an unusual small point, which moved slowly in a direct sense. Its motion determined its planetary character, but the twenty asteroids previously discovered rendered its originality doubtful. M. Goldschmit, however, taking the elliptic elements of the orbits of all the small planets, calculated their respective positions, and ascertained none were then in the constellation Aries. He reported the facts at the observatory, and the astronomers confirmed his discovery. This planet has the appearance of a star of the eighth or ninth magnitude, and at the suggestion of Arago has received the name Lutetia, in honor of the city of Paris. The usual prize has been awarded to M. Goldschmit by the French Academy.

On the 16th of November, Mr. Hind discovered the twenty-second asteroid. Its inclination to the ecliptic is 14° 20′ 13″; mean distance from the sun 2.9412, eccentricity 0.10458; period of revolution 1842 days, or little more than five years. This planet has received the name Calliope.

The number of asteroids, therefore, known at present to exist between Mars and Jupiter, is twenty-two. Nearly all these minute bodies have heen detected by means of the Berlin Star Charts; the largest of their number, Vesta, never appears, even when nearest the earth, brighter than a star of the sixth magnitude; while Metis, the smallest, is never more brilliant than one of the eleventh. Their names, date of discovery, &c., are as follows: —

NAME.	DISCOVERED.	BY	AT
1. Ceres,	1801, January 1st,	Piazzi,	Palermo.
2. Pallas,	1802, March 28th,	Olbers,	Bremen.
3. Juno,	1804, Sept. 1st,	Harding,	Lilienthal.
4. Vesta,	1807, March 29th,	Olbers,	Bremen.
5. Astræa,	1845, Dec. 8th,	Hencke,	Dresden.
6. Hebe,	1847, July 1st,	"	"
7. Iris,	1847, Aug. 13th,	Hind,	London.
8. Flora,	1847, Oct. 18th,	"	"
9. Metis,	1848, April 25th,	Graham,	Markree Castle, Ire.
10. Hygeia,	1849, April 12th,	Gasparis,	Naples.
11. Parthenope,	1850, May 13th,	"	"
12. Victoria,	1850, Sept. 13th,	Hind,	London.
13. Egeria,	1850, Nov. 2d,	Gasparis,	Naples.
14. Irene,	1851, May 20th,	Hind,	London.
15. Eunomia,	1851, July 29th,	Gasparis,	Naples.
16. Psyche,	1852, March 17th,	"	"
17. Thetis,	1852, April 17th,	Luther,	Bilk, Germany.
18. Melpomene,	1852, June 24th,	Hind,	London.
19. Massilia,	1852, Aug. 21st,	Chacornac,	Marseilles, France
20. Fortuna,	1852, Aug. 22d,	Hind,	London.
21. Lutetia,	1852, Nov. 15th,	Goldschmit,	Paris, France.
22. Calliope,	1852, Nov. 16th,	Hind,	London.

THE ASTEROIDS.

Mr. Carrington, an English astronomer, has lately computed with much care the positions of the orbits of all the small planets, with relation to two planes at right angles to the ecliptic and to one another, and has constructed a model representing them all. This has brought to light a remarkable relation hitherto unobserved.

All the orbits are so arranged, both in reference to their planes and the position of their points of perihelion, that they approach very nearly to one another in about heliocentric longitude 185°. This was made out for the first twelve planets before the discovery of Egeria; and her orbit conforms to the rule in a very remarkable manner, her path coming down abruptly to the point of concourse as that of Pallas rises still more abruptly from the same region of space. Whether this relation may exist or not for planets still to be discovered, or should fail, it must have a marked influence on the perturbations of those planets, and may lead to remarkable consequences in the theory of their physical connection. — *Jameson's Journal, April.*

Symbolical Notation of the Asteroids. — On account of the inconvenience resulting from the present arbitrary symbols for the large family of small planets between Mars and Jupiter, it has been agreed upon by several astronomers in Germany, France, England, and America, to propose for adoption a more simple system for this group, viz: a circle containing the number of the planet in the order of its discovery. — *Astronomical Journal.*

New Theory of the Origin of the Asteroids. — Mr. Nasmyth at the British Asssociation brought forward the following view respecting the origin of the Asteroids. "As the progress of science is frequently aided by advancing hypothetical views in explanation of the cause of certain phenomena, I hazard a suggestion as to the cause of the breaking up of the original planet, whose fragments it has been conjectured, form that numerous and remarkable group of small planets revolving between the orbits of Mars and Jupiter; some peculiarities of whose path have led to the supposition that they must have parted company from a parent mass at the same time and place. In order to render my views on the subject, more clear, I would refer to the well known toy called a 'Prince Rupert's drop;' namely, a drop of glass which has been let fall while in a semi-fluid state, into water, by which the surface of the glass drop is caused to cool and consolidate so rapidly, that the subsequent consolidation and contraction of the interior mass induces such a high degree of tension between it and the exterior crust that the slightest vibration is sufficient to overcome the cohesion of the external crust, and by so letting free the state of tension to cause the glass drop to fly into thousands of fragments. Nor is the action confined to 'Rupert's drop,' as we have examples of the same action in our foundery apparatus, in the case of masses of brittle metal, when the exterior of the casting first consolidating, (as it always does before the interior,) the after contraction of the interior of the mass induces a sort of 'touch and go' state of tension, which frequently results in such castings flying into fragments in spite of their *apparent strength*, either *per se*, or on the application of some force otherwise totally inadequate to produce so destructive a result. Now, let us apply this action (which we find constant in the cooling of all masses of brittle material) to the case of the supposed parent planet of the asteroids. It appears to me that we shall find in such the elements of a very feasible, if not the true explanation of the origin of this remarkable and numerous group of planets, namely, that the parent planet may have consisted of such materials as that by the rapid passing of its surface from the original molten condition to that of solidification, while the yet fluid or semi-fluid went on contracting by the comparatively gradual escape of its heat into space, through the solid crust, a state of tension may thereby have been induced, such as that in the 'Rupert drop,' and that the crust may have at last given way with such violence as to cause the fragment to part company, and to pass off, whirling into orbits, slightly varying from each other, according to corresponding variations in the condition of each at the instant of rupture. The remarkable fact that the orbits of these asteroids have one common node, or point of coincidence, causes us to look to some such explanation as I have thus hazarded."

COMETS DISCOVERED IN 1852.

A SMALL comet, very faint, without nucleus, was discovered on the 15th of May, in the constellation Cepheus, at the Observatory at Marseilles, by M. Jany Chacornac. Two days subsequently it was detected by M. Peterson, at Altona, and the next night by Mr. George P. Bond, at the Cambridge Observatory, Massachusetts.

M. Westphal, of the Observatory of Goettingen, discovered on the 24th of July, a comet about $1\frac{3}{4}°$ south of the star *f*, Pisces. In the finder it occupied a space of several minutes.

Return of the Twin Comet of Biela. — On the 26th of August Prof. Secchi, of Rome, discovered a portion of the twin comet of Biela on its return, and on the 16th of September, he detected the other portion. It was very faint, without nucleus, and of an elongated ovoid form, the apex being turned away from the sun. It followed the other part at a distance of about two minutes of time, and was about half a degree farther south. The principle part of the comet did not continue to appear of the same figure as at first. It looked quite irregular, and had two very faint streaks; it was more luminous in the centre, but without any nucleus.

SHOOTING STARS OF AUGUST 9–10, 1852.

AT the meteoric epoch in August of the year 1852, the weather at New Haven was very unfavorable for observation. During the night of the 9th, the sky was almost entirely overcast, and the following night was rainy, and observation wholly impossible. On the night of the 9th, Mr. John Edmunds watched here between two and three hours, A. M. (10th) and within forty minutes ending at two hours forty minutes, observed nineteen shooting stars, which with one or two exceptions moved in paths which traced back would meet in the constellation Perseus. During these forty minutes, the sky was generally overcast except a small opening about ten degrees in diameter a little south of the zenith. He estimated that had the sky continued through the whole time of his observation as it was at the most favorable moment, he could not have seen more than one-fifth of the meteors that fell, and owing to the clouds he saw less than one-half that fell in the space visible at the best moment. From these data, it may safely be inferred that the meteoric sprinkle of August did not fail this year.

M. Coulvier Gravier reports (Comptes Rendus, August 16, 1852) that according to his observations at Paris from June 18 to August 13, 1852, the average hourly number of shooting stars seen (by one observer ?) at midnight was, in the first half of July, about 8; from the 16th to the 21st, 11; from the 22d to 27th, 21; from August 2d to 6th, 38; on the 10th, 63; on the 11th, 50; on the 12th and 13th, 45. — *Silliman's Journal.*

Lieut. Jonquieres, of the French Navy, in a letter to M. Arago, states that on the 9th and 10th of August, while off the Sardinian coast, he observed under favorable circumstances the shooting stars which appeared at that time. The sky was clear and the meteors were very numerous from the end of twilight. Between midnight and 4 A. M. of the 10th, the number was about sixty-six per hour. The divergence of the meteors was quite constant from a point having a right ascension of two hours, twenty minutes, and north declination of sixty degrees. The next evening the meteors appeared less abundant.

NEBULÆ DISCOVERIES OF LORD ROSSE.

Dr. Robinson at the last meeting of the British Association exhibited drawings of large numbers of nebulæ as seen through the powerful telescope of Lord Rosse. He stated "that the contemplation of them was well fitted to increase the obligations of the astronomical world to Lord Rosse, as well as to fill every mind with astonishment at the wondrous revelations of his matchless telescope. Each of them was a new proof of a former statement of his,—that this instrument would probably disclose forms of stellar arrangement, indicating modes of dynamic action never before contemplated in celestial mechanics. He referred to the drawings, in which the spiral or vorticose arrangement of the stars and unresolved nebulæ was first remarked in its simplest form; and to others already published where it presents itself under conditions of greater complexity. He also referred to the important fact that the class of planetary nebulæ might now be fairly assumed to have no existence, as all of them which have been examined prove to be either annular or of a spiral character. Thus M. 97, which was considered by Sir John Herschel the finest specimen of them, and seemed even in his eighteen-inch reflector a uniform disc, presents in the six-feet a most intricate group of spiral ones, disposed round two starry centres, looking like the visage of a monkey. Among the new ones are H. 2,241. It is a ring of stars, with faint nebulæ within, and a fine double star near its edges: H. 2,075 of the same kind, but with a bright star almost exactly central, and nine others round it, evidently part of the same group. H. 450 is a most extraordinary object; the ring exactly circular, its light mottled and flickering, and within it what is evidently a globular cluster. Scarcely less surprising, but more magnificent from its association, is the planetary nebulæ at the edge of M. 46, which he had seen, though in a night not so favorable as that must have been when the drawing was made. It is a resolvable double ring, or rather spiral, with a centre star; and from the improbability of two objects so rare as a splendid cluster, and one of their compound rings being casually connected, it seems reasonable to think they constitute one system. The double star ι Orionis belongs also to this class; and he called attention to the absolute darkness of the aperture in the nebulæ round the two stars, and that the larger of them was at its edge, instead of being central. He argued from the remarkable difference between these objects as seen in the telescopes of Lord Rosse (even the three-feet) and those of previous observers, how desirable it is that a complete review of the nebulæ should be made without loss of time. Even now much labor and talent were expended in theorizing on the imperfect data given by instruments which, though matchless in their time, have now been surpassed. Among others, he directed the notice of the Section to H. 602, where the two clusters and the associated spirals are propelled into ellipses; to H. 2,205, in which the long, resolved ray, being the most intense, was alone seen by Herschel, but the magnificent spirals and their central stars escaped him. M. 65, and H. 857, appear to be helices seen obliquely. But the most curious one is M. 33, of which the centre is a triple star disposed as an equilateral triangle among a mass of smaller stars, from which proceed eight or nine spirals, and round all is an enormous nebula, in which however no spiral character had yet been traced. There were several examples of another singular system — nebulæ streaked with dark bands; such, Bond discovered in the great nebula of Andromeda, H. 399, a wisp; H. 1,393, a long ray of most marvellous appearance; H. 218, an oblique, with sixteen or seventeen dark transverse stripes; and H. 315, having in the nebula a cluster nearly insulated by offsets from the broad, curved, dark band, are among the most surprising. But the number of these curious objects was so great that their time would only permit him to invite their notice to H. 1,052 and 1,053, where the cause of spirality had been interrupted by some other forces that bent the system at a right angle and drew the nebula into a straight ray; to H. 444, a double-resolved nebula inclosed in a large and faint oval ring; and above all to M. 27, the "Dumb-bell" nebula as shown by the six-feet, with its brilliant two clusters of comparatively large stars, its dark bands, and the faint range which surround it, differing even more from the picture of the three-feet than that does from the figure of Herschel.

Lord Rosse adverted to the peculiar condition of equilibrium which must prevail in these systems, or rather to the forces which are required to produce the peculiar constitution which they indicate, and pointed out the difficulties of such an investigation. It could, however, not be undertaken with advantage till we possess a much more extended collection of data,—to which he would contribute to the utmost of his power. The drawings exhibited were based on measures carefully taken with a bar-micrometer (the only one available in such cases,) and he believed they might be trusted. He had already described the improvement effected by supporting the speculum on its levers by 81 balls, and mentioned the striking fact, that with a speculum weighing $3\frac{1}{2}$ tons, a slight pressure of the hand would deform for a time the image of a star.

ON THE MOTIONS OF NUMEROUS SMALL BODIES ROUND THE SUN; AND THE PHENOMENA RESULTING FROM THEM.

The following communication, on the above subject, was prepared for the American Association, for the advancement of science, by Daniel Vaughan, of Kentucky.

It appears from recent discoveries that the sun numbers among his attendants, not only planets, asteroids, and comets, but also immense multitudes of meteoric stones and shooting stars. Great magnitude, indeed, is not essential for membership in the Solar system, while, at the same time, there is a necessary limit to the size of projectiles in the same manner as there is to the size of edifices, in consequence of the strength of bodies increasing in a slower proportion than their weight, or the force required for their motion. The larger planets, though formed of materials possessing many thousand times the tenacity of iron, should be shattered to fragments in receiving their present velocities, not only from an impulse, but from any force applied under the most favorable circumstances. This should lead us to conclude that all planetary motion, if it originated from natural causes, must have been first imparted to a number of small masses which subsequently united to form the larger members of the solar system.

If a rare medium be diffused through the planetary spaces, the smallest attendants of the sun will be the most sensible to its influence; as similar solids traversing it with the same velocity, must sustain a loss of motion inversely proportional to their linear dimensions. Supposing the medium at rest while our system is moving to the constellation of Hercules, my investigations show, that a very singular result will be produced on the orbits of the smallest members of our system, when their diminutive size, or great rarity, causes the resistance of the medium to predominate over the disturbances proceeding from the action of the planets. The eccentricity of their orbits must continually change, until they all describe very elongated ellipses having the lower apsis directed to the constellation to which the sun is advancing. The medium will also produce a motion of their nodes, and change the positions of their planes, which after some oscillations, will rest in the direction of the sun's motion. The perihelia of all the small and rare bodies belonging to our system, and the intersection of their orbits, must be, therefore, situated between the sun and the point to which he moves, and the line or the narrow space extending in this direction, will be accordingly crowded with swarms of them, arriving there from every quarter of the planetary regions. From the great extent of surface which they possess, even with an inconsiderable amount of matter, they are enabled to reflect a large portion of the solar rays, and to this cause we may justly ascribe the ZODIACAL LIGHT. In the opposite part of the heavens, a like, though less dense collection of these cosmical particles, cluster in order to pass their common aphelion; and, though at too great a distance from the sun and from the earth to send any sensible portion of light to northern latitudes, they sometimes cause the appearance which Humboldt, (describing the Zodiacal light in tropical climates after sunset,) calls "a faint reflection visible in the east."

