Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

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

TERMS.

One copy, one year, postage included....................$3 20

One copy, six months, postage included.................. 1 60

Club Rates:

Ten copies, one year, each $2 70, postage included..................$27 00

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VOLUME XXXII., No 10. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, MARCH 6, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

REPORT OF THE COMMISSIONER OF PATENTS.

The annual report for the year 1874, which has recently been published, presents a very satisfactory statement of the transactions of the Office during that time, and of its present condition. There have been 13,599 patents issued, which exceeds the number for any other year except that of 1869. There have been some extraordinary expenditures, but the revenues have been sufficient to meet all these, leaving a balance of $58,989.76.

The *Official Gazette*, which among other things has superseded the annual Patent Office reports, has the advantage over its predecessor of furnishing from week to week a brief description of the patents which have been issued during the week then ended, setting forth at least the titles, claims, and drawings of such patents, instead of delaying till the end of the year, and several months, and sometimes a year or two, longer, before such information used to be communicated to the public. A charge of six dollars a year must, however, be met by those who would avail themselves of this information instead of receiving it gratuitously, as was formerly done through the annual reports.

A very great improvement has recently been introduced by placing the illustrations in each case in immediate proximity with the respective descriptions and claims. This was done in 1853, but for some reason was afterwards discontinued and a different rule substituted. It is much superior in point of convenience.

We are promised a general index of all the patents issued from 1790 to 1873 inclusive. This index is to consist of two sets of three volumes each: the one of these sets containing an alphabetical list of the names of all the patentees, and the other an index of the subject matter of all the patents that have been issued. These will be of great service. The aggregate cost of both sets, being forty dollars, will, however, probably prevent their being widely disseminated except in some of our principal libraries.

The Commissioner suggests the propriety of making the *Official Gazette* to a considerable extent a business paper by rendering it a medium for advertising. If there are no political objections to such a course, we see none other of sufficient importance to prevent its being adopted. The precedent of thus rendering one of the bureaus of the Interior Department not only a publishing house, but also a competitor for advertising patronage, will probably not be long continued without exciting formidable objections to the proposed practice.

In the necessity of a thorough and systematic revision of the patent law, as set forth in the report, we heartily concur, and trust that such a measure will not long escape the attention of Congress. The present law is full of incongruities and imperfections, which loudly call for the hand of thorough reformation. It is in many important respects far more objectionable than the law which it superseded.

But with regard to the Commissioner's idea of providing for an appeal in cases of the allowance of a patent as well as in those of rejections, we see a very grave objection. How would such an arrangement be successfully conducted? The same rule should be made applicable to all cases. Every patent that is allowed by an examiner should be brought before another tribunal for revision. A double examination would thus become necessary in all cases. If the examiners are fit for their positions this is superfluous; and if they are not it would be pernicious. The wrongful granting of a patent is less harmful than the wrongful refusing of one. If it be said that the examiners who review the first decisions should be men of more ability and experience than they who make those decisions, then we say, discontinue the latter and let the better examiners decide in the first instance.

Practically the present arrangement is in substance the same as the Commissioner proposes in all doubtful cases. The first examinations are usually made by the assistant examiners. If there is any doubt as to the patentability of the subject matter of the application, a rejection is usually the result. A second examination is then called for, which brings the matter before the principal examiner. If the Commissioner, will establish the rule that no patent shall be allowed to issue until the matter is presented to the principal examiner for his approval, he will have what he desires, and without any additional complication or expense. No Patent will in that case issue without a review of the decision of the Officer who makes the first examination, whether the patent be allowed or rejected.

The importance of rendering a patent unimpeachable was long since brought to the attention of Congress by a former Commissioner as will be seen by reference to the Patent Office report for the year 1855. Whether any such plan is practicable, without entailing more injury than benefit, is a matter of no little doubt, but one which is well worthy of serious consideration by the law-making power.

As to the wisdom or efficacy of the competitive examination of candidates for appointment or promotion, we have very grave doubts. A man of superficial abilities will generally, on such an examination, far outshine another of far more sterling and useful qualities. A fresh graduate from a college, with no experience and perhaps but little common sense, would often, on such an examination, surpass the most experienced and useful examiner to be found in the Office. Nothing but a thorough trial, or the exercise of a very sound discretion on the part of the appointing power, will lead to a wise conclusion in such cases. We do not think that such a conclusion can generally be reached through a competitive examination.

