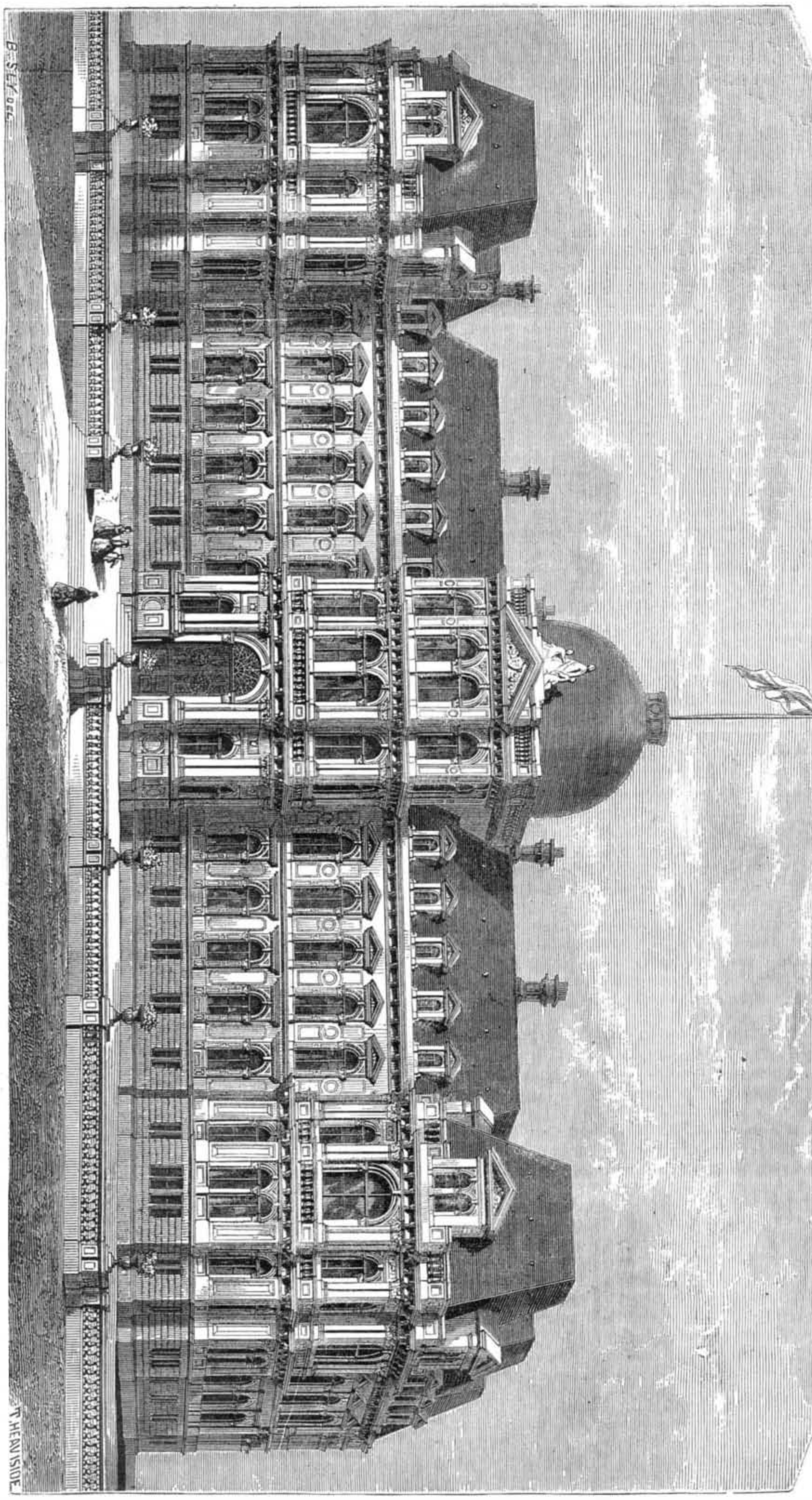
A MANSION AND MUSEUM COMBINED.