As the sun's rays are very intense and powerful in his vicinity, they must be reflected by a more extensive zone of these numerous bodies, and hence proceeds the conical form of the zodiacal light, its greater intensity at the base, and its gradual evanescence at great distances from the sun. The extraordinary length and brightness of the cone during some years, the diminution and the disappearance of it at other times, are owing to very great irregularities in the supplies of materials by which it is reflected; while the flickering and wavering of the light are caused by the frequent interception of the rays, as the small bodies change their relative positions. During the month of June, this cone of light (which always retains the same actual, though not the same apparent position,) is at its nearest distance from the earth; but in this and the other months of summer, it continues above the horizon only during the day, and is therefore invisible. I am inclined to think, that repeated observations of the position of the cone of light should enable us to ascertain with great accuracy, the direction in which our system is travelling through space, or may perhaps serve to detect some motion in our universe.

The uniform position of the orbits of all these small and rare bodies, might be expected to present favorable conditions for the play of their feeble attractions, especially at their greatest distances from the sun; and if we suppose a union to occur, whenever they cluster there in unusually large numbers, we may find a very plausible explanation for the ORIGIN OF COMETS. Nor should a comet thus formed, have the axis of its orbit fixed in the direction of the solar motion. As the mass enlarges, the disturbances of the planets will preponderate over the resistance of the medium, and cause a motion of the line of apsides. By this means the increase of size will be arrested, and in the space from which it has removed, a new accumulation may be expected to commence, as soon as the collisions of cosmical masses, and the entrance of fresh acquisitions of matter into our system, furnishes materials for calling a new comet into existence.

As to the cosmical masses revolving round the sun in ellipses whose transverse axes are in different positions, it seems impossible that a number of them could be drawn together by their mutual attraction, either to form a single mass or to revolve round a new centre. The attractive power even of the asteroids, could not control the enormous velocity with which bodies sweep by one another on meeting in the planetary spaces, when they move in different planes, or in ellipses differently situated. A mass of matter one mile in diameter would be prevented by an eccentricity equal to 1-10,000 part of its transverse axis from collecting by its attraction smaller bodies equidistant from the sun. An eccentricity 1,000 times smaller should present an unsurmountable obstacle to the union of the largest meteoric stones which visit the earth. Should collisions occur between them, they will only be broken into smaller fragments; or they will at least rebound into space, in spite of their feeble attraction, or the resistance from the exceedingly rare atmosphere they are able to confine around them.

Bodies revolving round the sun in the same direction, in planes nearly coincident, and in orbits almost circular, and differing little in dimensions, should be likely to come together, and unite at their first conjunction or soon afterward; for in this case, their relative motion is slow enough to be controlled, and they remain long enough in proximity to render their attraction adequate to this object. These conditions, which chance could never supply, together with another still more favorable, will be found to arise from a peculiar state of the disturbing forces, which come into play in the remote parts of the solar system.

Although no kind of action calculated to correct the eccentricities of the planetary orbits, has been hitherto discovered, I shall shew that every body which comes within the sphere of the sun's attraction, and happens to describe an elongated ellipse round him, will have its orbit gradually changed into one nearly circular. The principle on which this is effected, will be understood from the action of the sun on a satellite about 800,000 miles from the earth; for the very great disturbance in this case, will change a very eccentric orbit to a more circular form. The first step to this alteration, is a curious arrangement in the position of the transverse axis, so that the higher apsis will be always in conjunction with the sun. It has been long known that if the planets were elipsoids, their longest diameters should be always directed to the sun, if not prevented by too rapid a rotation. A similar tendency is manifested by the orbits of their satellites: and the line of apsides would be continually directed to the sun whenever the disturbing force exceeds a certain amount, at least, when it is adequate to cause a motion of the apsides differing little from the sun's increase of longitude during the satellite's revolution. The smallest distance at which this phenomenon could occur cannot be stated with much precision, as it depends on the eccentricity; but it appears that were the moon situated at double her present distance from the earth, her apogee should never deviate more than a few degrees from the sun's place, supposing her eccentricity to remain unaltered. It appears also, that at all greater distances, at which the existence of satellites is possible, the axis of their orbits will have invariably a similar position.

With the transverse axis of its orbit continually directed to the sun, the satellite will be in a great measure free from the periodical irregularities which at present characterise planetary motions. If it moved in the order of the signs, the slow motion in the aphelion, and the increased length of the radius vector, should cause the action at the syzigies to preponderate over that at the quadratures; and this should produce A PERMANENT DIMINUTION OF THE ECCENTRICITY. Were the motion in an opposite direction, a contrary result may be expected, until the satellite should be compelled to desert the earth, or fall to its surface; but it will soon appear that there is scarcely a possibility of a retrograde motion ever attending the process, by which planets must have collected from space, the materials of which their satellites are composed. Should the orbit be elongated in any direction by the disturbing force, the longest diameter will turn to the sun, and thus any considerable deviation from a circle will be prevented.

It is easy to conceive how the masses collected by a planet, and compelled to describe circular orbits around it, might accumulate in numbers and form satellites. When a nucleus once formed, its attraction, extending to a greater distance, should collect the matter very rapidly from the space which it traversed, until after some revolutions there should be little left for future acquisitions. Masses too remote to be drawn to this satellite should be disturbed by its attraction, and prevented from acquiring such a conformation of their orbits, or such velocities as may render their coalescence possible. A second satellite could not, therefore, be called into existence until the orbit of the first had been much contracted either from the resistance of a medium, or from the accession of new matter to the primary. Hence, the regular intervals between the moons of Jupiter, Saturn and Herschel.

But the sun himself is moving through space in a curve, in obedience to the attractions which proceed from myriads of other systems. The masses, therefore, which the sun meets in his course, must have their motions modified and their orbits shaped by the resultant of these forces, and they are sensible to its control long after they become members of our system. Like the sun's action on the secondary planets, this disturbing force must operate with the most efficacy on the bodies near the verge of our system, giving a fixed position to their apsides, and causing them to describe either circles or small curves. If, now, the planets were too remote to produce any sensible irregularities, the formation of a planet from these acquisitions of matter should take place near the confines of our system, where motion is slow. But it is only after the numberless ages which this world should occupy in contracting its orbit so much that its influence may disappear on the verge of our system, that another similar body could be formed. We are thus conducted to a satisfactory explanation of the LAW OF BODE.

In travelling through space, our sun collects those masses which have very nearly his own velocity: for if their velocity differed considerably from his, there could be little chance that their orbits could be rendered elliptical either by the resistence of a medium, or by the action of other bodies. But, in the presence of an attraction from numerous systems, the velocity of bodies can approximate to equality, only when they move in parallel curves and planes which nearly coincide. The result is, that the sun's attendants instead of exhibiting every degree of inclination in their orbits, never deviate far from the SAME PLANE, though their paths, however, are inclined at a much greater angle when introduced into our system, than when controlled by the attraction from more distant centres. While new worlds are thus formed at the verge of our system, those of an earlier origin are continually approaching the centre from the causes I have previously noticed, and from the immense size of the sun it would appear that he has received not only large supplies of meteoric stones and comets, but even several worlds, which, after revolving around him for unnumbered ages, were at last entombed beneath his surface.

ADVANTAGES OF THE CLIMATE OF THE SOUTHERN STATES FOR ASTRONOMICAL OBSERVATIONS.

Mr. C. O. Boutelle, of the Coast Survey, in a communication made to the Savannah (Ga.) Republican, says: Three years' experience in astronomical observations in this climate, enable the writer to assert with some degree of confidence, that the general condition of the atmosphere is such as to be highly favorable to the use of large telescopes, with high powers. Astronomers experience great difficulties from the irregularities of temperature of our atmosphere, rendering vision with telescopes of high magnifying powers, very indistinct. On clear cold nights, when the stars appear to twinkle most beautifully and to shine the brightest to the unassisted eye, when "the chill stars sparkle," the astronomer can see nothing. Every object appears confused and irregular in his telescope. His richest harvest frequently occurs when a slight haze covers the heavenly bodies with a filmly veil, through which the smallest objects can be distinctly seen. In this climate, the number of still nights, *i. e.* when the outlines of the heavenly bodies appear clear and distinct, greatly outnumber those in more Northern Latitudes, where our observatories are mostly situated.

RUSSIAN MEASUREMENT OF THE ARC OF MERIDIAN.

The measurement of the great arc of a meridian in Eastern Europe, undertaken by the Russian Government, has been advancing during the past year with unexampled rapidity, and to an extent hitherto unparalleled. Originating in topographical survey in Esthonia and Livonia, and commenced in 1816, the operation, both geodesical and astronomical, have been completed between Izmail on the Danube and Fugleness in Finnmarken, an extent of $25\frac{1}{3}$ meridional degrees. Next to this in extent is the Indian arc of 21° 21′, between Cape Comorin and Kaliana; and the third is the French arc of 12° 22′. It appears by a note presented to the Imperial Academy of Sciences at St. Petersburgh by M. Struve, that a provisional calculation has been made of a large part of the great arc of Eastern Europe, and that it has been found to indicate for the figure of the earth a greater compression than that derived by Bessel in 1837 and 1841, from all the arcs then at his command,—Bessel's compression having also been greater than Laplace's previous deduction.

OBSERVATIONS ON THE ZODIACAL LIGHT.

Mr. R. H. Birt submitted to the British Association at their last meeting, a series of observations on the Zodiacal light, made at the Kew Observatory. It appeared to the author that two very important features presented themselves in connexion with the observations: viz., the position of the great mass of light being constantly north of ecliptic,—and the apparent change in the form of the light, or at least that portion of it forming the apex of the luminous triangle on the cone of light, which is very perceptible in the groups of observations, those in February presenting a narrower cone, the axis being very perceptibly inclined to the ecliptic. In this respect these observations are in decided contrast with those of March, when the cone of light had become much larger, the apex more rounded, and the inclination of the axis to the ecliptic changed. It would appear from the projections that accompanied the observations, that while the great mass of light was still northward of the ecliptic the direction of the axis was so inclined that it occupied a different position with respect to the ecliptic than it did in February. In the month of April the author considered the axis of the zodiacal light to be slightly north of the ecliptic, the northern side of the cone still exhibiting the greatest luminosity. The contrast of these observations in this month (April) with those in February, is very remarkable; the cone had become very considerably enlarged, and consequently much broader than the cone seen in February. Two observations, those of March 3 and April 10, were particularized as indicating that under peculiar circumstances we see more of the zodiacal light than is presented to us ordinarily. In connexion with these phenomena the author observed earlier in March a sudden brightening of the light for an instant, and also variations in its lustre of intermittent character. These intermissions of brightness were observed on the same evenings at Nottingham. They are described by the author not to be of the nature of pulsations in the usual acceptation of the term, but to consist of alternate brightenings and dimmings of the entire mass of light such as might be produced by the approach and recess of a luminious body.

GREENWICH OBSERVATORY.

From the official report of the Superintendent of Geenwich Observatory, Prof. Airy, we derive the following particulars: — The long established system of meridional observations, for which Greenwich has been so long and so justly celebrated, is maintained inviolate. Each standard star is observed, if possible, twenty times in three years. The moon is always observed on the meridian when visible, and the sun and planets, except on Sundays. The number of observations from 1851, May 30, to 1852, May 18, was, transits, 4,500; circle observations, 5,000. Under the head, "Reduction of Observations," Mr. Airy states that the reduction of a long series of observations of the solar spots is much advanced, and that the occultations of 1851, and the double image micrometer measures to the present time, are completely reduced. With respect to the reduction of the observations made by the transit circle, a curious circumstance is mentioned. While the construction of this instrument, and the modes of observation with it, have given a warranty, such as the world never possessed before, for the steadiness of the instrument and its adjuncts, there have been instances when the azimuth of the instrument, greatly to the surprise of the Astronomer Royal, has varied four seconds, as determined by opposite passages of the pole star. Mr. Airy has no other way of explaining this than the supposition that the "sound and firm-set earth" itself is in motion.

A new reflex zenith telescope has been introdced. The fundamental principle of its construction is, that the micrometer and wire-frame are carried by the frame of the object-glass, and that the convergent pencil of light coming from a star is received, at a distance of half its focal length, upon the surface of quicksilver contained in a trough, whose support is independent of the telescope.

ON DETERMINING LONGITUDE AT SEA FROM THE ALTITUDE OF THE MOON.

The following paper was read before the Royal Astronomical Society, England, by Lt. Ashe, R. N. Lt. A. states, that during an interval of leisure in 1849, his attention was drawn to the subject of longitudes, by the circumstance of one of the chronometers (which had gone well for four years) changing its rate very considerably without any assignable cause: and knowing what implicit confidence is placed in a good chronometer, I felt that it was to be lamented that there was not some plan less laborious and of easier attainment than the lunar distance for checking chronometers; for, notwithstanding my experience of more than twenty years' sea time, I can only recollect one instance of the chronometers having been checked by the lunar distance, which may be, perhaps, accounted for by the many inconveniences attending the observation, and the large amount of practice necessary to ensure success. The data for the problem proposed by Lieut. Ashe, are, the sidereal time of the observation, the latitude of the place, and the observed altitude of the moon. Lieut. Ashe first computes the zenith distance of the moon on the supposition that the observer is on the meridian of Greenwich. As the Greenwich sidereal time is known, the arc of the equinoctial between the moon's node and the meridian may be computed from the "Nautical Almanac," and the angle which the moon's orbit makes with the equinoctial may be assumed to be equal to the moon's greatest declination. Hence the solution of a right-angled triangle will give the arc on the moon's orbit, from her node to the meridian, or arc a; the arc on the meridian between the orbit and the equinoctial, or arc b; and the angle included between these arcs, or γ. Again, if a perpendicular be let fall from the zenith upon the moon's orbit, the angle in this triangle opposite the perpendicular will be γ, and the hypothenuse is the latitude of the place when increased or diminished by arc b; hence the value of the perpendicular arc d is found, and also the distance of the foot of the perpendicular from the meridian e; the addition or substraction of e to a gives the longitude of the foot of the perpendicular, reckoned on the moon's orbit from the node. Finally, having the values of the perpendicular on the orbit, and of the moon's zenith distance calculated for the meridian of Greenwich, the third side is computed, which when applied to the last found arc gives the longitude of the moon on her orbit reckoned from the node, on the hypothesis that the observer is on the meridian of Greenwich at the sidereal time supposed. Lieut. Ashe then assumes that the change of meridian from Greenwich to the place of observation will not alter the relation of these circles to each other, and that the moon will merely occupy another situation in her orbit. As the zenith distance at the place of observation is supposed to be known, there are, in the right-angled triangle requiring solution, the perpendicular on the moon's orbit, and the observed distance of the moon from the zenith; and from these data the longitude of the moon on her orbit, reckoned from the node, is found for the time and meridian of the place. The difference of the two arcs thus found, divided by the moon's motion, will give the difference in longitude between Greenwich and the place of observation. Lieut. Ashe suggests a second mode of determining the longitude by an altitude of the moon, when compared with an altitude of the sun or a star. "For the sake of simplicity, take an example with a star. Let the altitude of a star near the prime vertical be taken, and compute its hour-angle. As soon after as many be convenient, take the altitude of the moon, and find her hour-angle; the elapsed sidereal time, and run of the ship (if necessary,) being applied to the hour-angle of the star, the hour-angles of the moon and star are known at the instant of last observation, and consequently the right ascension of the moon is known from the right ascension of the star. A simple proportion will show what is the Greenwich time corresponding to this right ascension of the moon. When the observations are made on the same side of the meridian, an error in latitude, or instrument, or that caused by bad horizon, or refraction, or personal equation, will not materially affect the 'difference' of the hour-angles, since the errors are common to both triangles Z P S and Z P M, and both are augmented or diminished nearly alike; and therefore the 'difference' between erroneous hour-angles will be nearly equal to the difference between correct hour-angles."

METEOROLOGICAL INFORMATION.

The following circular has been issued by the Smithsonian Institution. It is to be hoped that the call for information may be readily responded to from all parts of our extensive territory.

The Smithsonian Institution is engaged in a series of investigations relative to the Meteorology of North America, and is desirous of collecting all information bearing on this subject.

