Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

☞ Messrs. Trubner & Co., 60 Paternoster Row London, are also Agents of the SCIENTIFIC AMERICAN.

☞ Messrs. Sampson Low, Son & Co., Booksellers, 47 Ludgate Hill, London, England, are the Agents to receive European subscriptions or advertisements for the SCIENTIFIC AMERICAN. Orders sent to them will be promptly attended to.

VOL. XVIII., No. 25....[NEW SERIES.]..*Twenty-third Year.*

NEW YORK, SATURDAY, JUNE 20, 1868.

Contents:

(Illustrated articles are marked with an asterisk.)

UNIFORMITY.

The only thing in nature or art that can be said to be perfectly uniform is the action of the physical laws which underlie and maintain the universe. Yet the results of these laws, the phenomena of nature, are endlessly various, and scarcely any two of her productions are exactly similar. A comparison between two plants, or animals, or minerals, of the same kind, always shows some point of difference. Even chemical elements, which if really elements cannot exhibit characters dependent upon combination, are found to vary in their color, the form of their crystals, etc., when different specimens of the same element are contrasted.

Why is it that invariable laws admit of variable results? The answer is that although any one of nature's laws acting alone would produce perfectly uniform results, that when they act in concert the effect produced is a resultant, and varies according to the accordant or discordant action of these laws. In fact, these laws may be so exactly and equally antagonistic that their resultant is nothing.

As in nature so in art that deals with her productions. The variable nature of the materials which are used in the arts, variations in size caused by variations in temperature, variations in appearance caused by optical phenomena, variations in judgment caused by differences in the power of sensation at different times, and variations in measurements which are the result of the above mentioned variations, all conspire to impede uniform production.

It is a well known fact that violins made by celebrated makers after the same model, and in each of which perfection was aimed at, differ widely from each other in power and quality of tone.

Chronometers have their individual characteristics also. Though they may be as uniformly made as human skill will permit, they will vary more or less from the true sidereal time. A knowledge of the ratio in which one of these instruments "gains or loses" is essential to its use in navigation.

It were an easy task to enumerate instance upon instance to show the utter impossibility of entire uniformity in production, although in many cases very close approximations to it have been made. Nature seems to disapprove of individual likeness, and this tendency to specific differences in individuals has been considered by Darwin and others to be sufficient to account for the origin of species.

By a selection of pigeons having certain peculiarities, and again selecting from their progeny such as had the same features as strongly marked as possible, Darwin obtained birds from the pigeon stock which had hooked beaks, talons like hawks, and that fed upon meat. In fact, so far as general appearance and habits are concerned, they were hawks.

The necessity of obtaining an approximate uniformity in the productions of the arts, and the impossibility of obtaining uniform materials and operating them under similar circumstances, are reasons why skill and experience are essential to success.

Could perfect uniformity in nature be depended upon, every thing might be reduced to formula, and exact results be relied upon. Chemical manufacture would become the easiest of conceivable occupations. No need then to take into account specific gravity, or to watch the thermometer. The photographer would no longer complain of failures depending upon the character of his materials; the child of ten would compound as good bread as the experienced matron of forty. In short, we should all be on a level, and a monotony would pervade the entire range of production. The word excellence would become obsolete, and ambition, the stimulus to all great enterprises, would share the same fate. There is as much truth and philosophy as poetry in the couplet

"Variety 's the spice of life,
That gives it all its savor."

WHY A LONG SCREWDRIVER IMPELS A SCREW MORE EASILY THAN A SHORT ONE.

In most cases, where there is an apparent conflict between theory and fact, people, who are not familiar with the facts involved, are too much inclined to give undue weight to theory, and too little credit to evidence which goes to support the facts. In such cases, however, it is well to be cautious in forming opinions, because it often happens that some point in theory has escaped notice and has led to wrong inferences and conclusions.

Perhaps nothing illustrates better the importance of giving attention to the opinions of practical men, in matters upon which they have a knowledge based upon experience, than the difference of opinion which is common upon the question, whether a long screwdriver impels a screw with more ease than a short one. A mechanic accustomed to the use of this implement will almost always answer the question in the affirmative; while a man whose knowledge of mechanical subjects is merely theoretical, generally conceives it to be impossible. For ourselves, we are assured that the opinions of mechanics upon this point are correct, and we obtained the assurance by means of a series of experiments, which not only convinced us of the truth of the statement, but also satisfactorily explained the phenomenon.