Mrs. Bowes, the wife of a wealthy Englishman, has recently built a new mansion, to be occupied not only as a residence but also as a museum and picture gallery, intended to contain for public exhibition a large collection of works of art and articles of *vertu*, to the purchase and assembling of which she has devoted much time and money. On the ground floor, in the center pavilion, is the entrance hall, 48 feet 6 inches by 40 feet, and 30 feet in hight, and adjoining is the principal staircase, 37 feet by 32 feet. Within, these have been built of polished ashlar work, having pillars and pilasters, with marble panels, carved caps, moldings, and spandrels. The stairs and galleries are all of polished stone, about 10 feet in width. On each side of the entrance hall are suites of large rooms; and behind are the museum, and painting and sculpture galleries, 200 feet in length by 45 feet in width.



MRS. BOWES' MANSION AND ART GALLERY, BARNARD CASTLE, ENGLAND.

The first floor is arranged the same as the ground floor, with the exception of the addition of a grand reception room above the entrance hall, from which a fine view of the beautiful surrounding country is obtained. The picture gallery is on this floor, and is 200 feet in length by 45 feet in width; it is lighted from the roof, and made entirely fireproof.

The second floor contains the bed and dressing rooms, and the attics in the roof include the servants' bedrooms.

The exterior of the building is of polished masonry, of a superior quality of stone from Mr. Bowes' estate. The ornamental terrace in front is approached by a wide carriage drive; the steps in the center lead to the flower gardens. The grounds are intended to be laid out with walks, terraces, lakes, gardens, and an orangery, and other buildings necessary for the purpose will be erected. The mansion was built from the designs of Mr. J. E. Watson.

Proposed Tunnel between Scotland and Ireland.

For many years there have been projects more or less before the public for uniting Scotland and Ireland by means of a tunnel; and the scheme has recently been again put forward, this time, however, with some reasonable probability of its being carried out. A single line tunnel, 15 feet wide at base, 25 feet wide at the maximum, and 21 feet high, the side walls of which would vary from 4 to 7 feet in thickness, is estimated by the present projectors to cost nearly $23,000,000, with the approaches. The length of the tunnel would be about twelve miles, and it would extend from a point on the north shore of Ireland, near Belfast, under the Irish sea, to the extremity of the peninsula opposite, in Scotland.

Electro-Music Reporter.

A novel application of electricity to musical instruments, for the purpose of recording the inspirations of genius in musical compositions, is now in process of construction for Mr. C. T. Shelton, of New Haven, Conn. It is a telegraphic attachment to an organ. Beneath each note of the three manuals and of the pedals, and connected with each stop of the organ, is a small brass spring, which is pressed down whenever the piece to which it is attached is brought into action. From each spring, wires run to a galvanic battery of twelve cells, and to the recording apparatus, which may be situated at any convenient distance from the organ. When the spring is pressed down, connection between the battery and the recording apparatus is formed, and the electric current passes through. The recording apparatus is very simple, and similar to that used in Morse's telegraph. Attached to the clockwork, by which a uniform motion is produced, are two cylinders some eighteen inches in length, between which is carried a strip of paper divided into about 250 longitudinal divisions—one for each note and stop in the organ. Corresponding to each of these divisions is a magnet whose armature carries a lever armed with a style, which indents the paper as long as the electric current is passing through. Now, when any note or stop is brought into action the spring connected with it is pressed down, the circuit is completed, the corresponding armature is attracted to its magnet, and the division of the paper belonging to the note struck is indented with a line proportionate in length to the time during which the note is held down. A staccato touch will be represented by a simple dot, while a longer tone will be recorded by a more prolonged indentation. The clockwork is so geared that the paper is carried forward on the rollers at the rate of about one half an inch per second, thus recording each note in the most rapid playing at the rate of about ten notes per second by a line one twentieth of an inch in length, and longer notes by lines proportionally extended.

Reduction of Copper Ores.