PROGRESS AND PROSPECTS OF SOLAR CHEMISTRY.

Several important circumstances unite to give unusual interest to the solar eclipse to occur in April next. The progress of solar chemistry has brought investigators face to face with problems of universal reach and significance, for the solution of which the four minutes of obscuration will be more valuable than as many years of laboratory work. A new instrument, the siderostat, destined, it is thought, to effect a great revolution in astronomical observation, will immensely increase the efficiency of spectrum photography; and the conditions under which the eclipse will be visible promise better opportunities for the observation of totality than can be enjoyed again before the close of the current century, or, more precisely, April 16, 1893. In not one of the four total eclipses which occur in the meantime—1878, 1882, 1886, 1887—or in that of 1900, will the duration of totality be so great, or the central line of the eclipse present stations so favorable for observation. A glance at the grander results accomplished during recent eclipses—following chiefly an elaborate review of the work in a late issue of the London *Times*—may help to make clear the grounds on which the expectations of the present are based.

Between the eclipse of 1860—during which photography decided the long vexed question of the origin and place of the strange red prominences seen round the dark body of the moon at the moment that the sun's disk is covered—and the eclipse of 1868, the spectroscope had revealed the approximate composition of the sun's atmosphere, taken as a whole. The great point to be determined in 1868 was not simply the place and shape of the prominences, but their material. The result is well known, namely, that they consisted of glowing gas, or a mixture of such gases, shot to immense hights through the solar atmosphere.

Almost simultaneously with this discovery, it was found that the prominences could be studied spectroscopically independently of eclipses; and observers were not long in finding out that, outside the bright round face of the sun, was an envelope of glowing hydrogen—the chromosphere—into which magnesium and sodium, and, more rarely, iron and other heavy metals, were injected from below, in the form of a vapor. It was further ascertained that the gases and vapors were not all mixed up together, but that the lightest, such as hydrogen, magnesium, and sodium, were generally at top; and that, as the others were shot up from time to time, some more frequently than others, the heavier were, as a rule, located lower down in the solar atmosphere than the other.

During the eclipse of 1869, the results of previous observations were confirmed; the halo of light outside the prominence envelope was photographed, and it was established that an unknown gaseous element extended beyond the hydrogen, hitherto accounted the lightest form of matter. The green line, by which this substance is distinguished, has not as yet been identified with that of any terrestrial element.

Great preparations were made for the observation of the great eclipse, 1870; but the weather was bad, and, though results of considerable value were obtained, nothing strikingly important was decided. Better fortune awaited the observers of the eclipse of 1871. The corona was photographed, under nearly the same instrumental conditions, from three different places, and the similarity of the pictures proved, beyond all doubt, that part of the corona was a solar appendage. Evidence was obtained, making it extremely probable that the light of the outer parts of the true solar corona—the coronal atmosphere, as Janssen proposed to call it—was stronger in the violet and ultra violet parts of the spectrum than elsewhere. And it was further established that, for some distance above the hydrogen envelope, as seen without an eclipse, less bright hydrogen existed. The inference was that the chromosphere—or lower atmosphere of the sun—consisted of brighter hydrogen and other vapors.