It is believed that there exist many records of observations extending back, in some cases, through a long period of years, the comparison and discussion of which would elicit much valuable information relative to the climate of this country, which would otherwise be liable to be lost. The undersigned would therefore earnestly request that copies of such journals, or the original records, be lent or presented to the Institution. In cases of records which cannot be sent to the Institution, monthly or other mean results deduced from them are requested, with explanations of the manner in which the observations were made, the character of the instruments, &c,

Proper acknowledgment of all information derived from the records will, in every instance, be given, and the registers themselves will be carefully preserved, and returned, if desired, to those from whom they were obtained.

When it is recollected that isolated observations are greatly enhanced in value, and made to yield new results by comparison with other observations, it is hoped that the request of the Institution will meet with favorable regard.

EVAPORATION AND CONDENSATION.

The total quantity of dew believed to fall in England is supposed to amount to five inches annually. The average fall of rain is about twenty-five inches. Mr. Glaisher states the amount of evaporation at Greenwich to have amounted to five feet annually for the past five years, and supposes three feet about the mean evaporation all over the world. On this assumption the quantity of actual moisture, raised in the shape of vapor, from the surface of the sea alone, amounts to no less than 60,000 cubic miles annually; or nearly 164 miles per day. According to Mr. Laidlay, the evaporation at Calcutta is about fifteen feet annually, that between the Cape of Good Hope and Calcutta averages in October and November nearly, three quarters of an inch daily; betwixt 10° and 20° in the Bay of Bengal it was found to exceed an inch daily. Supposing this to be double the average throughout the year, we shall, instead of three, have eighteen feet of evaporation annually; or were this state of matters to prevail all over the world, an amount of three-hundred and sixty thousand cubic miles of water raised in vapor from the ocean alone.

OBSERVATIONS ON THE CLIMATE, FLORA AND FAUNA OF THE SOUTH SHORE OF LAKE ERIE.

Some interesting observations on the climate, flora, and fauna of the south shore of Lake Erie, have recently been published by Dr. J. P. Kirkland, of Cleveland, Ohio. They seem conclusively to show that a section of country on the lake shore, in the vicinity of Cleveland, has a decidedly southern character, as regards its climate, flora and fauna. At this point, during ten years of observation, the thermometer has in no instance fallen so low, as at places situated 120 to 150 miles to the south. The first severe frosts of autumn, which generally occur throughout Northern Ohio about the 25th of September, rarely take place at Cleveland before the 25th of October, and sometimes not until late in November. If the warm season upon the lake shore is protracted, the spring at the same point is somewhat later. In the middle and southern sections of Ohio, spring sets in during the month of March — perhaps earlier. The warm winds blowing up the vallies of the Mississippi and Ohio, in conjunction with other causes, bring forth vegetation earlier; but cold weather and disastrous frosts too often follow. While these changes are progressing in those parts of the State, winter will remain steadfast on the lake shore. Little advancement will be made by spring so long as any considerable bodies of ice float upon the lake, even as low down as Buffalo. No sooner do they disappear, than spring sets in with reality, and vegetation puts forth with *subarctic* rapidity.

The lake rapidly imbibing heat at this season, becomes a safeguard against any subsequent vernal frost. The mode by which it exerts its influence, does not appear to be uniformely the same at different times. In some instances, on the approach of a cold night, the warm emanations from the lake condensing may give off caloric, and obscure the atmosphere with haze, mist, or clouds, when no frost will occur. Under circumstances apparantly similar, on the approach of a cold night, neither haze, mist, nor clouds may form, but a stiff breeze springs up, and the stars become unusually brilliant. The thermometer vacillates between 32° and 38°, rising with the gusts of wind and falling during the intervals of calm. Then no frost will appear. Again, none of those modifying causes may intervene, but the temperature may fall below freezing point, ice form on the surface of water, and the expanded fruit leaves and blossoms congeal. Under such circumstances, the first rays of the rising sun, the next morning, will be arrested by haze, which will soon thicken, and before noon a warm rain will probably fall. The frost will be abstracted so gradually from frozen vegetation as not to impair its vitality.

In autumn this great body of water begins to part with its warmth to the colder incumbent atmosphere, and the process continues during the winter. While its progress is most rapid, strong southerly winds prevail at the earth's surface, while volumes of clouds, at a high elevation, might at the same time be moving rapidly on an opposite direction. These counter currents have sometimes given origin to a phenomenon in the city of Cleveland, not well understood by all of its good citizens. The vane of the lofty spire of one church, standing on a high ridge of ground, may point steadily to the north, while that on the low cupola of another church, which is situated on a less elevated plateau, may be directed to an opposite point of compass with a stiff southerly breeze at the same time. It has been surmised that water-spouts are most common when there is great inequality of temperature between the water and atmosphere. Their more frequent occurrence at such times may have been dependent on other causes. Cool north winds begin to prevail about the middle of October. The lake changes its hue from green to slate color, varying as the temperature is warmer or colder, and ultimately to a hue almost as dark as ink, at times when the sky is obscured with heavy clouds. The emanations from the lakes then begin to condense and pass off to the south, in the form of thick clouds, without discharging, at first, much rain. About the 20th of October, the cold from the north seems to gain the ascendency; squalls of rain, hail, and rounded snow appear alternately, with intervals of clear and warm weather. These squalls always precede the autumnal frosts. The gardners feel no apprehension for their tender vegetables till these premonitions have appeared. Common observations, as well as the more sure test, the rain-guage, show that larger amounts of evaporation from the lake are carried south, where they condense in the form of rain and snow, than fall upon this vicinity. During winter comparatively little snow falls, and still less accumulates here, though it may be abundant on the higher grounds, thirty or forty miles in the interior.

The indigenous vegetation of this vicinity is of rather a southern type — shown by the absence, in a great measure, of evergreens, and the occurrence of more Genera, as the Cercis, Ilex, Æsculus, Nelumbium, Gleditschia, Magnolia, &c. Eliott's Botany of South Carolina and Georgia has been found to be a convenient hand-book for investigating our flora. On the other hand, strange hyperborean plants are frequently found, which have been washed down from the far northwest, through the chain of great lakes. Many of the birds are species whose most northern ranges of migration have been assigned many degrees south of this by ornithologists.

The insect tribes show still more strikingly southern affinities. The Papilio Cresphontes has been repeatedly taken here, though it has been considered as exclusively southern in its resorts. In the south the larva feeds on the orange and lemon — here it lives on the Hercules-club. The Papilio Ajax and Marcellus have also been described as southern insects; and the late Mr. Doubleday located the former exclusively in Florida and fixed the most northern limit of the latter in Virginia. Still they are common at this point, and subsist, in the larva state, on the Pawpaw. An undescribed species of Libythea has been taken in Northern Ohio; it has been found also, in South Carolina, and is without doubt, legitimately a southern species.

During the winter, 1850–51, a lower temperature was experienced in the vicinity of Cleveland than during the preceding ten years. On the 16th and 17th of December, 1850, when the thermometer continued below zero, the general cold, says Dr. Kirkland, seemed to contend for predominance with the warmth of the lake. Even at the low temperature which prevailed warm emanations were constantly arising from the water and exhibited a beautiful phenomenon when viewed from the perpendicular bank of the lake, which rises 80 feet above its level, at this point. The warm vapors ascended several feet into the air, then condensed, congealed and fell back again in such rapid succession as to cut off from view the water, and to give to the unlimited expanse of the lake, the appearance of an immense cauldron, waving or boiling like plaster of Paris parting with its water of crystalization at a high temperature.

It was a cloud of these snowy spicula, thus formed, which enveloped the steamer Mayflower, and resulted in her running ashore. Passengers on board of her, though surrounded with falling snow, could occasionally discern the sun and clear sky overhead. The occurrence of this extreme cold at a time when the lake contained no ice, and the water was comparatively warm, was extraordinary.

LUNAR ATMOSPHERIC TIDE.

The facts derived a few years since from the barometrical observations at St. Helena, showing the existence of a lunar atmospheric tide, have been corroborated in the last year by a similar conclusion drawn by Capt. Elliot, of the Madras Engineers, from the barometrical observations at Singapore. The influence of the moon's attraction on the atmosphere produces, as might be expected, a somewhat greater effect on the barometer at Singapore, in lat. 1° 19′, than at St. Helena, in lat. 15° 57′. The barometer at the equator appears to stand on the average about 0.006 in. (more precisely 0.0057, in lat. 1° 19′) higher at the moon's culminations than when she is six hours distant from the meridian.

NEW THEORY OF THE AURORA.

Lieut. Hooper, R. N., at the British Association, read a paper containing some new views respecting the origin of the aurora. The author says : — "I believe the aurora borealis to be no more nor less than moisture in some shape (whether dew or vapor, liquid or frozen,) illuminated by the heavenly bodies, either directly or reflecting their rays from the frozen masses around the pole, or even from the immediately proximate snow-clad earth."

BALLOON ASCENTIONS FOR METEOROLOGICAL PURPOSES.

Under the superintendence of a committee of the British Association, several balloon ascentions have recently been made in England for the purpose of obtaining meteorological observations. The chief points to which attention has been directed, are the variations of the temperature and humidity of the air due to elevation above the earth's surface. The instruments used consisted of a syphon-barometer, on Guy Lussac's principle, two pairs of dry and wet thermometers, and the dew-point hygrometer of Regnault and Daniell. One pair of dry and wet thermometers was mounted with the bulbs protected from the effects of radiation by double concentric shades, with brightly-polished silver surfaces, open at top and bottom, for the free circulation of the air. The second pair had their bulbs enclosed within polished tubes, (also protected by polished shades,) a brisk current of air being made to pass over them by the action of an aspirator. The object of this arrangement was, to diminish the effects of radiation — to cause the thermometer to assume more readily the temperature of the surrounding air — and to remove from the neighborhood of the wet thermometer the vapor formed by evaporation from its bulb, and thus to cause the instrument to indicate with more accuracy the true temperature of evaporation. Care was taken to procure thermometers of extreme delicacy, the bulbs of those actually employed being cylindrical, about half an inch long, and one-twelfth of an inch in diameter: they were found to assume the temperature of the surrounding medium with very great rapidity. The aspirator used was a pair of elongating cylindrical bellows which were drawn open by weights attached to their lower end — the air being allowed to enter by means of the tube which enclosed the dry and wet thermometer. The same aspirator was, by means of a second stop-cock and tube, used to produce the current of air necessary in operating with Regnault's hygrometer. On the third ascent the temperature on leaving the ground was about 58° Fahr.; at the lower surface of the cloud (1,500 feet high,) it was 50°; at the upper surface, (3,400 feet,) 50½°; at 4,400 feet, or 1,000 feet after clearing the cloud, 52½°: after this height the temperature decreased till it reached 25° at the elevation of 12,600 The thermometer indicated, in the first ascent, a fall of one degree for every elevation of 808 feet; and, on the second occasion, a fall of one degree for every 345 feet of ascent. This ratio of fall to height was observed to be very nearly constant.

The two points of greatest interest noticed in these ascents were — 1st, That the tension of vapors decreased at a regular rate for some distances from the surface of the earth, and then very abruptly diminished by a large amount, being in fact reduced to nearly the lowest value attained during the remainder of the ascent. The height at which this sudden reduction in the quantity of aqueous vapor occurred was different on the two days — on the 17th it was about 5,000 feet, and on the 26th nearly 3,000. 2nd, it was also noticed that at the same elevation at which the great reduction of vapor took place, the gradual diminution of temperature was for some distance arrested.

The greatest height attained to was 19,500 feet. The first clouds occurred at 2,000 feet height; after they had been passed through, no other clouds presented themselves until the balloon had obtained the height of 13,000 feet. At the highest elevation, clouds were still visible nearly on a level with the balloon, and the atmosphere was filled with fine crystals of snow. At this elevation the aeronauts found no difficulty in breathing, but experienced a slight pressure ón the ears and some pain in the temples.

COMPARISON OF THE CLIMATE OF NEW ENGLAND AND GERMANY.

At a meeting of the Boston Natural History Society, 1852, Mr. Desor offered some remarks on the difference of the climates of Germany and New England. In conversation with numerous German residents here he had learned various interesting facts growing out of the remarkable dryness of the climate. One of the first things noticed by them was the rare occurrence of arborescent forms on the windows produced by frost. These appearances are regarded with peculiar interest in Germany, and are associated with many popular legends. They are comparatively of rare occurrence here from the circumstance that the dew point is several degrees lower. Various differences are noticed by artisans in the processes of their different callings, attributable to the dryness of the atmosphere. Painters can finish their work more rapidly. Cabinet makers are obliged to use much thicker glue. Watch makers have to use animal instead of vegetable oil. Articles of furniture made in Europe are found not to wear well. Inlaid wood floors are much more expensive, requiring to be made with much greater care. In the collections of Natural History in Europe lime is necessary for the absorption of moisture, which would otherwise injure the specimens; none is needed here. It has been said that the climate of New England is moister than that of Central Europe, because rains are more frequent. Humboldt made the same remark of the high Alps. This is not true, however, for there is a very great change of hygrometric condition in the atmosphere immediately after rain. In the northwestern part of Europe and in England, a fall of one or two degrees only in the temperature causes rain. On the whole, Mr. Desor regarded the climate of New England as more nearly resembling that of the high Alps than that of any other part of Europe.

Mr. Desor added that Germans find that they lose flesh after their arrival in America.

Mr. Briggs said that he had noticed that English workmen who had been accustomed at home to drink from four to six quarts of beer daily, are quite unable to drink that quantity here without intoxication. In Missouri, with a temperature of 120°, and a dew point at 90°, sufficient to make the roads muddy with condensed moisture, he had noticed that men drank very large quantities of stimulants without intoxication. At the winter season of the year the air of New England is so nearly anhydrous that such articles as raw hides dry in a temperature just below freezing, without being frozen.

OBSERVATIONS ON THE FALL OF RAIN.

At the British Association, Belfast, Col. Sykes communicated an Analysis of the Mean Daily Temperatures and Fall of Rain at 127 Stations in the Bengal Presidency. These observations afforded striking illustrations of the influence of hills and other local and physical causes on the fall of rain; owing to which the difference in the quantities of rain collected at two different stations in the same latitude, and not many miles apart, was often very great. At some stations the enormous quantity of 600 inches were observed in a single year. Col. Sykes also read extracts from a letter from Dr. Buist on four simultaneous experiments in the island of Bombay, to determine the fall of rain at different heights below 200 feet. The results of these observations were indecisive; but from the discussion which followed it appeared an established fact, that up to a certain height the quantity of rain increased, attained a maximum, and afterwards decreased. Dr. Buist also dwelt upon the numerous exceptions to the admitted rule, that the annular range of the barometer increased, and the diurnal fluctuations decreased, as we recede from the equator. In reference to the communication of Col. Sykes, Sir David Brewster showed the influence which the times chosen for observation would have upon the results — without regard to this, indeed, the observations might be utterly worthless. There are two hours in the day at which the temperature is a mean of the day; the first occurs in these countries at about 9 o'clock, A. M., and the last at about 8 hours 15 minutes, P. M.; the critical interval, as it is called, being thus about 11 hours 15 minutes. It was of the greatest importance to ascertain whether this interval was the same in India, where the circumstances were so very different.

EFFECT OF CLIMATE ON CONSUMPTION.