The practical working of the Hunt & Douglas copper process, at the Ore Knob mine, Ashe county, N. C., is described as follows by J. E. Clayton:

The ore to be treated was a copper pyrites of low grade, dressed to contain from 100 to 120 pounds of copper to the tun of 2,000 pounds; the gangue was a clay slate. Our mode of treatment was as follows: The ores were crushed, sized by being passed through a sieve of forty holes to the linear inch, and sent to the calcining furnaces. These furnaces were simple three-hearth reverberatories, and were charged every eight hours with 2,000 pounds of the prepared ore; the charges, after being in the furnace for twenty-four hours, were withdrawn, weighed, assayed, and sent to the tanks. The calcination was effected at a low red heat, with a view of converting about one third of the copper in the charge into sulphate; the remainder being as oxides, with the exception of from five to seven and a half pounds to the tun remaining as unoxidized sulphuret.

The calcined ore was next charged into tanks of about 3,000 gallons capacity, two thirds filled with bath, in weighed portions of 3,000 pounds. The mixture was then agitated by a stirring apparatus connected with the tank, and steam injected in sufficient quantity to raise the temperature to about 120° Fah. After eight hours stirring, the mixture was allowed to subside, the copper solution drawn off into settling tanks, and about 600 gallons of weak bath drawn down upon the residues remaining in each stirring tank, to cleanse them of the copper liquor. This weak bath was then drawn off into tanks containing metallic iron, the copper precipitated therefrom, and the liquid passed into a reservoir tank, to be again used in washing the residue from the following charge. The stirring tanks were then emptied and the residues wheeled away. The general average of loss in these residues was from six to ten pounds of copper to the tun of ore treated.

The strong copper solution, after fully subsiding in the settling tanks, was drawn into tanks containing iron (cast or wrought iron scrap), the copper precipitated, and the bath, with a small addition of salt, used in the treatment of a new charge of roasted ore.

After an experimental trial of a few months, we erected works equal to the treatment of the whole ore product of the mine. We, in the first start, prepared a given amount of bath, according to the inventors' formula, with copperas and salt; and found in working the process that, by calcining the ores at a low heat, avoiding a dead roast, and bringing from 25 to

33 per cent of copper into sulphate, the bath was easily kept at standard strength without the addition of any copperas whatever. The salt added was equal to twenty-five per cent, and the maximum of iron consumed, to seventy-five per cent of the copper produced.

Our cost of making copper, obtained as cement, exclusive of mining and dressing the ores, and not including the power required to work the stirring tanks, which was merely nominal, was, for producing 2,100 pounds of copper, from 21 tuns of $5\frac{1}{2}$ per cent ores, $76.96, equal to $3\frac{2}{3}$ cents a pound.

The cost of the plant required is small. The furnaces are simple and inexpensive in construction, and require about 2 5,000 bricks each. The tanks cost, complete, about $60 each, and the labor employed need not be skilled or high priced.

AMERICAN ACADEMY OF SCIENCES.

During the second day's session, papers were read by Professor Elias Loomis on the phenomena of great storms, in which he gave some results derived from the examination of the United States weather maps, and by Professor Theodore Gill on the number of classes of vertebrates and their mutual relations. Dr. Newberry repeated the paper read by him before the Portland meeting on the circles of deposition of American sedimentary strata, giving a comprehensive theory of the formation of all the sedimentary rocks in this country.

The association then adjourned to meet at the Stevens Institute, where Professor Mayer described a

NEW METHOD OF ANALYSIS OF COMPOSITE SOUNDS.

It is well known that if a surface advance regularly under a point of a body having a pendulum vibration in a plane parallel to the surface, this point will describe on the surface a sinuroidal or (as it is now more generally called) a harmonic curve. Ohm states that such a vibration, and only such, can produce on the ear the sensation of a simple sound—in other words, of a sound which has one and only one pitch. But the point of the sonorous body, whether it be a point of a membrane, of the drum of the ear, of the end of a vibrating rod, or of the air itself, may be actuated by a motion which, when it is caused to describe itself on the above mentioned surface, may depart greatly in its form from the simple harmonic curve. Yet in this case, according to Ohm, the ear will act on this composite motion as the analysis of the mathematician can act on its corresponding curve, and will decompose it into the simple harmonic vibrations which compose it. Therefore the ear will, in this case, perceive several sounds, each having one definite pitch, and with the proper degree of attention can take cognizance of any one of them, to the exclusion more or less of all the other components.