Since 1871 the spectroscopic study of the chromosphere has been carried on vigorously under the clear sky of Italy, and the clearer sky of our mountain observatory in the Far West. Through this thin atmosphere, 9,000 feet above the sea, Professor Young has been able to study a much more complicated chromosphere than appears to observers lower down. Among other things, he has found that, along with magnesium, there frequently appears the vapor of the metal calcium, the principal characteristic lines of which can be seen only under the most perfect atmospheric conditions. In the meantime, extensive laboratory researches have been undertaken for the elucidation of the phenomena observed in the chromosphere. It has been proved that, in the case of any one metal present in the sun, the metal behaves exactly the same in the sun's atmosphere as it does when driven into vapor by the passage of the electric current between the carbon poles of an electric lamp, thus making it possible to interpret many appearances in the chromosphere, which would otherwise be inexplicable: as for instance, the almost complete spectra of hydrogen, the metals of the alkalies and alkaline earths, and the metals of the iron class, while such metals as zinc and lead show only a few lines. The metals of the tungsten, antimony, silver, and gold classes show no traces of existence in the sun's atmosphere; nor do the metaloids, such as oxygen, carbon, nitrogen, sulphur, and the like, which make up more than half of the parts of our planet, so far as known. It would appear, however, that the presence of the latter may be inferred. In fact, it has been claimed that we have, in the solar system, exactly such a record as we should expect if this large class of bodies existed in a comparatively cool part of the atmosphere, at a hight above the hotter lower strata. It is also claimed that granting this, it is possible to explain the various classes of stars by supposing that, as a star grows older and colder, the metaloids are enabled to exist lower down in the atmosphere, and thus to change the character of the spectra of stars bright and hot into that associated with those which are dim and possibly colder; until at last the metaloid rain, so to speak, falling on the metals below, gives the material of a future crust.

Associated with these chemical questions are physical questions of the greatest interest, the solution of which will help to make clear the development of our Universe from nebulæ to suns and worlds. How far the coming eclipse will further the inquiry remains to be seen. It is confidently expected that the result to be accomplished will be the "fruit and crown" of the work begun in 1860, and carried on with so much zeal by all civilized governments since that time.

The course of the central line of this eclipse is mainly a sea track, yet, in its passage from the Nicobar islands, in the Bay of Bengal, to Siam, it crosses several points that will afford good stations for observation. At Kaikul, in the island of Camorta, totality will continue four minutes twenty-seven seconds. On Bentinck Island, the maximum duration of totality will be four minutes seventeen seconds; at Mergui, four minutes six seconds; at Tenasserim, three minutes fifty-seven seconds; near Bangkok, Siam, to which point astronomers have been invited by the King, the total eclipse will last three minutes fifty-four seconds.

AN IMMENSE TELEGRAPHING ESTABLISHMENT.

The Western Union Telegraph Company moved into their new building, at the corner of Broadway and Dey street, in this city, on the first of February. Moving a large business of any kind from one place to another is usually a troublesome affair, but the peculiarities connected with this business rendered the moving a matter of more than ordinary complication. A merchant can send the fixtures and goods to the new store, and only loses the time required for rearranging them. The telegraph company, however, must continue sending messages from one building as long as it is occupied, and on moving to new quarters must find everything ready for carrying on the work. The wires cannot be shifted from the old building to the new, but a new set must be provided, and a considerable number of new instruments must be in position before any of the old ones can be taken down. So we find that the most of the apparatus and arrangements in the new quarters of the company are also new. We made an examination of the building, a few days after its occu pation, and found so much to please and interest us that we propose to give a short description of it to our readers.

The messages are received and delivered in the basement, and the operating room is in the seventh story. When a message is delivered to a receiving clerk, he puts it into a pasteboard cylinder, drops the latter into a pipe, the upper part of which is connected with an exhaust blower, and the message is sent to the operating room without much loss of time. When an operator in the room above receives a dispatch from abroad, he writes it out and delivers it to a clerk to copy. It is then put into an envelope and addressed, and dropped through a tube to the basement, where it is given to a boy for delivery to the person for whom it is intended. These arrangements seem to work very satisfactorily, and interested us exceedingly. The operating room, however, excited our greatest admiration, and it seems to have been designed to please the eye as well as for the efficient performance of the work. Nearly 400 wires are brought into this room and connected with the instruments, which are generally operated by sound; though there are a few printing instruments, in addition to those of the Gold and Stock Telegraph Company. The batteries are on the sixth story, occupying the greater part of this floor, and give the visitor, who knows the effects that can be produced with even a few cells, a very vivid idea of the company's business. Any one who gets up to this hight in the building should continue his ascent until he stands on the roof surmounting the clock tower, for the sake of the magnificent view. Standing in this position, the beholder seems to be almost on a level with the spire of Trinity church, and the city and its environs present somewhat the appearance of an enormous map.

