or by a stretching machine. To manufacture the cloth an extra width to allow for the losses would entail increased expense, and would fail of the object, for a shrunken cloth would be different in texture and "feel" to one restored to its natural width.

But beetling is never undertaken for the sole end of stretching cloths, as it is too expensive a process. Its chief purpose is to give a "finish" which cannot be obtained by any other means, although very many attempts have been made. As each faller descends it flattens the yarns on which it impinges, and at the same time produces a slight motion of the various layers upon one another, the result being that the threads are given a distinctness and a brilliancy which is characteristic of linen, and with which every one is familiar in the white pocket handkerchief of daily use. It is only in high class goods that the process of beetling can be carried out, for it is slow, and takes very considerable power. For cheaper cloths, the stretching machine and the calender are made to suffice.

Referring to the engraving, it will be seen that there are two beams, either of which can be placed under the fallers while the other is being filled or stripped, as the case may be. The fallers can all be raised out of range of the wipers by means of a cross bar lifted by chains and drums from a shaft operated by worm gear and a hand wheel. The wiper shaft is driven by bevel gear through a friction clutch.—*Engineering.*

CHARLES FREDERICK CHANDLER.

BY MARCUS BENJAMIN.

The early history of chemistry reads with the fascination of an Oriental tale, for out of alchemy came chemistry. It seems as if there were giants in those days, for with rude implements and impure reagents great results were obtained. Honor and distinction came to those who followed the new-born science. An apothecary's clerk became the great Scheele; the medical student was made Baron Berzelius; the boy who walked to Paris developed into the mighty Dumas, famous as the great lecturer and cabinet minister; and then Hofmann, once a poor student in Liebig's laboratory, discovered the aniline colors, and was called to fill the most important of all scientific offices in the German empire, that of a professor in the University of Berlin.

The history of American chemistry shows no such conspicuous illustration of phenomenal success, but in the annals of that science in this country there will be found many names that have been made illustrious by ability and research. The discovery of oxygen was made by Priestley, whom we claim as our own. The oxyhydric blowpipe was invented by Robert Hare, in Philadelphia; Samuel Guthrie was the first to give chloroform to the world, and Charles T. Jackson followed with ether, and so on until recently, when saccharin was discovered by Ira Remsen and Charles Fahlberg in the chemical laboratory of the Johns Hopkins University, and a new process for the reduction of sodium invented by Hamilton Y. Castner, in New York. America has, indeed, great reason to feel proud of the work that has been accomplished within her boundaries.

C. F. Chandler

Personal influence has had much to do with this. The elder Silliman gathered around him many of the scientists of a former generation, most of whom have since passed away. The elder Draper likewise attracted to his lectures students who have enriched science with their discoveries. Of later date is Louis Agassiz, from whom nearly all of the American naturalists of to-day received their inspiration, and it is from him that Professor Chandler first received his fondness for natural science.

Charles Frederick Chandler was born at the residence of his grandfather, Nathaniel Chandler, in Lancaster, Mass., on December 6, 1836. His paternal ancestors were descended from William Chandler, who came from England in 1637, and settled in Roxbury, Mass. On his mother's side he came from John Whitney, an old Boston merchant.

The curious chiastolites and the lithium minerals, spodumene and petalite, which he gathered in the vicinity of his grandfather's home in Lancaster, whither he went to spend his vacations, were evidences of his interest in practical science, and were perhaps the first indications of that collecting mania which he has since put to so excellent a use in his museum of applied chemistry in the Columbia College School of Mines, New York. As he grew up he attended lectures on scientific subjects, and among others those by Agassiz. The latter seemed to have determined his career, for the old workshop in the attic was transformed into a laboratory, where, with improvised apparatus and kitchen chemicals, his first experiments were made.

Regular studies, however, were not neglected, and in due time Chandler graduated at the high school in New Bedford, and then after a year's private study of the advanced classics, began his professional education by entering, on September 1, 1853, the Lawrence Scientific School of Harvard University. In this institution he received instruction in chemistry from Eben N. Horsford, geology from Louis Agassiz, and mineralogy from Josiah P. Cooke.