But if Ohm's proposition be true, then there must be a reason for it in the very dynamic constitution of the ear. This Helmholtz saw, and the discovery of the 3,000 chords of corti in the cochlea and of Schultze's bristles in the ampulæ led him to suppose that these bodies effected the analysis of the sound, vibrating sympathetically with its simple components.

If we represent any composite sound by a periodic curve, Fourier has shown and states in his theorem that such a curve can always be reproduced by compounding harmonic curves (often infinite in number) having the same axis as the given curve and having the lengths of their recurrent periods as $|$, $\frac{1}{2}|$, $\frac{1}{3}|$, $\frac{1}{4}|$, etc.

To decompose into its elementary harmonic vibrations the sonorous motions which such curve represents and indeed reproduces when it is drawn under a slit in a piece of paper which exposes only a point of the curve at once, it is required that only one vibrating point of the body should be experimented on, and that the composite vibratory motion of this point should be conveyed along lines to bodies vibrating sympathetically to the elements of the composite vibration, and that these sympathetically vibrating bodies should be capable alone of giving simple or pendulous vibrations.

It is evidently impossible to subject to experiment the interior portions of the ears of mammalia, and we must therefore study the progress of the change in the position of the inner ear as we descend in the scale of life, so that, if possible, we may at last find animals whose external ear is exposed to view. It appears that, as we descend from the mammalia in the scale of life, the exterior parts of the ear disappear and the interior portions advance toward the surface.

After this introduction Professer Mayer gave an account, illustrated with elaborate experiments, of a recent research on the analysis of composite or musical sounds, and detailed experiments on the organs of hearing of insects, or what are supposed to be organs of hearing.

After having first shown experimentally all the existing methods of the analysis of sound by taking one after another the elementary notes out of a reed organ pipe by the former known methods, he proceeded to analyze the same sound given by the reed organ pipe by his own method which is as follows: A membrane is placed near the sonorous body. Attached to a point of this membrane are several fibers from a silkworm cocoon. Each of these leads to a tuning fork. Now it is known that a tuning fork can only give a simple sound, that is, a sound having only one pitch. Hence if any of the sounds which are given by these forks exist in the sound given by the sonorous body, the forks giving these sounds, and only these, will vibrate. Professor Mayer showed this by placing on the prongs of the forks small pieces of wax. This system of analysis is found to be so delicate that, if the fork is thrown out of tune by the weight of the piece of wax, so that it will give one beat in eight seconds with the sound which it had before it was loaded, it will thus detect this difference in the pitch. According to Weber, of Germany, the most accomplished musical ear can detect a difference of pitch in two notes whose ratio of vibration is as 1,000 to 1,001; but by this method a difference of pitch can be detected in two notes where the ratio of vibration is 4,000 to 4,001.

Professor Mayer then gave an account of experiments, in which he has partly succeeded in measuring the relative intensity of sounds by the quantity of heat that sounds give when the bodies producing them are caused to send their vibrations into india rubber. The rubber is in the form of a very thin sheet, stretched between the prongs of a fork and inclosed on the sides by a thermo battery. Professor Mayer is still conducting researches in this direction. Unless we can measure the intensity of sounds there is no science of acoustics. Last year Professor Mayer made an initial step in that direction by measuring with great accuracy the relative intensity of sounds of the same pitch. But to measure the relative intensity of sounds of different pitch is a much more difficult matter, and has not yet been successfully accomplished. Professor Mayer, however, hopes to succeed in this by converting a certain known fraction of a sonorous vibration into heat.

Professor Mayer now exhibited to the Academy the resultant curve produced by combining the first six harmonics of a musical note. This curve was then drawn in a circular disk of glass by removing from its blackened surface the continuous line of the curve, which returned on itself. This curve was now placed in front of a lantern, and the image of the line was projected on a screen. A slit in a piece of cardboard having been placed in front of the curve, and in the direction of a radius of the disk, and the disk being revolved, caused the spot of light on the screen to vibrate like the drum of the ear when it listens to a musical note.