On retracing his steps, the visitor will do well to take a trip in the water balance elevator, and notice how smoothly and quickly it works. The principle by which the car is moved is exceedingly simple. It is balanced over a large pulley by an iron bucket which is connected to it by a rope. If water be admitted in the bucket, it descends and raises the elevator car; if the water is let out, the car descends, and can be held at any point of its path, by the application of a friction clutch. In this brief sketch, we have merely glanced at the prominent features peculiar to the building, which, in design and construction, will bear comparison with the many other elegant structures in New York, and is an ornament to that part of the city in which it is located.

A NEW STYLE OF BOOK-MAKING NEEDED.

There are few books which have more than a temporary life or a temporary value. Like the daily newspaper, nine books out of every ten, perhaps ninety-nine in the hundred, serve a present purpose, are read and thrown aside. This leaving out of the account the great mass of books which have no purpose and are never read. Even of standard books in science or literature, new editions are constantly superseding the old, and though the work itself be immortal, the individual copies have but a brief existence. Today the book stores are full of the "latest edition;" tomorrow you will find a copy only in out-of-the-way places, or on the shelves of second-hand dealers. In a short time the fireplace or the paper mill have made an end of all but the struggling copies in unused libraries. Not one copy in a million is worn out by use, yet most books are printed and bound as though they were to be used for ever.

The direct consequence is that a man who has to read, say a hundred books a year—and he will have to do something like that to keep up with the drift of thought in its various departments—such a man will have to pay for a hundred bindings which he does not want, a hundred packets of thick paper which he has no use for, and an uncertain but certainly large bill of charges for carriage, handling, and the like, which might for the most part be avoided. A secondary consequence is that few men can afford to buy many books, and those who do buy have to stand the excessive cost of small editions.

It is no doubt more satisfactory to the booksellers to handle a few books at a large price than a multitude of cheap ones, the profit being the same, and naturally they favor that method of publishing. Nevertheless we believe that the successful book maker of the future will print for the million as well as for the few, and be the gainer by it. We believe, too, that any responsible firm which should enter at once upon the work of printing good books, especially scientific books, so that they could be sold for a quarter the price now asked for books of the kind, would achieve a splendid success. But they would have to print editions of a hundred thousand.

The book publisher prints an edition of a thousand copies, say of Helmholtz's "Essays," charges two dollars or two and a half a copy, and loses money. The magazine publisher puts into a pamphlet a greater amount of matter at an immensely greater cost, taking illustrations and all into account, prints fifty or seventy-five thousand copies, and makes a profit, selling them at one tenth the price of the book. Printed on thin yet clean white paper, on type the size of that of this page, the book could be sold in like quantity, unbound, for the price of the magazine, and at a greater profit, the first cost being so much less.

We have taken an extreme case, a book not calculated to be very popular, believing that the market for even such books might be indefinitely increased were they offered cheap enough. A work like Draper's "Conflict of Religion and Science" would outsell any magazine at the same price.

Of course an enterprise of this sort would have to be conducted with great discretion—as every new venture must—and possibly with a preliminary outlay like that involved in starting a successful magazine. The first issue might not pay at once, nor the second, nor the third. It would take time to convince the public of the real existence of the enterprise, and to prove itself worthy of confidence; this done, its success would be morally certain.

The comparative failure of several excellent series of nominally cheap scientific publications is no ground for doubting the success of a more liberal scheme such as we have suggested. The little pamphlets in question have really been very dear. Containing not a tenth as much matter as a Harper's or Scribner's *Magazine*—chiefly reprint matter at that—their price has been twenty-five cents. Printed on heavy toned paper and prettily covered, they were undoubtedly worth twenty-five cents as things go: but the mass of readers have no money to spare for such luxuries. At ten cents a copy, the pamphlets would find thousands of buyers where they now find a hundred.

Said a prominent publisher to the writer not long ago: "The book business has seen its best days. Men do not read books any longer, they read the papers and magazines." In view of this change of habit in the reading world, the proper thing for the book makers to do is to change their habits accordingly. To a limited extent, high-priced, handsomely bound books will always be called for, but not by the multitude. To reach the masses, the book makers will have to meet the publishers of periodicals on their own grounds, and give an equal amount of matter for the same price, and give it when it is wanted.