It appears that the medical faculty are beginning to question the opinion which has so long prevailed among medical men, that a change of climate is beneficial to persons suffering with the consumption. Sir James Clark, of England, has assailed the doctrine with considerable force, and a French physician, named Carriere, has written against it; but the most vigorous opponent of it is a Dr. Burgess, of Scotland. Dr. Burgess contends that climate has little or nothing to do with the cure of consumption, and that, if it had, the curative effects would be produced through the skin, and not the lungs. That a warm climate is not in itself beneficial, he shows from the fact that the disease exists in all latitudes. In India and Africa, tropical climates, it is as frequent as in Europe and North America. At Malta, right in the heart of the genial Mediterranean, the army reports of England show that one-third of the deaths among the soldiers are by consumption. At Nice, a favorite rasort of English invalids, especially those afflicted with lung complaints, there are more native-born persons die of consumption than in any English town of equal population. In Geneva this disease is almost equally prevalent. In Florence pneumonia, in the Doctor's words, "is marked by a suffocating character, and by a rapid progress towards its last stage." Naples, whose climate is the theme of so much praise by travellers, shows in her hospitals a mortality by consumption equal to one in two and one-third, whereas Paris, whose climate is so often pronounced villainous, the proportion is only one in three and one-quarter. In Maderia no local disease is more common than consumption. "The next position of Dr. Burgess is, that as the beasts, birds, and fishes of one region die in another, a change of climate cannot, unless exceptionably, be beneficial to an invalid. Notwithstanding the greater adaptability to climate which man preserves, the human constitution it is plain cannot endure changes of temperature without being more or less affected by it. The frosts and thaws of England have corroded, during the lapse of ages, the solid stone on it of which their cathedrals were built. In like manner a foreign climate gradually undermines the health. Dr. Burgess refers to the shattered constitution of every officer who has served for any length of time in India; and to the well-known fact that children born of white parents in India are delicate as a class. The African, as we know by the experience of its country, cannot endure severe and protracted cold. Canada is the common grave as well as refuge of fugitive slaves. If such is the effect of changes of climate on persons in health, what must it be, argues Dr. Burgess, on invalids? And he fortifies this theoretical conclusion by reminding the reader that it is not only the natives who die of consumption in Maderia, but that the grave-yards of that Island are whitened by the headstones of thousands who have gone there for health, and remained to die.

"Persons not professional imagine that the consumptive patient, by breathing a mild atmosphere, withdraws irritation and leaves nature free to work a cure. But this notion Dr. Burgess characterizes as entirely erroneous. It is through the skin, not through the lungs, he contends, that a warm climate acts beneficially. When a sudden change in the temperature produces a chill, cutaneous perspiration is checked, the skin becomes dry and hard, and the lungs suffer from excessive action; for they are compelled now to eliminate what should have passed off through the skin. The Doctor illustrates this by referring to the instantaneous relief which is generally obtained through free perspiration, where difficult breathing or oppression of the chest have been occasioned by artificial heat. What is best for consumptive patients, therefore, is an equable climate. It is the fluctuations, not the high temperature of a climate that is injurious."

An able article on this subject has been published in the Boston Medical Journal by Dr. Burnett, of Boston, in which he attributes the prevalence of consumption in the New England States to the intemperate changeable climate, the tendency of which is to produce disease in the pulmonery organs. The only season of the year when the climate is favorable to lung diseases, is during the month of September and the first part of October, when the air is warm, dry and quiet. It has been customary for northern invalids to return when benefitted. In general, all who did so have been re-attacked and finally carried off — sometimes very suddenly. From statistics and information which Dr. Burnett has been collecting, he has come to the conclusion that consumptive invalids to be permanently benefitted by a change of climate, must go South and make their home there. The climate of Greenville, S. C., and some parts of Georgia, is exeeedingly favorable to those laboring under this disease. In Summer the temperature rarely exceeds 90°, and is free from sudden changes. Dr. Burnett is of the opinion that the United States possess a variety of climate and advantages for this disease far superior to those of Europe.

ON THE APPLICATION OF THE LAWS OF STORMS TO NAVIGATION

The following rules and suggestions, applicable to ships which have become involved in storms, were published by Capt. Andrews, R. N., in the Bermuda Royal Gazette.

By keeping the wind on the Starboard Quarter, when in a revolving Storm in the Northern Hemisphere, ships gradually sail from the Storm's centre: and by keeping the wind on the Port Quarter, when in the Southern Hemisphere, Ships sail gradually from the centre ot a revolving Storm. This rule applies to three-quarters of the Storm's Circle. But there is always one Quadrant in a progressive whirlwind Storm, more dangerous than the other three, being that over which the Storm's centre passes in its progress; and there would be danger in applying the rule with a Ship in this Quadrant. Within the Tropics whilst the course of Storms tends towards the West, the quadrant of greatest danger will be on the west sides. But these quadrants will gradually change their position as the Storms recurve; and in high Latitudes, as the course of the Storms becomes Easterly so will these Quadrants of greatest danger come to be on the East side of the Storm. In order to know which is the Quadrant of greatest danger, the theory must be studied until it is understood.

An example of Capt. Andrews's rule for the Southern Hemisphere was practiced by Captain Moorsom, when commanding the Andromache Frigate, at Mauritius, in 1826, and is the more remarkable because it was executed by Captain Moorsom, before the theory of Storms was understood. Leaving H. M. S. Ariadne, in Port Louis Harbor, at the wish of her Commander, Captain Moorsom put to sea in the Andromache with the wind at S. E., veering to S. S. E., predetermined to steer without regard to the compass, and to keep the wind as it veered, always upon the larboard or port Quarter. He had come to this decision from attentively studying the Logbooks, of Ships which had encountered Hurricanes, in the neighborhood of Mauritius, and observed that the wind veered there in a uniform manner. By steering as described, Captain Moorsom gradually carried his Frigate away from the centre of the storm, until he had gained its opposite side, and moderate weather. Then having the wind at N. E., veering to E. N. E., he brought his Ship upon the Starboard tack, in order to return to Mauritius which Port she reached uninjured. By comparing extracts from the two Logbooks, it appears that the Ariadne in Port Louis Harbor, was in the centre of the Hurricane, and had the Storm very severely; whilst the Andromache, by putting to Sea, and being steered so as to keep the wind on the Port Quarter, had comparatively moderate weather.

GEOGRAPHY AND ANTIQUITIES.

SOURCES OF THE NILE.

At the last meeting of the Bombay Geographical Society, a paper was read by Mr. Smith, on the discoveries made by the East African Missionaries, on what appear to be the sources of the Nile. This mysterious river is said to arise from two lakes, one of which is of great dimensions, nearly under the line, and they seem fed by the melting snows of the gigantic range, which rises to the altitude of 22,000 feet at least, close by. The description of this long looked for locality coincides exactly with that given of it by Ptolemy, two thousand years ago.—*Bombay Times*, 1852.

A Mr. Rolle, who early in last winter had gained a point on the White Nile within 4½° of the equator, has sent back an account of his discoveries, with a map, which has reached the French Geographical Society. It appears from his account that the upper part of the Nile channel is surrounded by great mountains, which extend eastwardly from the southern Abyssinian range far toward the centre of the continent, in a line curving to the south. In these mountains are nourished the many streams whose reservoirs supply the inundations of the Nile, continuing as they do for months. Mr. Rolle finds in that country the tradition of a white people who formerly brought merchandise from the South; he supposes that these traders were Portuguese, and that they crossed the mountains by some pass which is yet to be discovered.

At about the same date with this communication a missionary, named Don Angelo Vico, was at a place which he calls Bellenia, on an eastern branch of the White Nile, between 4° and 5° north latitude. What with these travellers, and with others who are scattered over that continent, it must soon be thoroughly explored. Mr. Rolle speaks of the practice of the Egyptian Turks, who kidnap and enslave the natives of these remote regions, as hindering greatly the progress of both scientific investigation and of commerce.

PACIFIC RAILROAD ROUTE.

Major Emery, U. S. A., in a letter addressed to the American Association, on the boundary survey between the United States and Mexico, states, that if a railroad between the Mississsppi and the Pacific be seriously contemplated, a passage exists near the thirty-second parallel of latitude, by which snows are entirely avoided, and where no elevation requiring tunelling or stationary power, will have to be resorted to.

This line may commence any where on the Mississippi or Missouri, from Independence to the Gulf; but it must, before it reaches the Rocky Mountain chain, deflect sufficiently far to the south to turn the Guadaloupe mountains, which terminate on an elevated plain in Texas, about the parallel of 31°; there it will follow any of the various passes explored by Colonel Johnstone, of the Topographical Engineers, and Captain Marcy. Crossing the Del Norte about El Paso, it will follow a direction not far from the thirty-second parallel of latitude until it strikes the emigrant trail from Chihuahua; thence it will follow that trail, by easy descents, some one huudred and thirty miles, to the valley of the Gila river. The line will then pass along that river, without obstacle, to the junction of the Gila and the Colorado, where Nature has made the abutments for a passage, far above the reach of floods, in the huge Feldsphathic-granite portals through which these rivers pass at the moment of uniting. From this point three practicable lines present themselves, any of which may be chosen; and the choice will undoubtedly be made by the preponderating commercial influence which exists at the time, viz:

First: A line to the Gulf of California or the sea of Cortez. Second: Across the mountains to San Diego. Third: By the valley of the Tulare Lakes and the San Joaquin, to the valley of the waters of San Francisco Bay.

LIVINGSTON'S RESEARCHES IN SOUTH AFRICA.

At a late meeting of the New York Geographical Society, Mr. Leavitt read a paper from Rev. Mr. Livingston, English missionary in South Africa. Mr. L. had made two excursions in company with Capt. Oswald and another officer of the British army. Passing the lake Ngami and the river Zonga, in latitude 20° south, they passed in their journey due north across the dry bed of the Zonga. Here they found numerous salt-pans or ponds. The Bushmen abound near the springs. They are a merry and honest race. For three days Mr. Livingston was without water; travelling by night to avoid the heat. On the fourth day they struck a rhinoceros trail, and followed it to the river Mataba, a small stream. They reached the Chobe on the next day. This is a deep and very crooked river. Here they found a famous old chief, Sabatoae. His tribe is a very savage one. This old chief died while the travellers were there. They then went on to the Sesheke or Skiota, on horseback, a distance of 100 miles. This is an immense stream; 300 to 500 yards across in the dryest season. Ten days up the river is the seat of the Barotsi, once the most powerful tribe in that region. The river has many tributaries and some rapids. In this region there are many large rivers; the country is flat, and in the rainy season is flooded for many miles from the streams. The people here are very black, very large, and strongly developed, but peaceful. They are more ingenious than the Cape people. The Baloc tribes melt large quantities of iron, and are very good smiths.

From an examination of the recently constructed maps of this country, it is seen that the Zambesi (which is a very large river, emptying into the Mozambique Channel, by innumerable mouths, in latitude 18° and 19° south,) seems to divide into two great branches some 350 miles up; that these branches run west, and then for several hundred miles north; that the branches are something like 200 miles apart, and that the country between is a rich delta, since junction streams constantly run from one branch to the other, thus forming large islands inhabited each by a different tribe; that 700 or 800 miles from the ocean, the western branch of the Zambesi receives the Chobe, which is also a large river—the Ohio to this African Mississippi; that the sources of none of these rivers are as yet known; that south and west of the Chobe runs the Zonga, another very large river, neither end of which has been found, but it is supposed to empty into the Zambesi; that one or two hundred miles further south is the Limpopo river, also unexplored either way. It seems probable, from these documents, that there is a large and fertile region, well watered, wooded and peopled, on the spot generally set down as the lower part of a great desert, lying within a space bounded by longitude 20° and 35°, and latitude 10° and 20°.

A NINEVEH IN THE PACIFIC.

Captain Alfred K. Fisher, of Edgartown, has communicated to the Vineyard Gazette, of that place, a most remarkable story of the discovery of an ancient and deserted city, upon an island in the North Pacific Ocean. The following is the captain's statement:—

"When on his last whaling voyage, in the ship America, of New Bedford, which was about eight years ago, he had occasion to visit the island of Tinian, one of the Ladrone Islands, to land some sick men. He stopped there some days. One of his men, in his walks about the island, came to the entrance of the main street of a large and splendid city in ruins. Capt. Fisher, on being informed of the fact, entered the city by the principal street, which was about three miles in length. The buildings were all of stone, of a dark color, and of the most splendid description. In about the centre of the main street, he found twelve solid stone columns, six on each side of the street; they were about forty-five or fifty feet in height, surmounted by capstones of immense weight. The columns were ten feet in diameter at the base, and about three feet at the top. Capt. Fisher thinks the columns would weigh about sixty or seventy tons, and the cap-stones about fifteen tons. One of the columns had fallen, and he had a fine opportunity to view its vast proportions and fine architecture. From the principal street, a large number of other streets diverged. They were all straight, and the buildings were of stone. The whole of the city was entirely overgrown with cocoa-nut trees, which were fifty and sixty feet in height. In the main street, pieces of common earthenware were found. The island has been in possession of the Spaniards for a long time. Six or seven Spaniards resided on the island when Capt. F. was there. They informed him that the Spaniards had had possession about sixty years; that they took the island from the knackas (natives,) who were entirely ignorant of the builders of the city, and of the former inhabitants. When questioned as to the origin of the city, their only answer was, 'There must have been a powerful race here a long time ago.' Capt. Fisher also saw on the island immense ledges of stone, from which the buildings and columns had evidently been erected. Some portions of them exhibited signs of having been worked."

RELICTS OF ANCIENT NINEVEH.

During the past year, Mr. Layard, the explorer of Ancient Nineveh, has presented to the British Museum many additional curiosities, illustrating the domestic economy and customs of the ancient Assyrians. These principally consist of instruments and vessels of bronze and earthenware, several in a very perfect state of preservation, others thickly encrusted with rust and broken to fragments. The use of some of them is quite inexplicable for the present, and must be left for future ingenuity and study to discover. There are, however, bowls and vases, many richly chased; some dozens of earthenware studs of different shapes, supposed to be for harness; a very perfect bronze wine strainer, similar to those in use at the present day; the hinges of the gates of the palace; legs and feet of chairs; a curious mask of iron or bronze; richly ornamented bands of various kinds; a large wheel, or the bronze casting of it, broken into many pieces; one or two small glass vases of very beautiful colors; a quantity of cylinders about $1\frac{1}{2}$ inches in length, carved or inscribed, one or two of them of a substance resembling plumbago both in appearance and weight, but the greater part of them of earthenware; a statue of a priest in stone, about four feet high and much ornamented, and with the peculiarity that the figure has no cap or covering on its head, and is apparently bald; and lastly, several slabs of inscriptions.

The discoveries of Dr. Layard at Ninevah have, it is known, inspired the French with a strong desire to rival them. Recent accounts from M. Place, their consul at Mosul, state that within the last few months he has caused further excavations to be made at Khorsabad, and that the result of these has been the discovery of a number of colossal statues, bas-reliefs, (some of them brilliantly colored,) articles of pottery and jewelry, inscriptions &c.; together with further portions of the palace and its dependencies, one of the entrance gates to the city, an extensive colonnade in marble — of which twenty-eight columns have already been found. All these *trouvailles* are of great interest, especially those connected with the palace, as they prove the Assyrians to have been accomplished architects. But perhaps the most interesting discovery of all is the wine cellar of the old Assyrian kings, connected with the palace. In it were found rows of jars still standing in order, though many were broken and others filled with sand; and at the bottom of these jars was a deposite of a violet color, evidently left by wine. M. Place has also caused excavations to be made in different hills on the left bank of the Tigris within thirty miles of Khorsabad. These places are called Bachiccha, Karamtess, Teu-Leuben, Matai, Karacock, Digigan, Barrain, &c. In most of them he has found sculptures, vases, articles of jewelry, and small vessels in metal, stone, and even in gold. At Digigan, a large monument has been discovered, which it is thought may turn out to be equal in importance to the edifice of Khorsabad. At Mattai and Barrain numerous bas-reliefs have been found, some of them cut in the solid rock, about 150 yards above the level of the plain. Gigantic personages, and a train of Assyrian kings at full length, figure in them.

THE LOST TRAVELLER.