Professor Mayer then proceeded to give an account, illustrated by experiment, of what he supposes to be the organ of hearing in insects. Placing a male mosquito under the microscope, and sounding various notes of tuning forks in the range of a sound given by the female mosquito, the various fibers of the antennæ of the male mosquito vibrated sympathetically to these various sounds. The longest fibers vibrated sympathetically to the grave notes, and the short fibers vibrated sympathetically to the higher notes. The fact that the nocturnal insects have highly organized antennæ while the diurnal ones have not, and also the fact that the anatomy of these parts of insects shows a highly developed nervous organization, leads to the highly probable inference that Professor Mayer has here given facts which form the first sure basis of reasoning in reference to the nature of the auditory apparatus of insects.

These experiments were also extended in a direction which added new facts to the physiology of the senses. If a sonorous impulse strike a fiber so that the direction of the impulse is in the direction of the fiber, then the fiber remains stationary. But if the direction of the sound is at right angles to the fiber, the fiber vibrates with its maximum intensity. Thus, when a sound strikes the fibrils of an insect, those on one antenna are vibrated more powerfully than the fibrils on the other, and the insect naturally turns in the direction of that antenna which is most strongly shaken. The fibrils on the other antenna are now shaken with more and more intensity, until, having turned his body so that both antennæ vibrate with equal intensity, he has placed the axis of his body in the direction of the sound. Experiments under the microscope show that the mosquito can thus detect to within five degrees the position of the sonorous center. To render assurance doubly sure, Professor Mayer, having found two fibrils of the antennæ of a mosquito which vibrated powerfully to two different notes, measured these fibrils very accurately under the microscope. He then constructed some fibrils out of pine wood, which, though two or three feet long and of the thickness of small picture cord, had exactly the same proportion of length to thickness as the fibrils of the antennæ of the mosquito. He found that these slender pine rods or fibrils had to each other the same ratio of vibration as the fibrils of the mosquito.

President Morton next explained his researches on the

REMARKABLE FLUORESCENCE IN NEW CHEMICAL COMPOUNDS.

The research has consisted in studying at the same time the fluorescence and the absorption spectra of various bodies, including the uranium salts, the organic substance anthracene and some of its derivatives, and a new body which he was fortunate enough to discover by the application of this method to products of the distillation.

As we have already referred to Dr. Morton's brilliant discovery of thallene and the similar substance petrolucene, it is not necessary to repeat his remarks regarding these bodies.

Resins.