To the objection that newspapers and magazines have their advertising pages to help them, it need only be said that a book in pamphlet form will carry advertisements just as well as a magazine; and with as large a circulation assured, the advertising pages would be just as valuable.

WHAT ARE BACTERIA?

Truly a question of Life and Death! In their microscopic field of existence, the great battle of biology, the problem of life's beginning, must be decided. So, too, one of the greatest problems of pathogenesis hinges on their origin and effects. Are they or are they not the cause of endemic and so-called "specific" contagious diseases?—a class of diseases which have been aptly described as distinguishing one country from another, one year from another; which have formed epochs in history, and, as Niebuhr has shown, have influenced not only the fall of cities such as Athens and Florence, but of empires; which decimate armies and disable fleets; take the lives of criminals which justice has not condemned; redouble the dangers of crowded hospitals; infest the habitations of the poor, and strike the artizan in his strength down from comfort to helpless poverty; carry away the infant from the mother's breast, the old man at the end of life, and fall with excessive fatality on strong men in their prime and vigor.

What are bacteria?

Four answers have been given to this question. Ehrenberg's, that they are animal organisms of the lowest grade having an individuality of their own; Hallier's, that they are of the nature of spores, produced from and destined to develope into some of the simpler microscopic fungi; Cohn's, that they represent the free-swiming stage in the existence of certain algæ; Bastian's, that they are the first and most common developmental phase of newly evolved living matter, capable, either singly or in combination, of developing into many different kinds of living things.

Ehrenberg's view is quite obsolete. They are not animals, nor are all agreed that they are vegetables. For these and other doubtful organisms of the lowest rank, Haeckel has proposed a new kingdom—the *protista*, intermediates between and connecting the animal and vegetable kingdoms, and from the modification of which both animals and plants have been derived. Barring the last clause, the proposition bids fair to be generally adopted, as it relegates to a sort of no-man's land a group of organisms in which animal and vegetable characteristics are so united that they cannot be classed with either animals or vegetables.

All that is positively known of the origin of these organisms is that they speedily make their appearance in all infusions of organic substances exposed to light and air, and under other conditions not so clearly understood. The smallest—usually globular—specks, ranging between a one-hundred-thousandth and a one-twenty-thousandth of an inch in diameter, have been variously denominated monads, microzymes, and plastide particles. According to Bastian, who adopts the last name, they are merely temporary and initial forms of many organizations which may afterward present distinct characteristics of their own; though some of them, through default of necessary conditions, may never actually develope into higher modes of being. From those which do continue their development, he holds, bacteria and other forms, which others have thought specific, are produced by a direct process of growth and development. In size and character, these bacteria and others differ according to the degree of putrescibility of the solution in which they appear, the amount of heat to which it has been exposed, and other modifying conditions. From this point of view, a rigid specific classification is uncalled-for and impossible.

According to Hallier's view, the smallest living specks of living matter—he calls them micrococci—are minute particles of plasma or naked matter produced by the repeated subdivision of the nuclei of fungus spores, or by the breaking-up of the protoplasmic contents of the larger reproductive cells of certain fungi. When introduced into a fluid capable of undergoing alcoholic fermentation, these micrococci, he says, develop into cryptococci, bodies resembling ordinary yeast cells; in an acid fluid, or one which becomes acid through fermentation, the micrococci assume the elongated forms commonly called bacteria, but which he names anthrococci. The first and the last named multiply by fission, while the cryptococci increase by a process of budding. By an elongated growth, the anthrococci are described as developing into distinct fungi of the oïdium type.

Thus, determined by the nature of the fluid in which they grow, micrococci are said to develope either at once into *torulæ* cells from which a perfect fungus may result, or into *bacteria*, which develop into segmented filaments and thence into distinct fungi of a different type. The various fungi so developed are supposed by Hallier to be capable of reproducing micrococci, as already described, and so completing the circle of life: an hypothesis which seems to have no other foundation than a desire to escape the necessity of admitting the origin of micrococci *de novo*.