We experimented in the following manner:—We selected a piece of very thoroughly seasoned cherry timber: a portion of a frame of some old machine which had been lying in the shop for a very long time, and after having selected the screws to be used in the experiment, we drilled holes in the timber of a suitable size, and, by means of a reamer, gave them a very gradual taper. The screws selected were 4-inch, gimlet points, with very strong heads, and about ⅛ of an inch diameter. The screwdrivers compared were, respectively, 8 inches and 20 inches in length, including the handle. The holes were tapered so that it would be impossible to drive the screws home, and were made as nearly of uniform size as possible. The wood was very homogeneous, and the screws were calipered to ascertain and obtain those of uniform size. Eight holes were prepared, and the eight screws selected, oiled, and laid in order. The screws were put in alternately by the long and the short screwdriver, and driven as far as strength would permit in each case. The result was a pretty uniform variation. Nos. 2, 4, 6, and 8, which were driven by the short screwdriver standing about ¼ of an inch higher than the rest. Applying the long screwdriver to these screws they were driven down to a pretty uniform level with the others. With the short screwdriver it was found impossible to start back any of the screws, but with the long one, we were enabled to take them all out.

Being thus satisfied that the long screwdriver had the more power in impelling the screw, we set ourselves to discover in what the secret of advantage consisted, and were enabled by a repetition of the experiment above described, but with slightly varied conditions, to refer it to the principle of the lever. If both screw drivers be held in such a position that the axis of each shall form a continuous line with the axis of the screw to be impelled, no advantage in favor of either will be discovered. But the long screwdriver admits of considerable play from side to side without releasing the screw, while the short one admits of very little. It is easy to verify this by the application of screwdrivers of different lengths to screw heads. In the effort to put in a screw where much exertion is necessary, this play and the consequent purchase are always obtained.

To prove such to be the facts, we arranged a guide or rest over the holes prepared for the reception of the screws so that by placing a suitable adjustment upon the blades of the screwdrivers we kept them in line with the axis of each screw. In this experiment no variation which could be attributed to the screwdrivers was apparent.

Repeating the experiment, a third time with the short screwdriver ground so as to incline it out of line, about as much as the estimated inclination of the longer one without causing it to lose its hold, we found, if any variation existed at all, it was in favor of the short one.

Undoubtedly, however, something in favor of long screwdrivers must be attributed to the fact, that they have larger handles than short ones, and thus present a greater leverage to the action of the hand.

Thus it is seen how statements apparently incongruous, may, by proper examination, often be proved to be in accordance with sound science.

GRINDSTONES---THEIR ACTUAL AND POSSIBLE USES.

The grindstone is of so ancient and common use that for the one the "memory of man runneth not to the contrary," and for the other its employment is already considered circumscribed. Yet the grindstone is capable of doing a much larger share of the work in the manufactory and machine shop than is usually accorded to it. On the farm its sole use is the sharpening of implements, from the carving knife down to the hoe and plowshare, but in the shop it is employed for grading the surfaces of metals—cast and wrought iron, steel, and some other of the obdurate metals. It is used either dry or wet, revolving swiftly or slowly.

Stones for grinding purposes are found in England, Scotland, Sweden, France, Nova Scotia, Ohio, and Michigan. Most of those, however, used in the East are from Nova Scotio and Ohio. From a practice of many years we prefer those of Nova Scotia to the Ohio stones because of their more even composition and genial grit. We are told, however, by one of the first saw manufacturers in the country that the artificial stones made by the Ransome process in Trenton, N. J., are superior to either in homogeneousness of texture and good grit. He uses them in preference to the others, although their first cost is somewhat greater.

One great trouble with the natural stones is the presence of spiculae, of hard, flinty substances standing out toward the circumference and resisting every legitimate effort for their removal. When a stone is found to contain these spikes of flint or obsidian the cheapest way is to discard it—roll it out of the shop,—for so long as it remains it will be a perpetual torment. Chipping off the obdurate spike, by the cold chisel is only a temporary expedient, as it will be sure to show itself again. A stone containing these hard spots is not fit for use in the shop; it will prevent any good work and be a permanent annoyance.