Among the numerous victims, distinguished travellers, whose lives have been sacrificed to the perils of African discovery, the world has almost forgotten that of the unfortunate Jacques Compagnon, who under the auspices of the Duke de Choiseul, left Senegal in 1758 to explore the country to the north and east of Senegambia, penetrated as far as the wooded desert of Simboni, where he was heard from in 1760, and then disappeared, never, it was supposed, to be heard from again. After ninety years of mystery and oblivion, however, the veil has been removed, and the secret of his fate has been disclosed by M. de Gaysa, a Hungarian explorer in Africa, from whom a letter has been received by the Imperial Society of Vienna, disclosing the discoveries which seem to place the fact beyond question, besides giving it a very interesting aspect. M. de Gaysa writes from the country of the Kommenis, a semi-civilized tribe, who have some religious notions "possessing a certain analogy with the Christian tradition, a regular language, an alphabet, and a mode of writing," all, or most of which, they appear, from their own account, to have derived from a stranger, a European, who died among them in 1775, and whose memory was revered as that of a sage or good genius. That this stranger was Jacques Compagnon, was proved by a number of circumstances, not the least conclusive of which was several personal relics, regarded by the people as sacred, one being a quadrant with his name engraved upon it in full. It would seem, from such accounts and traditions as M. de Gaysa was able to gather, that Compagnon was detained by the Kommenis, and, being reconciled at last to his captivity, devoted himself to instructing them in the useful arts. His tomb, consisting of "a little stone monument of a conical form, covered with an inscription in hieroglyphical characters," was pointed out to the Hungarian visitor in one of their principal villages.

HIEROGLYPHICAL DISCOVERY.

It appears from a paper recently read in the Academy of Archæology, at Rome, that Father Secchi has found a new interpretation of the Egyptian hieroglyphics, which enables him to declare that most of them are not mere tombstone inscriptions, as is generally assumed, but poems. He has given several of his readings, which display great ingenuity, and professes to be able to decipher the inscriptions on the obelisk of Luxor, at Paris.

ABORIGINES OF NICARAGUA.

According to a communication read at the American Association, by Mr. E. G. Squier, there still exists in the interior of Nicaragua, an Indian nation, who are descendants and representatives of the once numerous and powerful Aztec nation, from which they were originally a colony. They occupy what is now called the plain of Leon, or the district between the northern extremity of Lake Nicaragua and the Pacific. The name at present applied to them, is Nagrandians, or people of Nagrando. Mr. Squier states that he has procured a considerable number of words of their language, and on comparison, finds them to be almost precisely like the ancient Mexican. The numerals used also show great coincidences with the Mexican ones. Valdez, the Spanish historian, visited Nicaragua in 1526, and describes these people under the name of Niquirans, and says of them, "They speak the Mexican language, and have the same manners and appearance as the people of New Spain." There are other evidences of a social and religious character, which contribute towards strengthening the evidence of the present Indians being originally Mexicans, or Aztecs. We have, therefore, says Mr. Squier, the extraordinary phenomenon of a fragment of a great aboriginal nation, widely separated from the parent stock, and intruded among other and hostile nations; yet from the comparative lateness of the separation, or some other cause, still retaining its original distinguishing features, so as to be easily recognized. The causes which led to their migration from Mexico, can probably never be accurately known. They have a tradition that they came from the north-west: and that they left their original seats in consequence of having been overpowered by a hostile nation.

EARLY AMERICAN ARCTIC EXPEDITIONS.

It is stated in the New York Express, that the Grinnell expedition is not the first American expedition which has attempted to penetrate the Arctic seas. Three distinct expeditions in search of that *ignis fatuus*, a north-west passage to India, are on record in times past, but all anterior to the war of the revolution. Two of these were fitted out at the port of Philadelphia, and the third in Virginia. We believe that no account of these voyages has been handed down—certainly these events have not been incorporated in the histories of the country. The Express gives the following account of these expeditions:

"The name of the vessel in the first expedition, was the Argo, a small schooner of 150 or 200 tons. She was commanded by Capt. Charles Swaine. She sailed from Philadelphia in the spring of the year 1752, and returned on the 15th of November, in the year ensuing. The result of this adventure profitted neither science nor those who embarked in it. The vessel was unable to get beyond Davis's Straits, the weather being so terribly cold as to defeat all attempts to reach a higher latitude than 65 degrees north. The crew of the Argo all returned well, and the vessel with but little or no damage from ice. But, nothing dispirited by the unprofitable fruits of his first voyage, Captain Swaine determined to make another effort to discover the north-west passage. And so he set out again, in the same vessel, early in the following spring. This was in the year 1754. The only record we can find of his voyage is contained in the Pennsylvania Journal, October 24th, of that year; the whole history being embraced in the following meagre paragraph:—'On Thursday last,' it runs, 'arrived here the schooner Argo, Capt. Swaine, who was fitted out in the spring on a discovery of a north-west passage, but having three of his men killed by the Indians on the Labrador coast, returned without success.'"

Eighteen years subsequent to the arrival of the Argo, the Virginia expedition was started. The name of the vessel was the Dilligence, a brig of about the same tonnage as the Argo, under command of Capt. Wilder. Few particulars relative to this voyage have been preserved. All we know is, that on his return the Captain of the Dilligence reported that "he reached a large bay in latitude 69° 11′, which he supposed hitherto unknown; that from the course of the tides, he thought it probable there might be a passage through it; but as the bay was seldom free from ice, the passsge could seldom, if ever, be practicable." It is surmised that Capt. Wilder, in this attempt, succeeded in sailing through Davis's Strait into Baffin's Bay.

DISCOVERIES IN THE CATACOMBS OF ROME.

A French gentlemen of the name of Perret has been engaged for six years in exploring the catacombs under Rome, and copying, with the most minute and scrupulous fidelity, the remains of ancient art which are hidden in those extraordinary chambers, Under the authority of the papal government, M. Perret has explored the whole of the sixty catacombs together with the connecting galleries. Burying himself in this subterranean city, he has thoroughly examined every part of it, in spite of difficulties and perils of the gravest character: for example, the refusal of his guides to accompany him; dangers resulting from the intricacy of the passages, from the necessity for clearing the way through galleries choked up with earth which fell in from above almost as fast as it was removed; hazards arising from the difficulty of damming up streams of water which ran in upon them from above, and from the foulness of the air and consequent difficulty of breathing and preserving light in the lower chambers; all these, and many other perils, have been overcome by the honorable perseverance of M. Perret, and he has returned to France with a collection of drawings which extends to 360 sheets in large folio; of which 154 sheets contain representations of frescoes, 65 of monuments, 23 of paintings on glass (medallions inserted on the walls and at the bottoms of vases) containing 86 subjects, 41 drawings of lamps, vases, rings, and instruments of martyrdom to the number of more that 100 subjects, and finally 90 contain copies of more than 500 sepulchral inscriptions. Of the 154 drawings of frescoes two-thirds are inedited, and a considerable number have been only lately discovered. Amongst the latter are the painting on the celebrated wells of Platonia, said to have been the place of interment, for a certain period, of St. Peter and St. Paul. This spot was ornamented with frescoes by order of Pope Damasus, about A. D. 365, and has ever since remained closed up. Upon opening the empty tomb, by permission of the Roman Government, M. Perret discovered fresco paintings representing the Saviour and the Apostles, and two coffins [tombeaux] of Parian marble.

These vast subterranean cavities in the early ages of Christianity served as an asylum for persecuted believers, as a sacred place for the celebration of their holy mysteries, and as the burial place of dead believers. In after times, when the new religion had triumphed, and Christians were able to worship in public, the catacombs continued to be consecrated cemetries, and the piety of the popes and of believers took pleasure in enriching them with monuments and paintings, where the history of Christian art is found reproduced, epoch by epoch, during a long series of ages. By the discovery and restoration of these monuments, M. Perret connects ancient with modern art, and illuminates certain points of the history of Christianity. For instance, he has been enabled to establish in the clearest manner the origin of the traditional images of Christ, the Virgin Mary, the Apostles, and a great number of holy personages. In the catacombs of St. Calixtus, upon the Appian way, he has discovered the most ancient paintings known, in which are represented the person of Christ, and subjects taken from the Old and New Testaments. These paintings go back to the first and second centuries. Expiring paganism and the new religion are singularly mingled together there, and the transition is marked as clearly as possible. The subjects, for instance, are taken from the Old and New Testaments, but the distribution of the groups, the accessories, the whole aspect, and generally whatever appertains to the mode of execution, belongs to the yet flourishing pagan art. Christianity furnishes the subject, paganism the form. From age to age, in proportion as Christianity gains ground, this form is modified; new art seeks and finds new modes of representation. It now not only furnishes the thought; it expresses that thought in a language which is its own.

The collections, drawings, &c., of M. Perret have been purchased by the French Government and an appropriation of £7,500 made for their publication.

ANTIQUARIAN RESEARCHES IN WISCONSIN.

Mr. Lapham's surveys of the Indian mounds of the State of Wisconsin, which for some years he has prosecuted at the expense of the American Antiquarian Society, are brought to a conclusion. His report, accompanied with full and beautiful drawings of these singular monuments, will soon be published, under the direction of the Antiquarian Society, among the "Smithsonian Contributions." They form an appropriate addition to the volume by Messrs. Squier & Davis. These mounds in Wisconsin present in many instances the curious feature, not observed till a few years since, of outlines bearing a rude resemblance, on a gigantic scale, to different animal figures, — bears lizards, buffaloes, &c.

SCULPTURES FROM NINEVEH.

Williams College has recently received, through the instrumentality of Rev. Dwight N. Marsh, American Missionary at Mosul, two of the wonderful slabs excavated at Nineveh under the directions of Dr. Layard. The specimens are large, one being seven and the other seven and a half feet in height, are cast in bas-relief, and are covered with inscriptions of the old cuneiform character. Both represent human figures, one, however, bearing an eagle's head, the other that of a man. The slabs were necessarily sawn into several parts in order to allow of their transportation. They are said to be as great curiosities as any which have been sent to the British Museum, and the liberality of Dr. Layard is therefore the more highly to be praised. The slabs have actually arrived at the College.

RECENT EXPLORATIONS AND EXPEDITIONS IN THE ARCTIC REGIONS.

The Gold Medal of the Royal Geographical Society has been awarded to Dr. John Rae for his unexampled explorations of various parts of the Arctic regions. His survey of the Inlet of Boothia in 1848 was unique in its kind. With a boldness never surpassed he determined on wintering on the proverbially desolate shores of Repulse Bay, where one expedition of two ships had previously wholly perished, and two others were all but lost. There he maintained his party on deer, shot principally by himself, and spent ten months of an Arctic winter in a hut of stones, the locality not even yielding drift timber, with no other fuel than a kind of hay made of the *Andromeda* *tetragona*, he preserved his men in health, and thus enabled them to execute their arduous surveying journeys of upwards of 1000 miles in the spring. In his later journeys, in which he travelled more than 300 miles on snow-shoes, Dr. Rae has shown equal judgment and perseverance. Dreading, from his former experience, that the sea might be frozen, he determined on a spring journey over the ice, and performed a most extraordinary one. With a pound of fat daily for fuel, and without the possibility of carrying a tent, he set out accompanied by two men only, and, trusting solely for shelter to snow-houses, which he taught his men to build, accomplished a distance of 1060 miles in 39 days, or 27 miles per day including stoppages—a feat which has never been equalled in Arctic travelling; and this without the aid of advanced depots, and dragging a sledge himself a great part of the way. The spring journey, and that which followed in the summer in boats, during which 1700 miles were traversed in 80 days, have proved the continuity of Wollaston and Victoria lands along a distance of nearly 1100 miles, and have shown that they are separated by a strait from North Somerset and Boothia, through which the flood tide sets from the north.

Dr. Rae in his last boat expedition had not even the Arctic luxury of a cup of tea, but was well content to share the chance luck of the kettle with his crew. His greatest suffering, he once remarked to Sir George Back, arose from his being obliged to sleep upon his frozen moccasins in order to thaw them for the morning's use. The naval expeditions sent out in search of Sir John Franklin, have contibuted much to our knowledge of the geography of the Arctic regions. The expeditions at present engaged upon this duty are those of Capt. McClure and Collinson, and of Sir Edward Belcher. The former of these is engaged in researches to the Northeast of Behring's Straits, and having entered the ice in the summer of 1850, has not since been heard from. The object of Capt. McClure was to penetrate from the Asiatic to the American coast, or in other words, to accomplish the Northern passage from the Eastern side. The prolonged absence of this expedition is already a source of some anxiety. Sir Edward Belcher sailed from England in May, 1852, and at the last accounts had passed up Wellington Channel, which in August, 1852, was fortunately, entirely free from ice. Sir Edward Belcher's vessel is a screw steamer, and he has undoubtedly ere this, solved the problem of the existence of a great Arctic sea, free from ice. It was the resolve of Sir John Franklin, to penetrate if possible, by the northwest into an open polar sea, and to navigate it until he reached the longitude of Bhering's Straits. If then he really passed through Wellington Channel, and did gain such a sea, he may have made considerable progress westward, and if compelled to abandon his ships, he might have taken refuge on land, and be yet living on the natural produce of the region, but cut off from all communication with countries to which we have access. On this idea, mainly founded on the character of Franklin, a bold project was started by Lieut. Pim, an officer formerly engaged in Capt. Kellet's voyage of exploration. He proposed to travel over Siberia, to the extreme edge of the Russian settlements, (a journey which occupies the post six months,) then to traverse the wilds of the Tchuktchi race, and from their shores to pass over channels of water in india rubber or skin canoes, to tracks inhabited by the most Northern Esquimaux, and there endeavor to learn the fate of is countrymen. This plan was warmly supported by many of the most eminent scientific men of Europe, Humboldt, Erman, Col. Sabine, Murchison, and others; a considerable sum to aid in the defrayment of expenses was also granted by the English Government. Under these auspices, Lieut. Pim visited St. Petersburgh, to obtain the sanction of the Russian authorities. The report, however, of a council of Russian Officers was adverse to the enterprise. They represented that in order to enable travellers, furnished with instruments and interpreters, to travel the ultra-Siberian country of the Tchuktchi, previous arrangements of 18 months would be required to assemble the necessary quantity of dogs and sledges; and that as the former expedition undertaken thirty years since by Von Wrangel, and others, had, by withdrawing the use of many of the dogs, produced fatal diseases among the natives, and great mortality; such an expedition ought not to be undertaken without motives of overwhelming necessity. In short, being informed that such an expedition could not be put in motion before March, 1853, and being aware of the responsibilities which they would be led into, whether as respected their relation to the native tribes, or to the young British officers, whose life they thought would be uselessly perilled, the Russian Government declined to co-operate in the project. Permission was, however, given to Lieut. Pim to travel in Siberia in any direction. He was, however, compelled to abandon the enterprise, and has since sailed in the expedition of Sir Edward Belcher.

In regard to the probabilities of the existence of Sir John Franklin and his party, who have now been absent seven years, most of the English geographers cling to the hopeful, rather than the desponding view of Arctic chances. The able Arctic naturalists, Richardson and Scoresby, the experienced seaman Kellet, and the practical explorer of snow-clad lands, Rae, all coincide in the belief that animal food sufficient to sustain life may have been found. Capt. Ommanney, who explored in 1850–51 the coast line to the south of Cape Walker, found the land he traversed very sterile, and affording little animal sustenance. On the other hand it is clear from the testimony of many explorers, that animals do abound in much higher latitudes than those explored by Capt. Ommanney. It is an interesting fact, that this unequal distribution of the means of supporting life is coincident with the direction of the isothermal lines. It must also be remembered, that during the last century, three out of four Russian sailors returned in good health from an exile of more than six years on the desolate Island of Spitzbergen; and while we may be permitted to hope, that Sir John Franklin and party may have been equally fortunate with the Russian sailors, it must also be considered, that they may have been compelled to take refuge on coasts where few animals, save seals, could be procured, whence birds so numerous in summer would migrate during the long season of darkness and cold; and that under such untoward conditions, their energies possibly paralyzed by disease, we could scarcely suppose that even the most hardy of the brave men could have struggled on for any length of time.

The Isabel screw steamer, of 140 tons, returned in November from an Arctic voyage of exploration. This vessel was fitted out by Lady Franklin, with some private assistance, and penetrated further north by 100 miles in Baffin's Bay than any one has reached before. By this voyage, Whale Sound was pretty clearly ascertained to be an entrance into the Polar Sea, and the commander of the Isabel believes he actually entered the great Basin, and was checked in his course towards Behring's Straits by continued heavy gales, which drove him back into Whale Sound. This Sound lies in the northeast part of Baffin's Bay.