Cohn classifies more extensively. By his latest scheme bacteria are divided into four groups and six genera, as follows:

I. Sphæro-bacteria	Genus	1 Micrococcus
II. Micro-bacteria	"	2 Bacterium
III. Desmo-bacteria	"	3 Bacillus
	"	4 Vibrio
IV. Spiro-bacteria	"	5 Spirillum
	"	6 Spirochæta

The first group appears to correspond with the micrococci of Hallier and the plastide particles of Bastian. They are exceedingly minute darkish or colored granules, frequently presenting the appearance of beaded chains. The whole group is divided by Cohn into three sections—the chromogens, the micrococci of pigmentation; the zymogens, those of ferment; and the pathogens, those of contagion. The chromogens have been the means of producing miracles, by causing bread to exude blood under "supernatural" circumstances, as in the instances described by Rivolta. Among the pathogen micrococci are *m. vaccinæ*, observed by Chauveau and Sanderson in vaccine lymph; the *m. dipthericus*, to which diphtheria is attributed, and *m. septicus*, found in the milary eruptions of typhus, pyæmia, and some other diseases. Lebert mentions also small pox, septicæmia, mycosis intestinalis, and puerperal infectious diseases, as characterized by the presence of members of this group.

The true bacteria Cohn divides into two species, *b. termo* and *b. lineola*. The first are the "dumb bell" bacteria, so called from their shape. Their length is about one nine-thousandth to one twelve-thousandth of an inch, and they move with a slowly vacillating motion. These Cohn regards as essentially the ferment of putrefaction, and is doubtful whether putrefactive changes can take place without them. *b. lineolæ* are rod-shaped and somewhat larger. They move with a somewhat stronger and more rapid to-and-fro motion. Lebert says they are constantly present in malignant pustule, They are regarded as essentially the ferment of sour milk.

The desmo-bacteria, or linked rods, as their name implies, are divided into two genera—bacillus, with transversely lined filaments, and vibrio, with filaments cylindrical and curved. The first Cohn divides into three species: (1.) *B. subtiles*, a slender, supple thread found in stale boiled milk; length one five-hundredth of an inch. It has a pausing motion, like that of a fish forcing its way through reeds. (2.) *B. anthracis*, an immovable, oblong, highly refractive body found in the blood of animals having carbuncle; length one ten-thousandth to one two-hundredth of an inch. It is occasionally found in chains of two or three links, and is remarkable for being unaffected by water, alcohol, ether, acetic, nitric, or phosphoric acid, soda, potassa, or ammonia. Sulphuric acid readily destroys it. (3.) *B. ulna*, which is distinguished from (1) by the greater thickness of its filaments and by its rigidity; length one six-hundred-and-fiftieth of an inch. It is found in the stale infusion of boiled egg. The vibrios are distinguished from the bacilli by their rotary motion. *V. rugula*, a curved, flexible thread one twenty-five-hundredth to one twelve-hundredth of an inch long, is found in the evacuations of cholera, diarrhœa, etc. Its rotation is slow. *V. serpens* is distinguished by the greater number and regularity of its curves, by the rigidity of its filament, and its more rapid motion; length about one two-thousandth of an inch.

The last group embraces the corkscrew bacteria. The three species of spirilla are distinguished chiefly by their relative size, the great regularity and closeness of their curves, and their uniform corkscrew motion. Lebert associates spiral bacteria with relapsing fever.

Whether bacteria are really responsible for the various maladies attributed to them is a question which involves too many considerations to be discussed in this connection.

The Diamond Drill in Dentistry.

At a recent meeting of the First Judicial District Dental Society, W. G. A. Bonwill recommended the diamond drill for the permanent separation of the incisors. The shape is pyramidal. It makes about five thousand revolutions per minute, and, in consequence of its extreme rapidity, causes not the least pain, even when cutting upon the most delicate enamel. Working so rapidly and perfectly, it will cut through or over the surface of the poorest fillings, without disturbing them in the least.

What Two Dollars Did.

W. J. Sanderson, of Syracuse, says that a two-line advertisement, which he put in the SCIENTIFIC AMERICAN a few weeks ago, brought him replies from all parts of the country, repaying him a hundredfold.

THE imperfections of the diamond, and in fact of all gems, are made visible by putting them into oil of cassia, when the slightest flaw will be seen.