But a chemist in those days needed the prestige of a course of study under the German masters, and so Chandler went to Europe. At first he entered the University of Göttingen, where he studied chemistry under Wöhler, the pupil of Berzelius, and in 1856 received from that institution the degree of doctor of philosophy for his researches in mineralogical chemistry. His inaugural dissertation, printed with that peculiar Roman type used in Germany, has a colored paper cover, with the imprint "Gottingen, 1856," and contains the eleven following papers: 1, Zircon from Buncombe County, N. C.; 2, Sassurite from Zobten; 3, Stassfurthite from Stassfurt; 4, Analysis of a rock resembling talcose slate, from Zipser; 5, Columbite from Middletown; 6, Columbite from Bodenmais; 7, Tantalite from Chateloube; 8, Yttrotantalite from Ytterby; 9, Samarskite from the Ural; 10, Experiments on the Cerium Metals; 11, Artificial heavy spar.

From Göttingen he went to Berlin and became the private assistant of Heinrich Rose, having as his associate the now celebrated Arctic explorer, Nordenskiold. He spent nearly a year in Berlin, studying also physics under Dove, applied chemistry under Magnus, and mineralogy under Gustav Rose.

On his return to the United States, in 1857, he was invited by Charles A. Joy to become his assistant at Union College, and a few months later (April, 1857), when Professor Joy was called to the chair of general chemistry in Columbia College, Chandler succeeded to the vacancy at Union, being thus an actual professor before he had attained his majority.

For eight years he continued in charge of the laboratory in Schenectady, also lecturing to the college classes on general and agricultural chemistry, mineralogy, and geology.

In 1864, at the suggestion of Prof. Joy, he was invited to come to New York City and take part in the formation of the School of Applied Science, now known as the Columbia College School of Mines, then about to be established under the direction of Professors Thomas Egleston and Francis L. Vinton. The department of chemistry was assigned to him, and without salary he began the delivery of the lectures on qualitative analysis, stoichiometry, quantitative analysis, applied chemistry, and geology. In 1865 he received the title of professor of analytical and applied chemistry, and became dean of the scientific faculty. The arrangement of the large qualitative, quantitative, and assay laboratories was developed under his guidance, and he continued in the active administration of these departments until 1877.

Meanwhile new buildings had been erected, and in lieu of a few students, classes numbering upward of fifty were receiving instruction, not from a handful of professors, but from a large and efficient faculty. This institution had become the greatest mining school of the United States. The departments of chemistry, assaying, mining engineering, and metallurgy have no superiors, and but few equals, in the country.

The school was reorganized in 1877, and the chair of general chemistry given to Professor Chandler, since when he has delivered the lectures on general chemistry to the students, not only in the School of Mines, but likewise to those in the School of Arts, and also the lectures on applied chemistry.

His work on the last named subject deserves special recognition. Professor Chandler at once recognized the importance of this branch. Appreciating the value of having educated chemists in various departments of the industrial pursuits of the country, he made himself thoroughly familiar with those subjects, visiting various factories and collecting specimens to be used for class room illustration. The latter now form his museum of general and applied chemistry, in which his specimens illustrating the manufacture of pottery and of the various photographic processes are probably unique.

In 1875 the department of chemistry and its applications in Johnson's New Universal Cyclopædia was placed under his control, and the resulting articles from his pen contributed to the four volumes issued since that year are unequaled in any work of similar character.

Professor Chandler has obtained recognition as having no superior as an authority on technical chemistry. His reputation extends throughout the United States, and he has been very frequently called into court as an expert to testify on matters pertaining to this specialty. Indeed, no case of great importance would seem complete unless his services were retained on one side or the other.

To return to his lectures, in 1872 he became adjunct professor of chemistry and medical jurisprudence in the College of Physicians and Surgeons, the medical department of Columbia College, and in 1876 succeeded to the full professorship.