The resins best known to commerce and used extensively in medicine and several of the mechanical arts are nine in number, and are known as copal, lac, amber, dammar, common resin, elemi, sandarac, mastic, and caramba wax. All these resins can be reduced to powder, and all can be dissolved by a union either with acids, oils, or alcoholic preparations. Gum copal is the concrete juice of a tree growing in certain sections of South America and the East Indies. The substance when pure is hard, shining, transparent, citron-colored, and inodorous. It is not soluble in water or spirits, but may be dissolved in linseed oil, when submitted to a heat a little less than sufficient to boil or decompose the oil. When the solution is diluted with spirits of turpentine, it forms a beautiful transparent varnish. Shellac, or more properly lac, is a resinous substance obtained mainly from the *ficus Indica*, or banyan tree, on which it is deposited by an insect. It is composed of five distinct but very similar kinds, each of which is united with a small quantity of several other foreign substances, particularly a red colored matter. Stick lac is the compound in its natural state, incrusting small twigs. When broken off and boiled in water, it loses its red color, and is called seed lac. When melted, strained, and spread into thin plates, it is called shell lac. United with ivory black or vermilion, it forms red or black sealing wax. When lac is dissolved in alcohol or other solvents, and submitted to different methods of preparation, it constitutes various kinds of varnishes and lacquers. Lac is really dissolved by a union with caustic soda. Amber is a yellowish resin, and resembles copal. It is found on the seashore and frequently on alluvial soils with beds of lignite. It is capable of receiving a fine polish, and is used for ornamental purposes, to adorn pipes, walking sticks, etc. It is also the basis of a fine varnish. By friction it readily becomes electric. Amber will not dissolve in alcohol, but it yields to the action of concentrated sulphuric acid, which will dissolve all resins except caramba wax. The union with the sulphuric acid gives dammar a brilliant red tint, but to other resins a dark brown color. Dammar is obtained from certain trees indigenous to the East Indies; among others the dammara and the dammer pine. It is principally used for making varnish. Dammer dissolves easily in sulphide of carbon, oil of turpentine, linseed oil, and benzol. Common resin is the product of the southern pine, and is readily soluble in alcohol and the essential oils. Elemi is a concrete substance obtained from several species of trees growing in the tropics, but having much the same appearance and undoubtedly allied in origin. It is used by the medical profession in ointments and plasters, and by mechanics as a base for the manufacture of varnish. This resin dissolves with difficulty in alcohol and linseed oil, but gives way under the action of turpentine and benzol. Mastic exudes from the mastic tree, which grows in the island of Scio in the Mediterranean Sea. It runs freely when an incision is made in the body of the tree, but not otherwise. It is of a yellowish white color, is semi-transparent, of faint smell, and is used as an aromatic and an astringent. It is also used by painters as an ingredient in drying varnishes. Sandarac is the product of a tree growing in Barbary. It is obtained in what are known as transparent tears of a white color, and is used principally for incense and the manufacture of varnish and, when pulverized and mixed with other substances in a pounce, as a perfume. The following resins will become pasty before melting: amber, lac, elemi, sandarac, and mastic; the others will become liquid at once. Ammonia will slowly dissolve copal, mastic, and sandarac; but on the other principal resins, it has very little effect.

Modern Miracles.

Under this heading we recently made mention of the alleged miraculous trickling stone in France, and expressed surprise that scientific persons like the editor of *Les Mondes* should lend themselves and their columns to the maintenance of an imposition so gross and barefaced as this.

Professor J. O'K. Murray, of St. Francis College, near this city, takes up the cudgel in behalf of the new miracle, and knocks daylight into the subject, and into the SCIENTIFIC AMERICAN, in the following heavenly style, which we publish in order that both sides may be heard:

"TO THE EDITOR OF THE BROOKLYN EAGLE:—For a slipshod, threadbare editorial commend us, from time to time, to the SCIENTIFIC AMERICAN. That any journal with such a respectable, high sounding name should make such an exhibition of shallowness, bigotry, and gross ignorance is quite astounding. The following quotations are from one of its recent leaders, headed "Modern Miracles." As a specimen of scant knowledge, obtuseness, and "stump" writing, it is worthy the days of Know Nothingism. Alluding to the justly celebrated shrine of Lourdes, it treats its readers to the following unscientific twaddle:

'A sickly child laboring under a diseased constitution, and a spring, opportunely trickling from a stone, sum up the entire wonder. * * * A peculiarity of this especial mystery is that it is not susceptible of direct test, and it is therefore a mere matter of faith. * * * If the editor of *Les Mondes* will visit any negro camp meeting in the United States, he will remark innumerable repetitions of religious ecstasy such as that of Bernadette. He will find both old and young of both sexes launching off into descriptions of golden cities and celestial inhabitants, which they sincerely believe, which will throw the peasant girl story far into the shade.'

This is poor English, but the utter stupidity of the logic is immeasurably below the lingo in which it is clothed. It is wanton and ignorant insult to every intelligent Catholic. The fact is, when the SCIENTIFIC AMERICAN attempts to treat of such matters, it goes out of its proper sphere, and no longer knows 'what it is driving at.' I consider it beneath me to refute language which carries with it its own refutation. It is a sample of the supreme ignorance and gratuitous nonsense which occasionally crops out among certain snarling scoffers and *soi disant* men of science, when they treat of some religious topic. About Catholicity or its miracles, such personages generally know a little less than nothing. A sewing machine or a balloon is a more proper theme for the exercise of their craniums. Pity and indignation alternately arrest the mind in reading the shabby effusions of these scientific upstarts. J. O'K. MURRAY,

Professor in St. Francis College."