In reviewing the late polar researches, remarks Sir. R. I. Murchison, in a late address before the Geographical Society of England, it is singular, that the great sea between Spitzbergen and Nova Zembla, by far the widest,—indeed the only oceanic opening towards the North Pole,—should in this century have been comparatively so much neglected, and that nearly all recent efforts should have been accumulated upon the north shores of America, where every succeeding year has brought with it discoveries, not of open sea, but of numerous masses of land separated from each other by comparatively narrow channels of water. Mr. Peterman, an eminent physical geographer, has shown that, whether we look to the ascertained outlines of the land, the range of the isothermal lines in certain longitudes, the results of the annual summer debacles, issuing from the mouths of the gigantic rivers of Siberia, or to the great predominance of water, and with it a milder climate, it is to be infered that, if a steam vessel were to be steered, during the winter or spring months, directly north-east from the British Isles, she might pass into polar seas in a fortnight, or little more, without encountering any serious obstacle, and thus be soon in a position which other ships have been struggling to reach through defiles of land-locked water, encumbered with ice. This ingenious hypothesis seems to rest on some good preliminary data; for at Bear Island, beyond Icy Cape, in the high latitude of 74°, 30′, great mildness of climate was experienced by some seamen who passed the winter of 1823–4 in this locality; they encountered no severe cold, nor saw either packed or floating ice in the sea. Again, in August, 1827, Capt. Parry proceeded in spite of a powerful counter-current to the most northerly point (N. 82° 40′) ever reached in our day, and found no bottom to the sea at 500 fathoms depth, no land visible, and little ice with much rain. This modification of climate in so northern a latitude, is doubtless due to the predominance of water over land; the former tempering cold, the latter, when in great masses, producing it. It is then by the application of this distribution of heat and cold, which resulted in the establishment of the isothermal lines of Humboldt, as well as by attention to the fact of the vast icy masses of the North Siberian shores being held together to the land during winter, that Mr. Peterman has made the novel suggestion, that a winter, or early spring, search should be attempted through a belt of water which is too broad to be affected by congelation; and that this effort should be carried out at a time when this sea is not rendered impassable (as it is in summer) by floating fields of ice, proceeding from the Siberian shore.

Of one thing, however, all geographers feel well assured, that no practical north-west passage, as suggested by Cook, and contended for by Barrow, can be detected. Every new voyage to the North makes the mystery of these regions more mysterious. The history of these voyages, from Hudson's and Baffin's down to our day, could be truly told so as to present a series of paradoxes. The expeditions worst equipped have made the most remarkable discoveries. The best equipped expeditions have often returned with no accounts to give but those of disappointment. Again, it would hardly be too much to say, that almost every expedition has found land where the best guides in conjecture had made water almost certain, and water where wise men looked for land.

A single instance is Capt. Sir John Ross's expedition in Prince Regent's Inlet, where he was frozen up for four years, and lost his vessel. He and his nephew, now Capt. Sir *James* Ross, were together. They had the command of the party. After roughing it for four or five years there, they came home to England with exactly opposite notions of what they had discovered. John was sure there was no strait. James was sure there was. Duels have been fought in England, rising from this question. Sir John Barrow, the most learned man on these subjects in England, as one would have said, took sides with James. He even wrote a book, which he ended by correcting "the erroneous impression—founded on the most absurd nonsense—from which a conclusion is drawn, that a passage does not exist between Prince Regent's Inlet and the Polar Sea, which has since been proved to be wholly incorrect." He just got this book cleverly published, when Dr. Rae returned from those regions, having proved that John was right and James was wrong; that the "erroneous impression" was true, and that the "incorrect" demonstration was a correct one.

Sir John Ross himself, in this very expedition, had had to sail through a chain of mountains, which he laid down on the charts in his first expedition.

Inglefield's discoveries in the Isabel, referred to above, are among the most remarkable of the whole series. They were made the last summer in a little steamer of only a hundred and fifty tons, in four months' time. They make probable again the idea of the old geographers, that Greenland is a great island, and Baffin's Bay a great channel into the Northern Ocean.

Indeed, the modern discoveries have, in two or three notable instances, compelled the geographers to enter on their maps again the drawings of the old map-men, which had been omitted because no authority was known for them.

RECENT ASIATIC EXPLORATIONS.

The explorations and journeys of Drs. Hooker, Campbell, and others, in Tibet and Nepaul, have thrown much light upon the Himalaya and adjacent country. Dr. Hooker made two ascents of the mountain Bhonetso, (10,400 feet,) having one peak 28,178 feet in height, in full view to the south-west, and another 23,930 feet high to the south-east. Dr. Hooker's general observations on the geograpical distribution of plants from low hills to the loftiest mountains, are of the highest interest. Shrubby rhododendrons having been gathered at 17,500 feet; grasses, sedges, compositæ, and other tufted herbs at 18,000 feet, and lichens at 18,500 feet. In all his journeys, Dr. Hooker used successfully the most delicate meteorological instruments, and brought back safe to England his barometer, which, when compared with the standard instrument of the Royal Society, showed an error of only +.005.

Tertiary fossils have been discovered in the region of the Himalaya, at heights of from 10,000 to 15,000 feet, flanking the valleys of the Indus and its tributaries. Explorations made upon the coasts of Arabia have also shown that in addition to the granitic and other eruptive and crystalline rocks, which prevail so much in that country, there is also a series of sedimentary aqueous deposites, the lowest of which is a compact micaceous sandstone, overlaid by strata of the cretaceous period, and these by a very great thickness of the nummulite or lower tertiary formation, surmounted by younger tertiary deposites charged with corals, shells, and its like, approaching to, and identical with species now living.

An interesting work on the coasts of Arabia and the adjacent countries, has recently been published by Mr. Carter of the East India Company. Learned geographers will be gratified by this author's comparison of the present features of this country, with those described by Ptolemy and others, and by the accurate agreement of the distances mentioned by them, with the measurements of English surveyors. The Ichthyophagi of Arian are still the turtle-fed Arabs of Masira. Some incense ports of the ancient merchants are yet to be traced, and the aromatiferous regions of the ancients, both in Arabia, and on the opposite shores of Africa, may now be mapped out with great certainty. "One geographical discovery," writes Mr. Carter, "the passage round the Cape, destroyed the grandeur of the Arabian empire, and throwing open the commerce of India to the Europeans, deprived its people of their ancient office. Now Aden has been taken possession of, the old routes of commerce between the eastern and western nations, have again been established; but the Arabs are no longer carriers of that produce. They have become poor and divided among themselves, the religion of Mohammed is disappearing from among them fast, and they are returning to the heathenism and barbarity of their original state."

REPUDIATION OF AMERICAN DISCOVERIES BY ENGLISH GEOGRAPHERS.

The following is an abstract of a paper recently read before the National Institute, Washington, by Peter Force, Esq., on the English maps of Arctic discoveries in 1850 and 1851.

When the American Exploring Expedition, in 1840, discovered the Southern Polar Continent, (a discovery that had baffled the efforts of Europe for a century,) the discovery was repudiated by the commander of an English expedition, and excluded from English maps. The people and the press of this country submitted to the injury in silence, leaving it to time to do the discoverer justice. But this forbearance has only invited a repetition of the wrong. England has now repudiated the American discovery in the North in 1850.

The manner in which this has been done, is as follows: the unsuccessful efforts of the English explorers to find Sir John Franklin, induced Lady Franklin to appeal to America for aid in seeking for her husband and his companions. Her appeal was responded to by Henry Grinnell. He purchased vessels, which, with the countenance and aid of the United States Government, were sent to assist in the search. This munificent act of Mr. Grinnell is without a precedent. It was an undertaking by a private citizen of one country to seek out and restore to their homes, if possible, the officers and crews of the absent ships of another. None of Sir John Franklin's own countrymen came forward to do as much. Not a man was found in England, from prince to peasant, who was able and willing to send at his own expense, an expedition to search for the English ships and their crews, such as was projected and carried out by this great-hearted American. The American searching vessels were placed under the command of an officer of the United States navy, who had seen some ice service in the expedition that discovered Wilkes' Land on the Antarctic Continent.

Without entering into the details of the voyage of the American Expedition, which are generally known, it is sufficient to say, that on the 18th of September, De Haven was north of Cape Bowden, the most northern point seen by Parry in 1819, and further north within Lancaster Sound than has been attained to this day by any vessel of all the English exploring and searching expeditions.

His discoveries began at Cape Bowden, on the 17th of September. By the end of the month he was at 75° 25′ N. Here he saw hitherto unknown land to the east and west, and far off to the north beyond the land on the maps. Of this new-discovered land he gave names to Maury Channel, Grinnell Land, Mount Franklin, and other places around De Haven's Bay, which names none that came after him had a right to alter. He says:

"To the channel which appeared to lead into the open sea, over which the cloud of 'frost-smoke' hung as a sign, I gave the name of 'Maury,' after the distinguished gentleman at the head of our National

Observatory, whose theory with regard to an open sea to the north is likely to be realized through this channel.

"To the large mass of land visible between N. W. and N. N. E., I gave the name of 'Grinnell,' in honor of the head and heart of the man in whose philanthropic mind originated the idea of this expedition, and to whose munificence it owes its existence.

"To a remarkable peak bearing N. N. E. from us, distant about forty miles, was given the name of 'Mount Franklin.'

"The eastern shore of Wellington Channel appeared to run parallel with the western, but it became quite low, and being covered with snow, could not be distinguished with certainty, so that its continuity with the high land to the north was not ascertained."

The exclusion of the discoveries of Capt. Wilkes in the Antarctic Ocean from the charts of Capt. Ross, with all the circumstances relating to this exclusion, were remembered, but it was not supposed that an attempt of a like character could be made to set aside the American discoveries in the Arctic Regions; for that no vessel of, and no party from, the English Expeditions was, in 1850, at any position from which Grinnell Land could be seen, was a fact unquestionably established by their own reports of their proceedings. Yet it has been attempted. In England, on their maps, it has been accomplished. There, on the authority of the Lords of the Admiralty, De Haven's discoveries of 1850, have been set aside. The names of "Grinnell" has there been erased, to make room for that of Prince "Albert."

This was first done in a map published in the Illustrated London News; secondly, in an authorized chart appended to the report of the Government Arctic Committee, and issued by the Hydrographic office; and finally in two other Government charts, prepared officially under the inspection of the admiralty. The ground on which these alterations have been made, is that the same localities discovered and named by the Americans in September, 1850, were subsequently seen and named by Capt. Penny and others in land expeditions made in June, 1851. These alterations could not have been made through want of information respecting the American discoveries, as the reports and direction of De Haven's voyage, were published before the preparation of any of the maps refered to. Besides changing the names affixed by the American explorers, the Admiralty have changed or ignored the positions laid down on the charts of De Haven,—thus officially recording their unbelief in their correctness.

RESOURCES OF THE VALLEY OF THE AMAZON.

A MEMORIAL has been submitted to Congress by Lt. Maury, in behalf of a southern line of steamers, from Norfolk or Charleston, to open the commerce of the river Amazon. The basin of the Amazon and the adjoining rivers, (the Orinoco being connected by a natural canal,) is the largest and most fertile in the world. The valley of the Mississippi is estimated at about 982,000 square miles, that of the Amazon and its confluents at nearly 2,000,000 square miles. The range of littoral navigation in the southern waters is three or four times that of the northern continent. The Amazon is navigable for ships of largest burden far into the interior, and Lieutenant Maury says that a 74 gun ship may anchor at the foot of the Andes. There are 1500 miles of furos or natural canals, besides the usual river navigation. The Mississippi, rising near 50° north latitude, runs south, with ever-varying climate, scenery, and products, collecting on its waters every species of merchandise till it reaches the tropics. In the Gulf of Mexico the products of the Amazon meet those of the great river of North America; commencing with sugar, the list of products includes coffee, cochineal, cocoa, cotton, wax, caoutchouc, gum, drugs, resin, and woods of great variety and value. The importance of connecting these two rivers by trade, cannot be estimated, and the Americans may look to this new region as their "Indies" of wealth and commercial enterprise.

PATENTS.

According to the report of the Secretary of the Interior, if the number of models sent to the Patent Office increases in proportion to past experence, they will amount to 150,000 by the close of the present century, and the whole of the Patent Office edifice will not be sufficient for their convenient display. "The number of models in the office" on the 1st day of January, 1836, was 1,069. In the beginning of the year 1851 they had increased to 17,257, and at the close of the year 1852 they fall a little short only of 23,000. In view of these facts the Secretary recommends "that the Commissioner of Patents be required to have prepared for publication a careful analytical and descriptive index of all discoveries and inventions which have been patented, accompanied by accurate descriptions and drawings which will fully explain the principles and practical operation of the subject of the patent. The advantages of such a publication would be almost incalcuable. It would not only perpetuate the invention or discovery by avoiding the casualities by fire and other causes, but it would multiply and diffuse among the people at large the specifications and descriptions, and substantially bring home to every neighborhood to which a copy of the work might be sent the benefits of the Patent Office. Inventors in remote parts of the country would be placed on an equal footing with those residing near the seat of government. When their thoughts were turned to a particular class of machinery, instead of being compelled to make a journey to Washington to see what had already been done in that department of the arts, they could at once turn to the analytical index and ascertain what progress had been made by others.

"Under the present system it not unfrequently happens that the ingenious persons having conceived what they believe to be a new idea, which, when carried into practice, will be of great value, employ much of their time, labor and money in perfecting their invention, and when it is finished they come to Washington filled with the hope of those rewards which crown the labors of the successful inventor. Their application for a patent is presented and submitted to an experienced and skilful examiner, who promptly refers the anxious applicant to a drawing or a model, which shows him that his ideas have been anticipated by another, and reduced to practice many years before. None of those who have taken pains to inquire into the subject can form any adequate idea of the amount of time, money, and labor which is uselessly expended under such circumstances like these, to say nothing of the anxiety of mind and heart. sickening disappointment, all of which might be saved if such a descriptive index as I propose were readily accessible to the public. The publication of it would also tend to stimulate the inventive genius of the country, and lead not only to the development of new agents and processes, but to valuable improvements upon those which have already been brought into practical operation. It is hardly necessary to add that such a work would be of great value in the investigation of courts of justice of legal controversy involving the rights of patentees.

"When the index is completed up to the close of the present year, it will be easy by an annual publication of an appendix to the ordinary report from the Patent Office to furnish a complete record of the inventions and discoveries of each successive year."

"To be of value, such an index should be prepared by a person fully competent to the task, and illustrated and printed, and bound in a style worthy of the subject and of the nation. It would, doubtless, be attended with a large expense, but it could readily be paid out of the patent fund, without encroaching on the national treasury, and I can conceive of no purpose to which that fund could be applied which would be more acceptable to inventors, and in all respects so appropriate, as in perpetuating and diffusing the knowledge of their labors, and presenting to the public a full description of the existing condition of the mechanic arts and the kindred branches of science in our country."

TABLE SHOWING THE NUMBER OF PATENTS, RE-ISSUES, DESIGNS, AND ADDITIONAL IMPROVEMENTS, GRANTED AT THE PATENT OFFICE IN WASHINGTON DURING THE YEAR 1852.

Whole number of Patents,	885
Re-issues,	21
Designs,	106
Additional Improvements,	2
Total,	1,014

TABLE SHOWING THE NUMBER OF PATENTS ISSUED TO CITIZENS OF DIFFERENT STATES DURING THE YEAR 1852.

Maine,	7	North Carolina,	1	Indiana,	16
New Hampshire,	18	South Carolina,	2	Illinois,	24
Vermont,	18	Georgia,	7	Missouri,	4
Massachusetts,	148	Alabama,	2	Florida,	0
Connecticut,	52	Mississippi,	4	Texas,	0
Rhode Island,	18	Louisiana,	2	Iowa,	3
New York,	339	Arkansas,	2	Wisconsin,	1
New Jersey,	21	Tennessee,	6	California,	2
Pennsylvania,	159	Kentucky,	6	District Columbia,	8
Delaware,	2	Ohio,	81	Foreign,	25
Maryland,	18	Michigan,	7	Total,	1,014
Virginia,	11				

OBITUARY

OF PERSONS EMINENT IN SCIENCE. 1852.