Much of the time and the cost of tools spent on the dressing, and even finishing of castings and forgings, which are now expended at the vice and by the use of cold chisel and file might be saved by a judicious use of the grindstone. It is singular that this ready means of abrading surfaces of metals and preparing them for after processes should occupy the very lowest place among the tools of a shop. Yet it is the fact that the grindstone, even when used only to give an edge to tools, is the worst kept appliance. The reason, we believe, is that its capabilities and possible uses are unknown. Why it should be so we are at a loss to conjecture. It may be made capable of saving much time now employed by skilled and costly labor and much waste of files and similar expensive tools. Many jobs generally submitted to the slow action of the planer might, by the more rapid action of the grindstone, be fitted for the after processes of the filer's art, with just as perfect satisfaction in the finished work.

TO ADVERTISING CORRESPONDENTS.---AXES TO GRIND.

We receive daily a great amount of very voluminous correspondence, upon subjects of great importance in the eye of the writer, but of no interest whatsoever to the readers of the SCIENTIFIC AMERICAN, and such articles are, of course, cast into the waste basket. In many cases, however, the subjects are important enough, but the writers have such a roundabout style that several pages are written in order to convey ideas that could easily be expressed in half a page, or even in a few lines. Correspondents should keep in view that the space in a journal of the circulation of this one is very valuable, and that the chance of having articles published is considerably increased by condensing them as much as possible.

We commend to the consideration of such correspondents the advice given by the editor of the London *Times* to a correspondent, who furnished him a very verbose article on an interesting subject. Said the editor, "You must reduce this one half." He did so, and reappeared with the article. "Reduce it one half," said the editor again. The abridgment was made, but not yet proving entirely satisfactory, a third condensation was ordered, when, in the editorial judgment the article had assumed reasonable shape, and shorn of every thing non-important to the subject, and in this condition made its appearance.

Often the whole purpose of the article, although sometimes ingeniously sugar-coated, is to recommend something the writer manufactures, or vends. To such correspondents we respectfully suggest that we are seldom deceived, and they are usually referred to our advertising columns to offer their wares. A Dr. Chase, of Ohio, for instance, sent us a long article on the non-explosiveness of all hydrocarbon oils, provided a certain kind of lamp burner was used, in which he has, no doubt, an interest, as also probably in making the combustible fluid, and offers to subscribe for our paper when we insert it. Now the extent of his article—entirely written in promotion of his private interests—is such, that at our regular published rates one insertion would cost $150; this will explain to him one reason for refusing to publish his communication, the other being that we by no means can endorse his assertion that the government test of kerosene oil is all nonsense; that only the lamp should be tested, and that gasoline, benzine, and other combustibles, are just as safe as kerosene. He should keep in view that the cause of the kerosene explosions is not the deficiency of the government inspection, but the adulteration of pure kerosene oil with cheaper benzine, made by men of his stamp, who have some new kind of lamp or oil for sale.

THE COOPER UNION IN NEW YORK.

During the last three days of May, this institution was in a blaze of glory, the occasion being the so-called yearly reception of the pupils, which, however, is nothing more than an exhibition of the work of the classes for drawing, painting, and sculpture. The exhibition was indeed very creditable, and it is doubtful if anywhere in the world a similar institution exists where several hundred pupils, receiving gratuitous instruction, at the end of the winter session are able to exhibit not only so many specimens of their industry, but so large a number of creditable productions, evincing a high degree of application and intelligence on the part of the pupils, as well as good thorough instruction on that of the teachers.

The department of mechanical and architectural drawing did not show any thing particularly noticeable above former years; but in that of free hand drawing, a decided progress was apparent. There were not so many copies of those familiar drawing-class lithographs, of which we have seen too much in former years. It must not be forgotten that copying a drawing is no art, in the higher sense of the word. True art is only attained by drawing from natural, or, at least, material objects; it is the only road to artistic power, and it was in this specialty that in former years the ladies' classes in the Cooper Union were far ahead of those for the young men. That this state of affairs existed, was the fault of the system of instruction, and the professors of male department appear to have at last waked up to its realization, as the exhi

bition of a great number of drawings from nature very creditably testify.

The modeling in the female department was so admirable as to astonish those able to appreciate this most difficult and most charming of artistic efforts. In painting, also, there were among the pictures some more worthy to be exhibited at our Academy than certain more pretentious specimens of so-called professional artists now on exhibition on its walls.