Soon after his advent to New York City he was asked to assist in the development of the New York College of Pharmacy, and in 1866 he became professor of chemistry in that institution, giving two lectures an evening, twice a week, during the college term. Through his active interest this school has become one of the most flourishing and advanced colleges of pharmacy in the United States.

In 1866 Professor Chandler was invited by the Metropolitan Board of Health to make scientific studies of sanitary questions affecting the health of New York City. There was no appropriation for this purpose, and he performed the work gratuitously. The authorities were so well satisfied with the importance of this undertaking that, at the end of the year, they created the office of Chemist to the Board of Health, and appointed Professor Chandler to the place, which he then held continuously until 1873.

His work while in this office was of the utmost importance, and it has resulted in enormous benefits to the community, concerning which comparatively little has ever been fully appreciated.

The food supply was one of the first subjects to which he turned his attention. Chemical analysis showed that the milk sold in New York City contained on the average one-third of water, or, in other words, frauds to the amount of $10,000 a day were perpetrated by the milkmen. After years of contention, during which several cases were tried in court, the action of the health board was finally sustained by the Court of Appeals, and thereafter the rigid inspection of milk became possible. The value of this reform is most apparent when it is recollected that a milk diet constitutes the principal food supply of fully 200,000 children under five years of age.

The sale of inferior qualities of kerosene, with resulting accidents, was one of the subjects very thoroughly investigated by Professor Chandler. Samples of this burning fluid, sold under various names, were collected and tested. In consequence of its almost uniform inferior quality, legislative action was obtained, fixing a definite burning point, below which nothing was permitted to be sold.

Intolerable odors resulting from the use of lime in the gas works were prevalent at various points in the city. Professor Chandler recommended that the process employed by the gas companies be modified, so as to prevent a continuance of this nuisance, and after a prolonged contest before a referee, his purpose was accomplished.

In 1873, the Board of Health, as now constituted, was organized, and Professor Chandler appointed its president by Mayor Havemeyer. Four years later, he again received the office at the hands of Mayor Ely. In 1883, Mayor Edson presented his name to the Board of Aldermen, but this body rejected the nomina-

tion, and General Alexander Shaler succeeded to the office. Professor Chandler declined the office in 1887, subsequent to the removal of General Shaler by the Governor.

The *Sanitary Engineer*, in urging upon the aldermen the desirability of reconsidering their action, said, in May, 1883: "At the present time it is probable that there is no other city in the world which has so complete a sanitary organization as New York." It is needless to say that this condition of affairs was the direct result of the wonderful executive ability possessed by Professor Chandler.

Under his administration as the official head of the board, the same energetic warfare was continued against existing nuisances.

One of the first of these to be taken up was the odors emanating from the rendering of offal and dead animals. Various establishments where this obnoxious pursuit was carried on were closed, and finally the entire business was restricted to Barren Island, whither all objectionable material was transported, according to laws enacted at the suggestion of the health authorities.

The slaughter houses, originally scattered through the city, were compelled to locate within narrow precincts on the river front, and placed under thorough sanitary supervision.

The driving of cattle through the city was prohibited by law, and thus owners were compelled to transport all live stock by boats, around the island. The sanitary disposal of stable manure and night soil were reforms of considerable importance effected by him. Petroleum refining and other objectionable trades were forced out of the city.

His raid on Washington Market, in 1873, is a well recollected event. This building was surrounded by structures which covered half the roadway of the public streets, and, after exhausting all peaceful measures, one evening Professor Chandler led a force of one hundred and fifty carpenters and laborers, three hundred policemen, and a corps of surgeons to the locality. Before morning the buildings were leveled, the materials carted away to the corporation yards, and the pavements, which had not seen the light of the sun for twenty years, swept clean. Similar action was taken with the stalls around Fulton, Center, and other markets.

The improved management of contagious diseases, the introduction of a separate vaccination corps, the system of disinfection, and the summer corps of physicians, were prominent innovations during his term of office.

