Magnetic Iron Ore Sands in the Forge Fire.

In a paper read before the U. S. Association of Charcoal Iron Workers, at Ironton, October 12, 1881, Mr. M. Hoagland, of Rockaway, N.J., gives the following interesting facts.

At the Rockaway Rolling Mill, in New Jersey, four Catalan forge fires are in operation, making charcoal blooms from black magnetic sand, and a very superior article is produced for steel purposes. The product is largely used by the Sanderson Brothers Steel Company, at Syracuse, N. Y., and it is found that crucible steel made from this mineral sand is superior to anything yet produced from any other American iron; in fact, equal in every respect to steel made from the best brands of Swedish iron. The steel made from this sand has been thoroughly tested for cold chisels, turning tools, and miners' drills, and in every instance has given entire satisfaction. The ore is treated by the Wilson process of deoxidizing, and afterward worked in the usual way in the Catalan forge. The deoxidizing, it is claimed, saves one half the charcoal, or, in other words, it takes only one half as much coal to make a ton of iron by the Wilson process as is used in the old-fashioned fires. The waste heat from the fire is used for deoxidizing the ore. It was found difficult to work this black sand, on account of the large percentage of titanic acid it contains, until they adopted a method of clearing it with a powerful magnetic machine invented by C. G. Buchanan, and manufactured by M. H. Hoagland, of the Union Foundry. The machine separates the magnetic sand so thoroughly that none of the titanium is found in the portion which passes over the magnet; in fact, where properly managed, the product of the machine will yield by analysis 71 to 72 per cent of metallic iron.

The results of the separation have been so satisfactory that parties who have other ores than black sand have adopted machinery invented by Mr. Buchanan to reduce their ores to a fine consistency, separating by the magnet, preferring the magnetic process, because the fine ore which is washed away by the jigging process is all saved, the magnet taking out nearly all the ore, leaving less than two per cent in the tailings. Another set of this machinery is to be put in operation as soon as it can be built, at Elizabethport, N. J., where the Wilson process will be used, producing iron by the direct method, using petroleum as fuel in puddling furnaces.

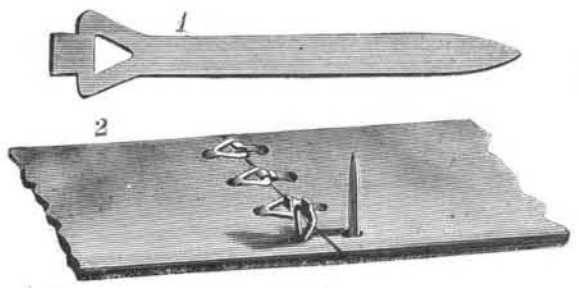
Printing Ink.

The base of our common printing ink, as is well known, is a linseed oil varnish, which sometimes possesses a disagreeable odor, and the ink made from it smells so badly as to make a freshly-printed paper an unpleasant companion for sensitive nostrils. Dr. Brackenbusch, of Berlin, proposes to overcome this disadvantage by replacing the linseed varnish with a solution of colophonium (rosin) in paraffine oil. He dissolves 45 parts of fine rosin in 25 parts of paraffine oil by heating them to 80° C. (176° Fah.) or by mixing them with a machine at ordinary temperature. When the solution is effected, if such it may be called, 15 parts of soot or lampblack are added.

NOVEL BELT FASTENER.

The engraving shows a simple, easily applied belt fastener, recently patented by Mr. Alfred H. Noble, of New Milford, Conn. The fastener is cut from a sheet of brass, as shown in Fig. 1, and has an open head or eye, a tongue or shank projecting therefrom and capable of being inserted through holes in the meeting ends of a belt and through the head or eye, and folded over. A lip projecting from the head or eye opposite the tongue is folded over the tongue to hold it down. The form of the fastener is shown in Fig. 1. The various steps in the operation of fastening the belt are shown in Fig. 2.

The first fastener is shown as merely inserted in the holes in the adjoining ends of the belt. In the second fastener the tongue is drawn through its hole in the head of the fastener, and is bent upward at right angles and cut off at the required length. In the third fastener the tongue is bent



NOBLE'S BELT FASTENER

down on the lip projecting from the head, and in the fourth the lip is bent over the end of the tongue.

This fastener, besides being simple and easily and quickly applied, is cheap and strong, having all of the advantages of the best leather lacing with none of its defects.