We, of course, fully appreciate the great importance of drawing to the mechanic and artisan, but we fear that the scientific department of the Cooper Union does not keep pace with the artistic. If the institute were conceived solely for a school of design and cognate branches for male and female pupils, it could be said that it is fully on the road to ultimate perfection; but it was founded "for the advancement of science and art," and the time and accommodation devoted to art far outstrip those devoted to science; this will become evident by the following statement, which at the same time will give our readers at a distance some idea of the extent of the building.

The fourth floor contains two lecture rooms, each about sixty feet square; a mineralogical cabinet, laboratory and apparatus room, each sixty by twenty feet; six or eight class rooms for mathematics, and rooms for the professor of natural sciences. On this one floor are taught the evening classes in mathematics, mechanics, natural philosophy, chemistry, elocution and music. The entire fifth story is devoted to the evening drawing classes for young men. The school of design for women occupies the whole third floor during the day, and the third floor contains the free reading room and library.

We must, however, in order to be just, remark that the scientific course requires more preparation than the artistic. A person may successfully follow a course of instruction in drawing, even if he is deficient in the common branches of education, though he cannot, of course, ever become a real artist, as for this a cultivated and well-trained mind is required. In the scientific course, however, a person deficient in arithmetic, for instance, can proceed slowly, if at all. This remark is verified by the statement of the secretary of the institute on the night of graduation, that of 1,200 pupils inscribed on the rolls, only about one third were able to continue the course, two thirds being deficient chiefly in arithmetic, and thus not prepared to follow the mathematical course, which, we are happy to say, is in this institution made the base of all further scientific instruction.

The aim of this institute is to give gratuitously a technical education to all, the instruction beginning at that point where the highest branches of the common school education ends. Several hundreds have availed themselves of the advantages the institute so liberally offers during the nine years of its existence, and thousands more may reap its benefits, as the institute is self supporting. The institute, as our readers must all know, was a free gift of Mr. Peter Cooper to the city. The original cost was about $700,000, while its actual value, according to the present valuation of real estate in that locality, is now one and a half million of dollars.

NEW ENGRAVING LATHE.

A very ingenious and effective lathe for engraving upon copper, steel, wood, and other substances is now in operation at 207 Pearl street, New York city, which is worthy the attention of all who are interested in the reproduction of art. The machine is the invention of Messrs. Guerrant and Field, of North Carolina, who have come North seeking for the necessary business talent and pecuniary aid to put their invention into extensive use. To engrave by means of this machine the operator sits with a copy of the drawing, photograph, or whatever design is to be engraved, directly in front of him. A small pointer rests upon the drawing, and the whole operation consists in moving the pointer over the several lines of the copy. The pointor is operated by two small cranks, one of which produces a vertical and the other a lateral movement; the simultaneous operation of both cranks producing a circular, inclined, or any desired irregular motion of the pointer, which is thus made to "follow copy." All the movements of the pointer are imparted by means of a very simple arrangement of levers to a graver which cuts or engraves the design upon the surface of a copper plate or block. Thus in a rapid manner even an unskilled person having a drawing before him, may engrave the same in superior style. The swelled lines as well as hair lines of copper plate writing may be produced with the utmost freedom, and there seems to be no limit to the execution of the finest and most difficult as well as the simplest kinds of work. It makes no difference whether the surface to be engraved is flat, circular, or irregular. We have seen the whole of the Lord's Prayer engraved by this machine upon the interior of an ordinary finger ring, every letter being perfectly formed and legible under a magnifying glass, but too small to be read by the unassisted eye. For jewelry work, the ornamentation of metals, the production of copper, steel, and wood engravings for letter press, and many other purposes, this invention seems to be well adapted.

MAGNIFIED PHOTOGRAPHIC PICTURES.

If it were possible to take a photograph, say of the moon, and then to take a second one of a portion of the first, and of the same size as the first, and to repeat the process as often as required, a picture might at last be obtained that would show the minute details in the structure of that body; and in the same way the minutest details in the structure of other bodies, now beyond the reach of the most powerful microscopes, might be shown and examined at leisure. In the present state of science it is not possible to accomplish this, for several reasons.