Professor Chandler obtained the passage of a tenement house act, which provided that plans of every such building to be erected within the city limits must first be submitted to the health authorities. With this should be included the legislation compelling the regular inspection of the plumbing and drainage of every building about to be constructed in the city. In this manner improved accommodations, with adequate light and ventilation, have been secured for the poorer classes.

It has been shown that the death rate of children under five years of age has been reduced 5,000 yearly, and a further estimate indicates that at least 8,000 lives have been saved annually, and for every death there are twenty-eight cases of severe illness, or 184,000 cases each year. These results are in direct consequence of the sanitary reforms and improvements introduced in New York City by Professor Chandler and his associates on the Board of Health.

In 1879 the New York State Board of Health was established. Professor Chandler was appointed one of its members, and became the chairman of the sanitary committee. Much of the excellent work on the adulteration of food executed by this board during the first years of its life was accomplished under his supervision.

Professor Chandler's name has been associated with others on important papers sent out by the National Board of Health, notably that on the "Instructions on Disinfection," of which report he was chairman of the committee appointed for its preparation.

To one whose time has been necessarily so largely occupied with duties as a teacher, and in public capacities, but little could be expected in the line of original investigation in pure chemistry. Indeed, there has been a disposition among certain chemists to criticise the work of Professor Chandler as being unworthy of the dignity of the Professor of Chemistry of Columbia College, claiming that little, if any, original research deserving that title had been accomplished in his laboratories; but such critics forget his masterly investigations of the water supply of leading cities—work that has not only been found worthy of great praise in the United States, but which has gained distinction for him wherever the subject of water analysis has been studied.

His examination of the water supply of the cities of Albany in 1872 and 1885, Brooklyn in 1868 and 1870, New York in 1866 and almost yearly since, and Yonkers in 1874, his analyses of the springs and artesian wells at Ballston in 1870, Saratoga Springs in 1868 and repeatedly since, including fully twenty extended analyses, Staten Island in 1871, Mount Vernon in 1886, and elsewhere, also his report on water for locomotives in 1865, are valuable contributions to scientific literature, and date back to a period when but little of that class of work was performed in the United States.

Besides the foregoing, many of the analyses of minerals, made for the geological surveys of Iowa, Michigan, Wisconsin, and elsewhere, were performed in his laboratory, also a great number of commercial and confidential chemical investigations have been executed by him.

In 1870, in connection with his brother, Professor William H. Chandler, of Lehigh University, he established the *American Chemist*, a journal that continued for several years. In addition to the original papers from chemists residing in the vicinity of New York, and also laboratory communications from prominent universities, there were a valuable series of abstracts prepared monthly by able compilers, who, with great care, examined the leading foreign exchanges. To its columns Professor Chandler contributed his own papers treating on the chemistry of foods and other sanitary subjects. Although probably the best journal of its kind ever published in the United States, it came to an end in 1877, from want of adequate financial support.

Professor Chandler is an effective popular lecturer, having an excellent voice, and a clear, direct, and vigorous style of delivery. He has appeared before large audiences in most of the leading cities, and especially in New York, where his lecture on "Water," before the American Institute, in 1874, and on "Photography," before the New York Academy of Sciences, in 1879, were enthusiastically received.

In 1874 he was called to preside over the convention of chemists gathered at Northumberland, Pa., to celebrate the anniversary of the discovery of oxygen by Dr. Priestley. The initial movement toward this celebration was made in the *American Chemist*, and full reports of the proceedings subsequently appeared in that journal. It resulted in the formation of the American Chemical Society, of which Professor Chandler is a life member, and held the office of president in 1881.

He is also a life member of the chemical societies of London, Paris, and Berlin, a member of the Society of Chemical Industry, a fellow of the New York Academy of Sciences, of the American Association for the Advancement of Science, the American Philosophical Society, the Sociedad Humboldt of Mexico, and other less celebrated scientific bodies.