Philander Anderson, an eminent American engineer, constructor of the great dam, Holyoke, Mass.

Woods Baker, Assistant United States Coast Survey, died of injuries received at the explosion of the Reindeer, Hudson River, September, 1852.

Prince Maximillian Beauharnais, of Russia, somewhat distinguished as a chemist and naturalist.

M. Fleurian de Bellevue, a French mineralogist, member of the Academy.

Jacob Bell, of New York, the builder of the celebrated steamships Atlantic, Pacific, etc.

Captain Brown, R. N., inventor of chain bridges and suspension piers.

George Buchanan, an eminent Scottish engineer.

Prof. Buchner, a distinguished chemist, Munich, Germany.

Robert Byrson, F. R. S., an eminent mechanician of Scotland.

Prof. Chipman, Professor of Mineralogy, Horton College, Nova Scotia, drowned while on a scientific expedition.

William Clark, a distinguished member of the Institution of Civil Engineers, England.

Isaac Cullimore, an eminent English writer on the cuneiform language of the Asyrians, and on the Antiquities of Egypt.

Prof. Couper, an English mechanic and chemist, well known for his connection with the Great Exhibition, and his improvement on the power-press.

John Dalrymple, an English surgeon, celebrated for his researches on the eye.

M. Dize, an eminent French chemist.

George Dolland, the eminent London optician.

Alfred Dolman, an English explorer of South Africa; murdered by the Hotentots.

A. J. Downing, the eminent American horticulturalist; drowned at the burning of the Henry Clay, Hudson River.

Dr. Drake, author of the Diseases of the Valley of North America.

Dr. Eisenstein, the successor of Jacobi in the Academy of Berlin, and the most eminent mathematician of Germany.

M. Gannal, the discoverer of the modern process of embalming.
William Gardner, an eminent Scottish botanist.
John B. Gluck, Assistant United States Coast Survey.
William H. Grant, Professor of Anatomy, Pennsylvania Medical College.
Mr. Grainger, an eminent British engineer, President of the Scotch Society of Arts, killed on a railroad.
M. Gruithuisen, an eminent astronomer attached to the University of Munich, Germany.
John Haviland, an eminent architect of Philadelphia, and originator of the celebrated Pennsylvania system of prison discipline.
Baron Hessinger, a well known Swedish writer on mineralogy and geology, and the early patron of Berzelius.
William Honiball, inventor of the so-called "Porter's Anchor."
William Howe, inventor of the celebrated railroad bridge bearing his name.
John Jex, an eminent self-taught English mechanician and inventor.
Prof. Walter R. Johnson, of Washington, D. C.
M. de Krusenstein, an eminent Russian geographer aud navigator.
Baron Langdorff, of Baden, an eminent German botanist.
Edward Lassell, Professor of Chemistry, Williams College.
Dr. Gideon A. Mantell, LL. D., F. R. S., the distinguished British geologist.
Dr. Herbert Mayo, F R. S., a distinguished English physiologist.
Sir James McAdam, author of the project of McAdamizing roads.
Prof. William Mc Gillivray, a Scottish naturalist of eminence, author of the "History of British Birds."
Prof. John P. Norton, Professor of Agricultural Chemistry, Yale College.
Frederick Overman, an eminent mining engineer; died from the effects of the inhalation of arsenureted hydrogen.
Dr. Plaff, Professor of Natural Philosophy, University of Kiel, Germany.
Dr. Achille Richard, a French botanist.
M. Rochoux, a French writer of celebrity; author of a treatise on apoplexy, etc.
Prof. James Rogers, Prof. of Chemistry, University of Pennsylvania.
Prof. Schouw, of Copengagen, an eminent Danish botanist.
J. F. Stephens, President of the British Entomological Society.
John L. Stephens, an eminent American traveller, author and antiquarian.
Thomas Thompson, Professor of Chemistry in the University of Glasgow, and author of the well known work "Thompson's Chemistry."
William Thompson, an eminent Irish naturalist.
Baron Walckenær, Vice President of the Royal Geological Society of France.
Frank Forster, an eminent English engineer.
Capt. Edwin Forbes, celebrated for researches in Western Africa, especially in Dahomey.
John Frost, of Brooklyn, author of the *Stame* Theory.

LIST OF BOOKS, PAMPHLETS, &c.,

ON MATTERS PERTAINING TO SCIENCE, PUBLISHED IN THE UNITED STATES DURING THE YEAR 1852.

The whole number of books published in the United States during the year 1852, *was twelve hundred and eighty-eight. Of these, three hundred and twenty-two were reprints of English publications and translations, and nine hundred and sixty-six were original works.*—NORTON'S LITERARY REGISTER.

MECHANICS AND USEFUL ARTS.

Acts of Congress relating to Steamboats. Little & Brown, Boston.
Agricultural Reports to the Legislature of Massachusetts, 1852.
American Polytechnic Journal. Page, Greenough & Co., Washington.
Elwood's Grain Tables. Cary, Philadelphia.
Guthrie, Sam'l. Memorial on the cause of Steam Boiler Explosion. Pub. Doc.
Griffths, J. W. Ship Builder's Manual. Stephenson, N. Y.
Johnson, B. P. Report to the Legislature of New York, on the Great Exhibition of 1851.
Milburn, M. M The Cow-dairy, Husbandry and Cattle Breeding. Saxton, New York.
Minifie's Mechanical Drawing-book. Baltimore.
Norris, S. Handbook for Locomotive Engineers. Baird, Philadelphia.
Nystrom, J. W. On Screw-propellers and their Engines. Baird, Philadelphia.
Patent Office Report for 1851. Mechanical. Ewbank. Pub. Doc.
" " " " Agricultural. " " "
Sloan, Sam'l. Model Architect. Jones & Co., Philadelphia.
Stuart, Charles B. Naval Dry Docks of the United States. Norton, New York.
Templeton's Engineer. Millwright's and Mechanical Companion. Appleton's N. Y.

PHYSICS.

Bartlett, Prof. W. H. Elements of Natural Philosophy. Barnes, New York.
Dick, Rev. Thomas. The Telescope and the Microscope. Lane & Scott, New York
Electrotype Manipulations. Baird, Philadelphia.
Hunt, Robert. Photography. Humphrey, New York.
Jenks, Capt. R. W. The Brachial Telegraph. Sanders & Co., New York.
Lardner, Dr. D. Hand-book of Natural Philosophy. Lea & Blanchard, Philadelphia.
Mahan, Prof. H. D. Elementary Course of Civil Engineering. Wiley, New York.
Perkins, G. R. Plane Trignometry and its Applications. Appleton, New York.
Pierce, Prof. Benj. On Curves and Functions. Munroe & Co., Boston.
Sestini, Prof. A Treatise on Analytical Geometry. Washington, D. C.
Smee, Alfred. Elements of Electro-metallurgy. Wiley, New York.
Turnbull, Laurence M. D. Lecture on the Electro-magnetic Telegraph, with an Historical account of its Rise and Progress. Philadelphia.
Transactions of the American Philosophical Society.
Wythes, Rev. Jas. Curiosities of the Microscope. Lindsay & Co., Philadelphia.

CHEMISTRY.

Biddle, J. B. Review of Materia Medica. Lindsay & Co., Philadelphia.
Byrn, M. L. Adulterations of Food and Drink. Lippincott & Co., Philadelphia.
" " Complete Practical Brewer. Baird, Philadelphia.

Dana, Dr. Samuel L. Report on the Value and use of Rosin Oil. Lowell.
Graham, Prof. Thomas. Elements of Chemistry.
Knapp's Technology Vol. 3. Balliere, New York.
Lieber, Oscar. The Assayer's Guide. Baird, Philadelphia.
Morfit, Campbell, Arts of Tanning and Leather Dressing. Baird, Philadelphia.
Mortimer, S. W. The Pyrotechnists Guide. Baird, Philadelphia.
McMuller, Thomas. Hand-book of Mines. Cowperthwait & Co., Philadelphia.
Mullaly, John. Adulteration of Milk. Fowler & Wells, New York.
McCulloh, R. S. Report to the Secretary of the Treasury on the Refining of Gold with Zinc.
Overman, F. Practical Treatise on Metallurgy. Appleton, New York.
Pharmacy, New York Journal of.
Silliman, B. Jr. Elements of Chemistry. New Edition, enlarged. Loomis & Peck, New Haven.
Solly, Ed. Rural Chemistry. Baird, Philadelphia.
Sidney, Rev. E. Philosophy of Food and Nutrition. Lane & Scott, New York.
Woehler. Analytical Chemist's Assistant, translated by Leber. Baird, Philadelphia.

GEOLOGY.

Adams and Gray. Elements of Geology. Harpers, New York.
Foster and Whitney. Second Geological Report on the Mineral Regions of Lake Superior. Pub. Doc.
" " Maps of Geological Surveys of Lake Superior Mining Districts. Pub. Doc.
Lea, Isaac. On the Fossil Saurian of the New Red Sandstone of Pennsylvania.
" " On the Fossil Footmarks of Red Sandstone of Pottsville, Pennsylvania.
Loomis, Prof. Elements of Geology. Gould & Lincoln, Boston.
Lynch, Lieut. Scientific Report of the Dead Sea Expedition. Nat. Observatory.
Owen, Dr. D. D. U. S. Geological Survey of Iowa, Wisconsin and Minnesota. Pub. Doc.
Shepard, Prof. C. U. A treatise on Mineralogy, 448 illustrations. New Haven.
Review of Jackson's Report on the Albert Coal Mines. By a Fellow of the London Geographical Society, New York,

ZOOLOGY AND BOTANY.

Adams, Prof. C. B. Catalogue of Shells collected at Panama, with notes on their synonomy and geographical distribution.
Annals of the Lyceum Natural History of New York.
Broderip, W. J. Leaves from the Note-book of a Naturalist. Scribner, New York.
Buchannan, Robert. Culture of the Grape and Strawberry. Moore, & Co., Cincinnati.
Buckley and Burgess. Manual of Diseases of the Skin. New York.
Dickson, Dr. S. H. Essays on Life, Sleep, Pain, &c. Lea & Blanchard, Philadelphia.
Eights, James, New Species and Genera of Crustacea.
Girard, C. Monograph of the Freshwater Cottoids of North America. Smithsonian Contributions.
Gould, Dr. A. A. United States Exploring Expedition. Mollusca.
Harvey, Prof. W. H. History of the Marine Algæ of North America. Smithsonian Contributions.
Journal of the Essex Co. (Mass.) Natural History Society.
Kidder, D. P. The Curiosities of Animal Life. Lane & Scott, New York.
Lambert, Dr. Third Book on Anatomy and Physiology. Alden & Co., New York.
Lea, Isaac. Synopsis of the Family of the Naiades. Lea & Blanchard, Philadelphia.
" " Observations on the Genus Unio, with descriptions of New Species. Phil.
Leidy, Dr. J. On the Osteology of the Hippopotamus. Philadelphia.
Nelligan, J. M. Practical Treatise on Disease of the Skin. Lea & Blanchard.
Nuttall, Thomas. Supplement to Michaux's American Sylva. Smith, Philadelphia.
Watters, J. H. An Essay on Organic or Life Force. Lippincott & Co., Philadelphia.
Warren, Dr. John C. Mastodon Giganteus. Boston.

ASTRONOMY AND METEOROLOGY.

American Almanac, 1853. Little & Brown, Boston.
American Nautical Almanac for 1855. Vol. 1. Pub. Doc. C. H. Davis.
Annals of the Astronomical Observatory at Georgetown, D. C. Dunigan, New York.
Brooks, Rev. C. The Tornado of 1851 in Medford, Mass.
Guyot, A. Meteorological Tables. Smithsonian Publication.
Hind, J. R. The Solar System. Putnam, New York.

Kiddle, H. Manual of Astronomy and Use of Globes. Newman, New York.
Maury, Lieut. Winds, Currents, and Sailing Directions. New Edition. Nat. Observatory.

MISCELLANEOUS.

Braithwaite's Retrospect of Practical Medicine. Stringer & Townsend, New York
Bulletin of the American Geographical Society, New York.
Bonynge, Francis. The Future Wealth of America; or, the Resources of the United States, and its Commercial and Agricultural Advantages.
Collections of the Massachusetts Historical Society.
" " New Jersey " "
Eckfield & Dubols. American Coins and Coinage. Putnam, New York.
Fishborough, William. The Macrocosm and the Microcosm. Fowler & Wells, New York.
French, B. F., Historical Collections of Louisiana.
Guyot, A. Mural Map of North America. Gould & Lincoln, Boston.
Girard, Charles. American Zoological, Botanical, and Geographical Bibliography for 1851.
Hall, Dr. A. G. Views of the New Theory of Disease.
Hayden, William B. Science and Revelation. Otis Clapp, Boston.
Humboldt, Baron. Cosmos, Vol. 4. Harpers New York.
Kendrick, John Ancient Egypt under the Pharoahs. Redfield, New York.
Nash. J. A. The Progressive Farmer. Saxton, New York.
Proceedings of the American Association, Albany Meeting for 1852. S. F. Baird.
" " American Academy, Boston.
Rankin, W. C. Half-yearly abstract of the Medical Sciences. Lindley & Co., Philadelphia.
Report of the Regents of the New York University, on the New York State Cabinet.
" " " " " " 65th Annual.
" of the Congressional Committee Vindicating Claims of Dr. Morton for the Discovery of Ether.
Report of the " " " " " of Dr. C. T. Jackson, for the Discovery of Ether.
Report of the Smithsonian Institution for 1851.
Ruschenberger, Dr. Origin, Progress, and Present Condition of the Academy of Natural Science at Philadelphia.
Smithsonian Contributions to Knowledge. Vols. 3, 4
Smith, J. Hamilton. Annals of Science. Periodical, weekly. Cleveland, Ohio.
Stansbury, Capt. Howard. Expedition to the Great Salt Lake. Pub. Doc.
Timbs, John. Year Book of Facts. Hart, Philadelphia.
Wells, David A. Annual of Scientific Discovery, 1852. Gould & Lincoln, Boston.
Worcester, J. E. An Historical Atlas. John Bartlett, Cambridge.
Williams, A. D. The Isthmus of Tehuantepec. Appleton, New York

GENERAL INDEX.

THE END.

ANNUAL OF SCIENTIFIC DISCOVERY.

NOTICES OF THE PRESS.