First, the photographic picture is painted by the deposit of metallic silver, which, in a minute state of subdivision, gives a general gray tone to the picture when it is not magnified; but when the entire picture, or a small portion of it, is inspected by means of lenses, the white luster of the silver appears more and more plainly as lenses of higher power are used, and the picture assumes a frosted and crystalline appearance, which obscures the finer details beyond a certain limit. The limit is reached by a lens of quite low power, and photographic pictures when viewed in stereoscopes show more or less of the silvery frosted-looking surface texture To obviate this difficulty a substance must be discovered as sensitive to light as the salts of silver now in general use for photographic purposes, and that will in its decomposition leave a perfectly amorphous coating upon the paper, where the light acts, and in proportion to the strength of its action from the lightest gray tint to the deepest black.

A second difficulty is the roughness of all surfaces upon which pictures can at present be taken. If we attempt to magnify a photograph, all the roughness of the paper or collodion which is imperceptible to unaided vision becomes apparent, and mingles its own images with that of the finer details, in such a way as to make complete confusion. The remedy is the discovery of new materials capable of receiving a polish so fine as to show a perfectly smooth surface under the highest magnifying powers.

The third and the greatest difficulty is the fact that in enlarging small pictures the amount of light reflected by them is constantly diminished, each picture becoming more indistinct than the one of which it is a copy, until finally the original image is completely extinguished. Formidable as this difficulty appears, it is within the range of possibility that it may be completely overcome. The reinforcement of the galvanic current obviates a similar difficulty which at one time threatened to interfere greatly with telegraphic communication. The reinforcement of a sound can make it audible through a large space where it apparently had totally ceased to exist. It remains to discover a means for the reinforcement of light. We believe that in time to come all the obstacles we have mentioned will be surmounted, and the photographic art will become the means of revealing the yet hidden mysteries of nature's grand laboratory.

Another difficulty, that relating to the imperfection of lenses, we will hereafter discuss.

CONSTRUCTION OF FIRE-PROOF BUILDINGS.

We present on another page several illustrations of experments made by Messrs. Hoe & Co., of this city, which, with the details of the trials we consider of the greatest importance to builders and others. We accordingly invite the attention of our readers to the subject.

The insecurity of our buildings generally, especially their lack of resistance to the ravages of fire, is well known. The aggregate of the sums of money yearly expended for premiums for policies of insurance, would surprise, if it were known, every person. When real defense against fire is undertaken the cost of the erection of buildings is immensely enhanced. The walls must be of great thickness, of fire-proof materials, and laid with great care. The floors must be of similar materials, arched to sustain their superincumbent weight, and supported at intervals by strong columns. All the passages from one floor to another must be defended and guarded by proper devices. This mode of construction and these appliances are too costly for general use; what is needed is some cheaper mode of construction which shall not be less effective in confining fire to the floor in which it originates, without the necessity of constructing a perfectly fire-proof and costly building in the style now considered necessary. It would seem that this result has been partially, if not fully attained by the satisfactory experiments of the Messrs. Hoe.

In addition to their method of rendering floors fire-proof, a patent was obtained in 1860 by J B. Cornell, of this city, for the protection of iron columns in case of fire, which, in connection with the plan of Messrs. Hoe, would seem to render increased security to buildings attacked by fire. The plan is to inclose the supporting columns with a casing, the space between which and the column is filled with plaster of Paris or any other non-conducting material. The object is to prevent the disintegration of the metal composing the supporting column by heat.

The subject of erecting fire-proof buildings is of vast and growing importance, and we hope experiments will be made all over the country with a view of improving the mode of their construction.

PHOSPHATE DEPOSITS.—The discovery of immense deposits of bone phosphates in South Carolina, which, more than a year ago, was heralded by the press of the country, is again brought before the public. The entire coast and Sea Island regions of the Palmetto State are now supposed to be underlaid by the osseons remains of extinct land and marine creatures of past ages. The statement is also made that human bones as well as stone implements have been recognized. An analysis, made by the State Geologist of Massachusetts, of a sample from th Ashley river, shows in 100 parts of bone; moisture and organic matter, .80; bone phosphate of lime, 81.60; sulphate of lime, .65; salt, .15; sand, etc,, 16.80.

FRANCE is well provided with lawyers and judges, governmental statistics showing that there is in the empire at least one man connected with the administration of justice for every 500 of the inhabitants, without counting the agents of external justice and city and rural police forces.

Editorial Summary.