In 1874 he was elected a member of the National Academy of Sciences. He has been a member of most of its committees appointed for the consideration of subjects in applied chemistry, such as that on waterproofing of the fractional currency, in 1876; on the preservation of the writing of the original Declaration of Independence, in 1878; sorghum sugar, in 1882; on glucose, in 1883; and on the tariff classification of wool, in 1886.

Professor Chandler received, in 1873, the honorary degree of M.D. from the University of New York, and that of LL.D. from Union College during the same year.

He has taken a prominent interest in all affairs pertaining to the development of New York City, and he is a member of the Century, University, and Union League Clubs.

At the beginning of this sketch, reference was made to Dumas. There is much in Professor Chandler's career that is similar to that in the life of the great French chemist. Dumas came to Paris when he was 23. Chandler's life work began at Union when he was 20; Dumas was 29 when he became the leading spirit in the establishment of the Ecole Central des Arts et Manufactures, while Chandler was only 28 when he came to New York to aid in the founding of the School of Mines. Chandler, like Dumas, has been called to fill important municipal offices and to lecture in other institutions besides the schools with which he was chiefly connected.

Is it too much to hope that, like Dumas, he may yet be called to fill some high national office? As he has been successful in directing the sanitary interests of a great metropolis, surely he can be trusted with larger interests, where, by the application of his scientific attainments, the entire nation may be benefited.

Cement from Blast Furnace Slag.

Three kinds of cement are made from blast furnace slag. The first, which is really more of a mortar than a cement, is produced by taking slag sand and grinding it with 15 per cent of lime and 15 per cent of oxide of iron. The grinding is generally done wet, and the product requires to be used within a few hours of being made, so that its employment is quite local. The second cement is made by grinding 75 per cent of dry slag sand with 25 per cent of dry slaked lime, according to Mr. Larsen's patent. It is essential that the ingredients should be reduced to a fine degree of pulverization, and that they should be intimately commingled. For this purpose the inventor uses a machine which he calls a "homogeneizer." The third cement is made according to a process brought out by Mr. Frederick Ransome. Equal weights of slag sand and chalk are ground together in a wet state, and after being dried are burned either in a kiln or revolving furnace, the process followed being similar to that used in making Portland cement. The following table gives analyses of two of the cements we have mentioned, and also of two examples of Portland cement:

Analyses of Cements.

	Lime.	Silica.	Alumina.	Ferric Oxide.	Ferrous Oxide.	Magnesia.	Water.
No. 1 cement.....	22·9	21·6	19·85	8·80	4	4·36	12
No. 2 (Larsen).....	41·96	24·34	18·74	0·14	0·27	6·57	4·70
Portland (No. 1).....	59·9	24·07	6·92				
" (No. 2).....	55·57	22·92	8·0				
Middlesbro' slag	40	52·34					
" (No. 2).....	36·88	51·12					
" (No. 3).....	40·45	50·08					

The first and second analyses are by Mr. J. E. Stead. The non-essential ingredients are not given.

From this it will be seen that the first two cements are widely different in their chemical constitution from Portland cement, and they are still more different in their physical condition, for the lime is mostly free, the materials not having undergone the incipient fusion which Portland cement experiences. Now, in the slag the proportion of lime to alumina and silica is about as 39:51, while in cement it as 58:31. Therefore, 100 parts of slag, including the inert matters, requires the addition of 56 parts of lime, or of 100 parts of dry chalk or limestone, to provide the constituents of a good cement, and this is the mixture used in Ransome's process. The result gives a product which exceeds the strength of Portland cement, and which improves by age. Samples seven years old are in existence, and show no signs of deterioration. Of course the process is only commercially feasible in districts where slag is produced, but there it offers a means of turning a useless product into a valuable material, and if it be carried out by Ransome's revolving furnace, the expense for plant is comparatively small.—*Engineering.*

The Use and Care of Chains.