"Nothing which has transpired in the scientific world during the past year, seems to have escaped the attention of the industrious editors. We do not hesitate to pronounce the work a highly valuable one to the man of Science."—*Boston Journal.*

"This is a highly valuable work. We have here brought together in a volume of moderate size, all the leading discoveries and inventions which have distinguished the past year. Like the hand on the dial-plate, 'it marks the progress of the age.' The plan has our warmest wishes for its eminent success."—*Christian Times.*

"A most acceptable volume."—*Transcript.*

"The work will prove of unusual interest and value."—*Traveller.*

"We have in our possession the ledger of progress for 1849, exhibiting to us in a condensed form, the operations of the world in some of the highest business transactions. To say that its execution has been worthy of its aim is praise sufficient."—*Springfield Republican.*

"To the artist, the artisan, the man of letters, it is indispensable, and the general reader will find in its pages much valuable material which he may look for elsewhere in vain." - *Boston Herald.*

"We commend it as a standard book of reference and general information, by those who are so fortunate as to possess it."—*Saturday Rambler.*

"A body of useful knowledge, indispensable to every man who desires to keep up with the progress of modern discovery and invention."—*Boston Courier.*

"Must be a most acceptable volume to every one, and greatly facilitate the diffusion of useful knowledge."—*Zion's Herald.*

"A most valuable and interesting popular work of science and art."—*Washington National Intelligencer.*

"A rich collection of facts, and one which will be eagerly read. The amount of information contained within its pages is very large."—*Evening Gazette.*

"Such a key to the progress and facts of scientific discovery will be everywhere welcomed."—*New York Commercial Advertiser.*

"A most valuable, complete, and comprehensive summary of the existing facts of science; it is replete with interest, and ought to have a place in every well appointed library."—*Worcester Spy.*

"We commend it to all who wish what has just been found out; to all who would like to discover something themselves, and would be glad to know how: and to all who think they have invented something, and are desirous to know whether any one else has been before hand with them."—*Puritan Recorder.*

"This is one of the most valuable works which the press has brought forth during the present year. A greater amount of useful and valuable information cannot be obtained from any book of the same size within our knowledge."—*Washington Union.*

"This important volume will prove one of the most acceptable to our community that has appeared for a long time."—*Providence Journal.*

"This is a neat volume and a useful one. Such a book has long been wanted in America. It should receive a wide-spread patronage."—*Scientific American, New York.*

"It meets a want long felt, both among men of science and the people. No one who feels any interest in the intellectual progress of the age, no mechanic or artisan, who aspires to excel in his vocation, can afford to be without it. A very copious and accurate index gives one all needed aid in his inquiries."—*Phil. Christian Chronicle.*

"One of the most useful books of the day. Every page of it contains some useful information, and there will be no waste of time in its study."—*Norfolk Democrat.*

"It is precisely such a work as will be hailed with pleasure by the multitude of intelligent readers who desire to have, at the close of each year, a properly digested record of its progress in useful knowledge. The project of the editors is an excellent one, and deserves and will command success."—*North American, Philadelphia.*

"Truly a most valuable volume."—*Charleston (S. C.) Courier.*

"There are few works of the season whose appearance we have noticed with more sincere satisfaction than this admirable manual. The exceeding interest of the subjects to which it is devoted, as well as the remarkably thorough, patient and judicious manner in which they are handled by its skilful editors, entitle it to a warm reception by all the friends of solid and useful learning."—*New York Tribune.*

COMPARATIVE

PHYSICAL AND HISTORICAL GEOGRAPHY,

OR THE STUDY OF

THE EARTH AND ITS INHABITANTS.

A SERIES OF GRADUATED COURSES FOR THE USE OF SCHOOLS.

BY ARNOLD GUYOT.

Late Professor of Physical Geography and History, at Neuchatel, Switzerland, Author of "Earth and Man," etc.

G., K. & L. are happy to announce that the above work, which has been undertaken in compliance with the earnest solicitations of numerous teachers and friends of education, is in a forward state of preparation. The plan of the author, and the principal characteristics of this series may be gathered from the following exposition of the subject :

A knowledge of the globe we inhabit, whether considered in itself alone, or in its relations to man, the distribution of the races of men, and the civil divisions of its surface, are subjects of interest too varied, too direct, and too vital, not to command the attention, and excite the sympathy of the mind at every period of life.

If Geography has been considered a dry and often fruitless study,—if indeed, to teach it with success has been considered as one of the most difficult problems in education, there is reason to believe that the difficulty lies not in the subject but in the method of teaching it.

In most manuals the accumulation of facts, and especially the want of an arrangement of them, really corresponding to their connection in nature, renders the study difficult, and overburdens the memory at the expense of a true and thorough understanding of the subject. Hence there is confusion and a want of clear and comprehensive views, and consequently a lack of interest for the student. For, if the mind seeks to comprehend, it is only interested in what appears clear and well connected. To attain to this end it is necessary—

First. To attempt a rigid selection of materials, and to reject from school instruction all details which have but a transient value, and, on the other hand, to render facts of permanent value prominent ; preferring, for instance, the details of Physical Geography and of Ethnography, to those of Statistics, which may find a larger place elsewhere.

Second. To distribute geographical instruction throughout the whole course of education, so as to divide the labor of learning, and to give at the same time to each period of life the nutriment most appropriate for its intellectual taste and capacity. To this end, the globe should be studied from the different points of view successively ; graduating each view to the capacity of different classes of students. At first, the fundamental outlines, alone, should be presented, and next, not only additional facts, but a deeper understanding of the connection, and so on ; and thus, by a regular and natural path, a full and intelligent knowledge of the globe in all its relations, will be finally attained.

Third. The comparative method, recently adopted with so much success in Europe, should always be employed ; for it is by the recognition of resemblances and differences that the mind seizes upon the true characters, and perceives the natural relations, and the admirable connection, of the different parts which form the grand whole ; in a word, gains real knowledge.

The series hereby announced is designed to meet these wants. It will consist of three courses adapted to the capacity of three different ages and periods of study. The first is intended for primary schools, and for children of from seven to ten years. The second is adapted for higher schools, and for young persons of from ten to fifteen years. The third is to be used as a scientific manual in Academies and Colleges.

Each course will be divided into two parts, one of purely Physical Geography, the other for Ethnography, Statistics, Political and Historical Geography. Each part will be illustrated by a colored Physical and Political Atlas, prepared expressly for this purpose, delineating, with the greatest care, the configuration of the surface, and the other physical phenomena alluded to in the corresponding work, the distribution of the races of men, and the political divisions into States. Each part with the corresponding maps will be sold separately.

The two parts of the first, or preparatory course, are now in a forward state of preparation, and will be issued at an early day.

Also, in preparation, by the same Author,

A SERIES OF ELEGANTLY COLORED MURAL MAPS,

EXHIBITING

THE PHYSICAL PHENOMENA OF THE GLOBE,

PROJECTED ON A LARGE SCALE, FOR THE RECITATION ROOM.

THE POPULAR

CYCLOPÆDIA OF BIBLICAL LITERATURE.

CONDENSED FROM THE LARGER WORK.

BY JOHN KITTO, D. D.,

AUTHOR OF "HISTORY OF PALESTINE," "DAILY BIBLE ILLUSTRATIONS," ETC.

ASSISTED BY NUMEROUS DISTINGUISHED SCHOLARS IN EUROPE AND AMERICA.

Octavo. 812*pp.* *With more than Three Hundred Illustrations.* *Price, cloth,* $3,00.

THE POPULAR BIBLICAL CYCLOPÆDIA OF LITERATURE is designed to furnish a DICTIONARY OF THE BIBLE, embodying the products of the best and most recent researches in biblical literature, in which the scholars of Europe and America have been engaged. The work, the result of immense labor and research, and enriched by the contributions of writers of distinguished eminence in the various departments of sacred literature, has been, by universal consent, pronounced the best work of its class extant, and the one best suited to the advanced knowledge of the present day in all the studies connected with theological science.

This work, condensed by the author from his larger work in two volumes, is not only intended for ministers and theological students, but is also particularly adapted to parents, Sabbath-school teachers, and the great body of the religious public. It has been the author's aim to avoid imparting to the work any color of *sectarian* or *denominational* bias. On such points of difference among Christians, the *historical* mode of treatment has been adopted, and care has been taken to provide a fair account of the arguments which have seemed most conclusive to the ablest advocates of the various opinions. The pictorial illustrations — amounting to more than three hundred — are of the very highest order of the art.

EXTRACTS FROM LETTERS.

From Rev. J. J. Carruthers, D. D., Pastor of Second Parish Cong. Church, Portland, Me.

By far the most valuable boon presented to the Christian public for many years. The condensation of the work, at little more than a third of the price, is, what it professes to be, a condensation, a reduction, not of ideas, but of words, without in the slightest degree obscuring the meaning of the gifted authors.

From Rev. Daniel Sharp, D. D., Pastor of Third Baptist Church, Boston.

A most valuable, as it was a much needed, publication. Every minister ought to have a copy of it on his study table. As a book of reference, shedding its collected light on almost all scriptural subjects, and furnishing a brief, but clear and compendious history of the most remarkable events and personages mentioned in the Bible, it cannot fail of being a great help. Every lover of God's word, not to say every Sabbath-school teacher, and every theological student, will find treasures of information in the above-named work.

From Rev. Joel Hawes, D. D., Pastor of First Congregational Church, Hartford, Ct.

A capital work, containing a vast amount of information on a great variety of subjects, in a very condensed, yet clear and interesting form. Every family and every Sabbath-school teacher, wishing to understand the Bible, should possess this work.

From Rev W. B. Sprague, D. D., Pastor of Second Presbyterian Church, Albany, N. Y.

I regard it as the most important auxiliary to the study of the Scriptures, among the great mass of people, of which I have any knowledge. Every Sabbath-school teacher, and indeed every Christian, who is able to do so, ought to possess himself of the work; and the fact that such a work is in existence, may well be regarded as one of the favorable signs of the times in regard to the progress of evangelical knowledge.

From Rev. J. B. Waterbury, D. D., Pastor of Bowdoin St. (Congregational) Church, Boston.

It is a most valuable book, suited to the wants of clergymen, and well adapted to aid Sabbath-school teachers in their responsible work. Every family that can afford it, would do well to possess themselves of so important and interesting a volume; to which they might refer in elucidating the Scriptures, and rendering their study not only profitable but delightful.

KITTO'S CYCLOPÆDIA OF BIBLICAL LITERATURE.

From Rev. E. N. Kirk, Pastor of Mount Vernon Congregational Church, Boston.

The work is invaluable to the student of the Bible. We have no other in this department to be compared with it, for condensing the results of modern researches or Oriental antiquities and topography, which are so valuable in explaining the language of the Bible.

From Hon. Thomas S. Williams, Hartford, Ct.

A mass of information, in a condensed form, highly important to those who regard the sacred volume; and to Sabbath-school teachers it will prove a most valuable assistant.

From Hon. Edward Everett, LL. D., Boston.

I have kept it on my table, and have frequently referred to it; and it has been a good deal read by different members of my family. I unite with them in the opinion that it is a valuable work, well adapted for the above-named purpose. It appears to embody, in a popular form, the results of much research, and will promote, I doubt not, the intelligent reading of the Scriptures.

From Hon. George N. Briggs, LL. D., Pittsfield, Mass.

To all who read and study the Bible it will be found to be a work of surpassing interest and utility. In families and in the hands of Sabbath-school teachers, its value and importance can hardly be over-estimated. Its explanations of the habits, customs, and religious rites of the Hebrews and the surrounding nations, are clear and important; and the light which it throws upon the biography, geography, and history of the Old and New Testament develops in those inspired volumes new beauties, and inspires a higher admiration for that Book of books, and a profounder reverence for its Divine Author. I wish there was a copy of it in every family in the land.

From Jared Sparks, LL. D., President of Harvard College.

I am glad to possess the work; and I enclose three dollars, which I understand to be the price of it.

From Hon. Theodore Frelinghuysen, LL. D., New Brunswick, N. J.

I regard it as a very valuable help to the student of the Bible. It brings to the aid of the reading community, in an instructive and condensed form, a rich treasure of historical and biblical literature, prepared and arranged by some of the best minds, and which could otherwise be gained only by a laborious and patient research, that very few have the leisure to give to the subject. No family would, I think, ever regret the purchase of a book so deserving of a household place.

From Hon. John McLean, LL. D., of Ohio.

It is only necessary to look through this volume to appreciate its value. There is no work I have seen which contains so much biblical knowledge, alphabetically arranged under appropriate heads, in so condensed a form, and which is sold so cheap. Under a leading word is to be found in this book, whether it relate to natural science or scriptural illustration, enough to satisfy every inquirer. Next to the Bible, this dictionary of it contains more interesting knowledge than any work of the same size, and it should be found in every family, in our public schools as well as in all our academies and colleges.

From Hon. Simon Greenleaf, LL. D.

A book that will prove highly useful to all persons engaged in the study of the Bible, or in teaching its sacred truths to the young. I hope, therefore, that it will be widely circulated.

From Hon. Robert C. Winthrop, LL. D., Boston.

I have examined with great pleasure your edition of Kitto's Popular Cyclopædia of Biblical Literature. It seems to me a most convenient and valuable aid to the study of the Scriptures, and I am glad that you have been able to publish it at so reasonable a price. It can hardly fail to commend itself to those who would teach, and to those who would learn, something more than the mere letter of the inspired volume.

From Henry J. Ripley, D. D., Author of "Notes on the Scriptures," and Professor in Newton Theological Institution.

It would be invaluable to Sabbath-school teachers, and of great utility to preachers. It every where shows evidence of research, and is particular and accurate in its details. It employs appropriate authorities, both less and more modern, as to questions of sacred criticism, of history and geography, and gives the reader the results of recent learned investigations. If the purpose of this book is gained, scriptural *knowledge will be increased.*

Valuable School Books.

ELEMENTS OF POLITICAL ECONOMY. By Francis Wayland, D.D., President of Brown University. Fifteenth Thousand. 12mo. cloth. Price $1.25

"His object has been to write a book, which any one who chooses may understand. He has, therefore, labored to express the general principles in the plainest manner possible, and to illustrate them by cases with which every person is familiar. It has been to the author a source of regret, that the course of discussion in the following pages, has, unavoidably, led him over ground which has frequently been the arena of political controversy. In all such cases, he has endeavored to state what seemed to him to be truth, without fear, favor, or affection. He is conscious to himself of no bias towards any party whatever, and he thinks that he who will read the whole work, will be convinced that he has been influenced by none." — *Extract from the Preface.*

POLITICAL ECONOMY, ABRIDGED, by the Author, and adapted to the use of Schools and Academies. Seventh Thousand. 18mo. half morocco. Price 50 cents.

*** The success which has attended the abridgment of "The Elements of Moral Science" has induced the author to prepare an abridgment of this work. In this case, as in the other, the work has been wholly re-written, and an attempt has been made to adapt it to the attainments of youth.

"The original work of the author, on Political Economy, has already been noticed on our pages; and the present abridgment stands in no need of a recommendation from us. We may be permitted, however, to say, that both the rising and risen generations are deeply indebted to Dr. Wayland, for the skill and power he has put forth to bring a highly important subject distinctly before them, within such narrow limits. Though 'abridged for the use of academies,' it deserves to be introduced into every private family, and to be studied by every man who has an interest in the wealth and prosperity of his country. It is a subject little understood, even practically, by thousands, and still less understood theoretically. It is to be hoped, this will form a class-book, and be faithfully studied in our academies; and that it will find its way into every family library; not there to be shut up unread, but to afford rich material for thought and discussion in the family circle. It is fitted to enlarge the mind, to purify the judgment, to correct erroneous popular impressions, and assist every man in forming opinions of public measures, which will abide the test of time and experience." — *Boston Recorder.*

"An abridgment of this clear, common sense work, designed for the use of academies is just published. We rejoice to see such treatises spreading among the people; and we urge all who would be intelligent freemen, to read them." — *New York Transcript.*

"We can say, with safety, that the topics are well selected and arranged; that the author's name is a guarantee for more than usual excellence. We wish it an extensive circulation." — *New York Observer.*

"It is well adapted to high schools, and embraces the soundest system of republican political economy of any treatise extant." — *Daily Advocate.*

THOUGHTS on the present Collegiate System in the United States. By Francis Wayland, D.D. Price 50 cents.

"These Thoughts come from a source entitled to a very respectful attention; and as the author goes over the whole ground of collegiate education, criticising freely all the arrangements in every department and in all their bearings, the book is very full of matter. We hope it will prove the beginning of a thorough discussion."

PALEY'S NATURAL THEOLOGY. Illustrated by forty plates, and Selections from the notes of Dr. Paxton, with additional Notes, original and selected, for this edition; with a vocabulary of Scientific Terms. Edited by John Ware, M.D. 12mo. sheep. Price $1.25.

"The work before us is one which deserves rather to be studied than merely read. Indeed, without diligent attention and study, neither the excellences of it can be fully discovered nor its advantages realized. It is, therefore, gratifying to find it introduced, as a text-book, into the colleges and literary institutions of our country. The edition before us is superior to any we have seen, and, we believe, superior to any that has yet been published." — *Spirit of the Pilgrims.*

"Perhaps no one of our author's works gives greater satisfaction to all classes of readers, the young and the old, the ignorant and the enlightened. Indeed, we recollect no book in which the arguments for the existence and attributes of the Supreme Being, to be drawn from his works are exhibited in a manner more attractive and more convincing."
Christian Examiner.