A NEW PYROMETER of English make, designed by Mr. Wood of the Tees Iron Works, consists of a metallic tube connected at one of its extremities to a pillar of porcelain, and at the other with an index on a dial, upon which the degrees of heat are measured. When used, the instrument is held over the aperture of a blast furnace, and the heated air passing through expands the tube longitudinally, and the difference in length as compared with the porcelain standard is indicated on the dial. In a recent experiment, the temperature was registered from 66° to 1,200° Fah. in less than a minute.

PHYSIOLOGICAL experiment has arrived at a close approximation to the average diurnal gain and loss in a man of one hundred and forty pounds weight. The daily gain is as follows:—

Oxygen	lbs. 2·192	Inorganic gain, lbs., 6·301
Water	lbs. 4·104	
Dry vegetable food	lbs. 1·687	Organic gain, lbs., 2·250
Dry animal food	lbs. ·563	
Total daily gain		8·551

The total daily loss in a healthy body will be exactly equal to the gain.

A LARGE collection of fossils from the green sand beds of the Squankum Marl Company, near Farmingdale, N. J., has been presented to the Peabody Museum of Yale College, by O. B. Kinne, of New York. This important acquisition consists of several thousand specimens, many of them new to science. Among the new vertebrate fossils, which will soon be described by Professor Marsh, are the remains of a huge swine-like animal, larger than a rhinoceros, and several others not previously discovered in this part of America.

IN AN important paper communicated to the Academy of Science, by M. A. Mallet, he stated that between 200° and 400° Fah., and in presence of steam, protochloride of copper absorbs oxygen from the air almost instantaneously to form an oxychloride, which parts with its one atom of chlorine at a higher temperature. So that oxygen gas, or chlorine gas, can be prepared at will, and in as large proportions as we wish, the same protochloride of copper serving over and over again.

BORAX AS A DETERGENT.—As a means of cleansing the hair, nothing is better than a solution of borax in water. It leaves the scalp in a most cleanly condition, and the hair just sufficiently stiffened to retain its place. This stiffness, however, can be readily removed, if objectionable, by washing with water. Borax is also an excellent dentrifice. Dissolved in water, it is one of the best of tooth washes.

THE use of raw meat in the treatment of debility and consumption is in the ascendant in France; but that it may be served in a style the least objectionable to the patient's delicate sensibilities, it is prepared nnder the name of musculine tablets, and is made of raw fillets of beef covered with fruit jelly and candied sugar.

A CANDIDATE for death honors proposes to shoot Niagara Falls in an india-rubber boat, oblong in shape, and with a mean diameter of eight feet, and six inches thick at the top and sides and three feet thickness at the bottom.

THE wire of a telegraph line just put up between Dover, N. H., and Lake Winnipiseogee is made of a steel core surrounded by copper. By this construction, it is claimed, the following advantages are secured: superior conducting power with less weight of metal, durability, and a less number of poles on the line.

OUT of the thirty-one days of the month of May, the residents of this latitude enjoyed twenty-three rainy days, amounting in the aggregate to a steady shower of 150 hours and 18 minutes, or 6 days, 6 hours, and 18 minutes duration. The depth of water that fell during that time, as measured by the hydrometer, was 6·98 inches, against 5·791 inches which fell during May of last year.

IN the town of Arkwright, N. Y., is a little lake which has no apparent inlet, but two outlets; through the one its waters flow into the Conewango river, thence through the Alleghany, Ohio, and Mississippi rivers to the Gulf of Mexico; the other outlet forms a branch of Silver Creek, which empties into Lake Erie, and its waters thus find their way into the ocean through the St. Lawrence.

NEARLY two acres of land on a farm in Hamilton county, Fla., lately disappeared from mortal view, the pasture land now being occupied by a lake of at least fifty feet in depth This sink is said to be the largest and deepest ever known in the State.

AN INTERESTING ELECTRICAL EXPERIMENT.—M. Becquerel, in making some researches into the subject of the dialysis of the electrical currents, lately found that in passing discharges from an induction coil, between the upper surface of a saline solution, contained in a glass tube, and the extremity of a platinum wire fixed at a short distance, the spark was surrounded with a cloud colored, according to the sort of salt used in the experiment.

HERSCHEL AND ARAGO found that the greater the number of spots on the sun during any year, the higher was the cost of breadstuffs. For the reason that the existence of these blots on the solar disk reduces the heat of the sun very materially. The experiments which led to this assertion were continued during a period of twenty-five years.