At a meeting of the Society of Civil and Mechanical Engineers, on the 27th of April, Mr. H. Adams, M. Inst. C. E., in a paper on "The Use and Care of Chains for Lifting and Hauling," divided chains into two classes—those with oval links and those formed of flat bars or plates; the former being subdivided into "common" and "short linked" chains. The latter, being of the most importance, received the principal attention. It was pointed out that the links being well rounded, each one acts as a spring when the load surges, and hence their universal adoption for lifting purposes.

The dimensions of the links are, for the extreme length and breadth, $4\frac{2}{3}$ and $3\frac{1}{3}$ times respectively the diameter of the iron of which the link is made. In repairing or joining a chain, the new link has to be made a little longer, to give room for welding, as there are two others in it instead of one, as in making a new chain. The various modes of welding were then described, and the peculiar tendency of some chains to twist while in use. Several illustrations of chain fastenings were shown and described; and the modern forms of hooks and shackles were contrasted with those thought to be "nice" some years ago. The strength of chains next received full notice.

It was shown that with Crown S.C. iron of B.B. quality, equal to an average tensile stress of 26 tons per square inch, an elongation of 15 per cent and a contraction at the point of fracture of 20 per cent, the chain should have a strength of double this; but there is usually a loss of 25 per cent from imperfect welding and other causes. Several defects in welding were explained. The author described in detail the system adopted for the care and maintenance of the chains at Messrs. Cory & Son's coaling establishments, where he has been responsible for chains which have lifted upward of 15 million tons of coal in the last ten years, and during this period only one fatal accident occurred from a chain breaking, although the machinery is in use day and night, and the men necessarily work under the cranes.

The inspection and lubrication are very thorough, and each chain will make about 100,000 lifts before it is worn out for lifting purposes. It is then cut up into sling chains, barge moorings, etc., as there are still many years of useful life in it. The author stated that coal dust is not very detrimental to chains, but coke dust is decidedly bad. In summarizing the points of economy in the maintenance of chains, the author said the testing should be moderate, the annealing frequent, the lubrication thorough; and when the wearing is not uniform throughout the length, the chains should be cut and pieced where partially worn, so that when finally discarded each link shall have done its full share of work without overstepping the limits of safety.

Paraldehyde in Insomnia.

Surgeon J. R. Tryon reports the case of a man who had been in the service about twenty-three years, and whose health had always been good until October, 1882, when he became afflicted with insomnia. By change to shore duty during the following year he obtained relief, but on his return to sea service on the Mexican coast the attack returned, together with general debility. In October, 1883, he was detached and sent home. He went to the mountains of North Carolina and remained there until June, 1884, when he was again ordered to sea. During the time spent on shore the insomnia gradually disappeared, but his general health improved slowly, and at the time he reported on board for duty he was far from well, and required tonics.

After several months the attacks of insomnia again recurred. Various hypnotics, sedatives, tonics—in fact, every remedy that promised success—had been used, but only with temporary relief. His habits were good; tobacco, tea, coffee, and everything that might contribute to his affection were excluded. The only discoverable organic lesion was slight hypertrophy of the heart. Urine contained phosphates in excess. About this time he was ordered Horsford's acid phosphate and the compound sirup of the hypophosphites, which, added to longer stays in port, produced some beneficial effect.

"He had himself noticed an account of the action of paraldehyde, and requested that it be tried on him. The first dose was 2 c. c., taken in the daytime, but probably on this account without effect. The second dose was 3 c. c., which produced four hours' sound, uninterrupted sleep, something quite unusual for him. Subsequently, doses from 3 to 4 c. c. were given about twice a week only, after vainly trying for about an hour to sleep without it. These doses have always been found sufficient to produce sound sleep, sometimes for the best part of the night, and never for less than two hours at a time. To avoid a diminution of effect, it has been given only when absolutely necessary, and so far, two, or at most three, doses a week have been sufficient. The sleep is sound, dreamless, and, unlike chloral or morphia, leaves no unpleasant effect. . . . It has a cooling taste, produces a feeling of warmth in the stomach, but has no effect on the heart, pulse, or temperature. His general health since he has been taking the drug, and been able to procure refreshing sleep, has greatly improved; but this may be partially due to the phosphate, which he is still taking."
—*Report Surgeon-General, U. S. N.*

Photo-thermography.

We have received the following communication, together with two pictures on glass, from Mr. George Mason, of Glasgow:

"I send you on to-night a transparency of one of the most wonderful things in the way of impressions I have ever seen. This picture, as you see it, is photographed from a piece of glass that covered an etching on which it must have imprinted itself from the etching behind. However, the etching and the glass in frame were never in contact, as there was an overmount between.

"The etching has been in the frame for some years, and has been hanging in a strong light. Messrs. Lawrie & Son, the fine art dealers here, sold the etching, and on removing it from the frame found the front glass had a faint impression of the picture on it, which we have photographed to send to you. From the transparency inclosed you will see the result. Of course the exposures turn out positives, the glass being negative in impression. The frame was three feet seven inches by three feet. The picture was one foot eleven inches and one foot three inches, the subject *The Pied Piper of Hamelin.* A mount fitted between the picture and the glass.

"Now this glass would be about a sixteenth of an inch away from the etching, and in front of it. Have you any idea how the impression could be taken up? It must have been thrown back from the picture to the surface of the glass again. It is such a curious thing, and probably new to you, that you might be able to make some use of it."

Having carefully examined these truly interesting photographs, we shall endeavor to give a few words of explanation concerning the phenomena.

There is a principle in physics first investigated by M. Ludwig Moser, who in 1842 announced the following fact: "If a surface has been touched in any particular parts by any body, it acquires the property of precipitating all vapors which adhere to it, or which combine chemically with it on these spots, differently to what it does on the other untouched parts." This was the form in which the law was first announced, but further investigation showed that contact was not necessary, mere juxtaposition sufficing. Emanations were found to be given off from one body to another, in virtue of which vapors were condensed on certain parts in preference to others. Moser designated the phenomena as having been produced by "invisible light," but Hunt adopted the more philosophical term thermography, and made numerous and valuable investigations in this department of physical science, which he published in the *Philosophical Magazine* of the period, and elsewhere. Having found that a blackened paper gave more forcible radiations than a white one, he tried the copying of printed matter, and eventually succeeded in doing so, developing the image by various agencies. The specimens received from Mr. Mason possess an exceptional degree of interest, and are by far the best examples we have seen. That their existence is attributable to thermography, however unhappily it may be named as applicable to this case, we have no doubt.—*British Jour. of Photo.*

THE RACQUET TAILED KINGFISHER.

The Obi Island tanyseptera has the head and wing coverts brilliant ultramarine and the rest of the back and wings deep indigo. The entire under surface of the body is creamy white, and the beak vermilion, while the median pair of tail feathers are greatly prolonged, to a length, perhaps, of nine or ten inches in full plumage. They are dark ultramarine in color and very narrow, but terminate in a racquet-shaped expansion of snowy whiteness.

THE RACQUET TAILED KINGFISHER.

I watched the bird sitting on the boughs a few feet only above the ground, motionless but for an occasional rapid movement of the head. Suddenly there was a flash as of a blue meteor descending to the ground, and a moment later the lovely creature had returned to his perch, and sat hammering away at the small crustacean he had found; the whole action reminding me strongly of that of the bee eaters.—*Dr. F. H. H. Guillemard, Cruise of the Marchesa.*

Cleaves' Method of Blue Printing.

At the recent convention of the American Society of Mechanical Engineers, Professor R. H. Thurston thus refers to this process:

"It gives me great pleasure to present to the society a copy of a very large blue print made by Professor E. C. Cleaves, of the Sibley College of Cornell University, by a new method devised by him, by means of which almost any desired size may be made.

"By the common method the larger sizes are difficult to make satisfactorily; the plate glass needed for the apparatus is very costly, and is subject to serious risk of breakage, and the whole arrangement becomes clumsy and difficult of management. By the process adopted by Professor Cleaves no plate glass is required; the apparatus is simple and easily and conveniently handled; and the size and cost of apparatus bear very little relation the one to the other. Any size likely ever to be required in any work of the engineer can be as easily made as the smaller sizes, and the cost and difficulty of construction of the apparatus are never likely to be such as to constitute a bar to the use of this system of printing. There is no practical difficulty in getting up an apparatus to print a drawing ten feet wide and thirty feet long, if it should be found desirable. That here exhibited in illustration of what can be done is three and one-half feet wide and eight feet long, and is probably the largest blue print yet made by any process.

"Professor Cleaves' apparatus consists merely of a cylinder of a length exceeding that of the widest drawing to be reproduced, and of a diameter such that the longest tracing to be used can be wrapped around it with sufficient space to spare to give room for the clamps by which it is drawn into place and held. The cylinder is smoothly covered with felt and the sensitive paper carefully wrapped about it, the tracing to be copied being drawn over the whole and held smoothly in place by spring clamps, which seize its ends. It is found to be easy to lay the tracing smoothly over the surface, and to draw it into contact so perfectly that the work done by this method is even better and more certain than that produced by the ordinary plate glass apparatus, even with the air cushion now so successfully used with it. The print shown has a defect at one corner; but it is the only defective one yet made, and was selected to send simply because it was feared that there might be some danger in sending it by express, and it was preferred to risk this rather than another. It is easy, with a little care and with some practice, to make these prints absolutely perfect, much easier than with glass.

"The apparatus being ready for use, it is mounted on a cradle, supported by its gudgeons, and is revolved in the sun by means of a cord leading from some convenient line of shafting; or it may be turned by hand until the exposure is satisfactorily complete. It requires a little more time to print a sheet by this method than by the old, as the tracing and the underlying sensitive paper is but one-half the time exposed to the rays of the sun. With these exceptionally large prints, however, for which only this process would be employed, this is not an important matter. They are not likely to be made every day."

Patents as Monopolies.

In view of the fierce attacks sometimes made on valuable patents, it is well to remember that they represent a monopoly of but limited duration, and that their very value lies in the economy that they effect in some way for the people who use them. The use of a patented article is in every instance, we believe, a matter of deliberate choice as to a convenience, and not the resort to an absolute necessity. The other side of the "monopolies" is rather neatly brought out in the following from the Omaha *Bee:* "A displeased correspondent of the New York *World* wrote to that paper and asked it to answer, if it could, 'What unpatented American industry is a monopoly in this country?' That journal referred him to the oil and coal industries. If the correspondent wants further information, let him come West, come to Nebraska, and gaze upon the workings of both patented and unpatented monopoly industries. We can show him where railroad companies not only own coal mines, but where they fix a price that is beyond all reason, and make the price within one hundred miles of the mines the same as they charge four hundred miles further east. We can show him where unpatented lime is owned and handled exclusively by one railroad company and peddled all over the State at the same price—distance making no difference. We can show him where salt from great salt works is sold in the same manner. We can show how unpatented dealers get special inducements, and how outrageous freights are charged on unpatented railroads. We could show him 'unpatented American industries which are monopolies,' by reason of the aggressions of great corporations, until his eyes would water, and he would gasp for breath."

After all, the inventor who arrives at great results by years of patient toil and the exercise of his unique talent is a very creditable monopolist, and we wish there were more of his kind. It sometimes happens, too, that large fortunes are acquired by those who obtain an interest in his inventions, but there is little to deplore in that, for they can only grow rich out of the greater economy effected in some special device for public benefit or by some improvement in manufacture.—*Electrical World.*

Hay Fever Cure.

Dr. Moorhead writes, in the British *Medical Journal*, that he has obtained relief from hay fever, his annual persecutor for thirty years, by hypodermic injection of one-twentieth of a grain of morphine and one two-hundredth of a grain of atropin night and morning. The relief was complete.