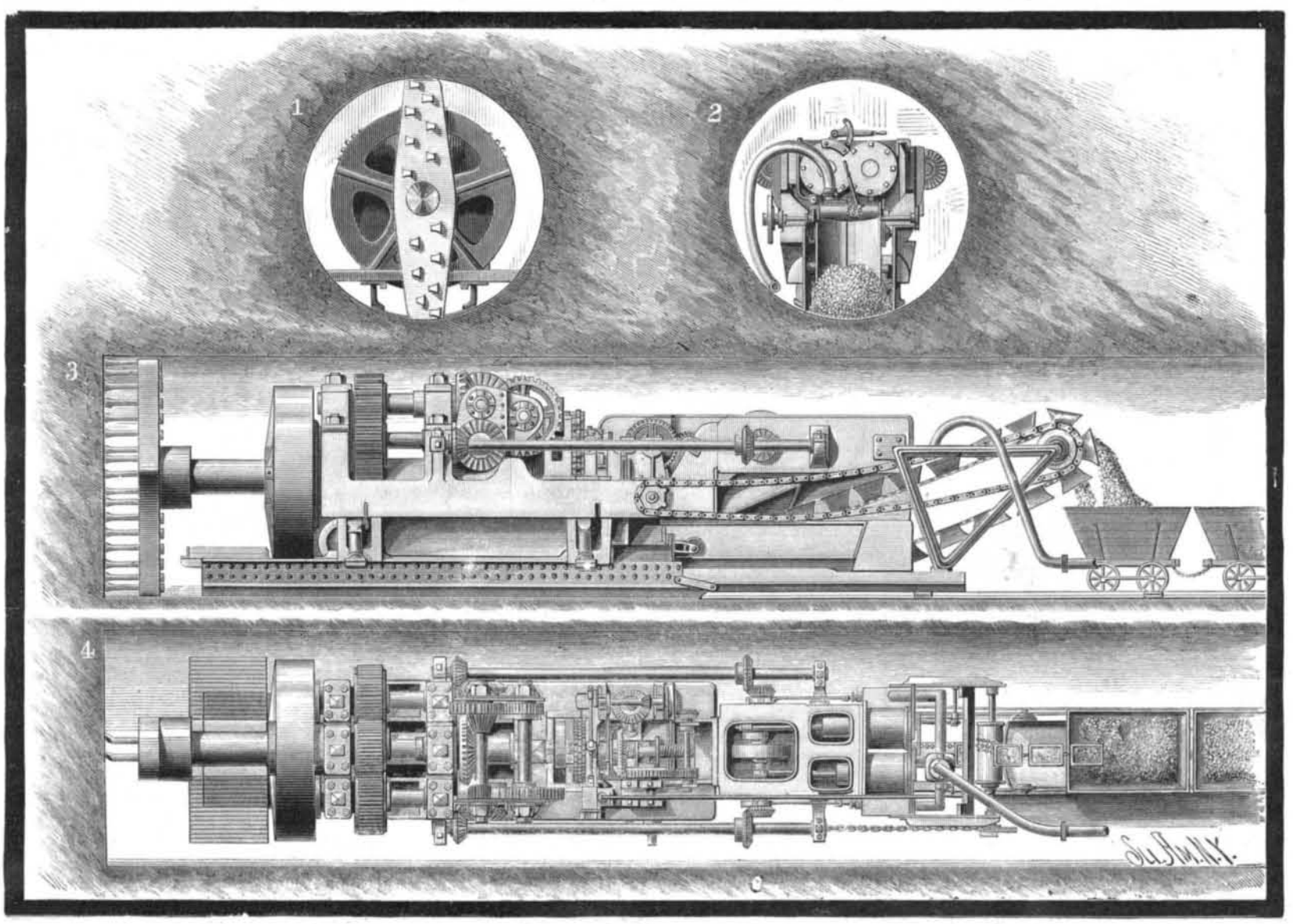
Further particulars may be obtained by addressing the inventor, or Messrs. Greene, Tweed & Co., 118 Chambers street, New York city.

COMPRESSED-AIR MACHINE USED IN THE CHANNEL TUNNEL.

The length of the Submarine Continental Railway Company's Tunnel, under sea, from the English to the French shore, will be twenty-two miles; and, taking the shore approaches at four miles on each side, there will be a total length of thirty miles of tunneling. The approach tunnel descends from the daylight surface by an inclosed gallery, with an incline of 1 in 80, toward Dover, to a point on the Southern Railway Company's line, about two miles and a half from Folkestone. The exact point is at the western end of the Abbot's Cliff tunnel, at which point the gault clay outcrops to the sea level. Half a mile of heading has been driven, by machinery, from this point; after which the works were suspended to enable them to be resumed at a point nearer to Shakespeare's Cliff, where the tunnel passes under the sea. The shaft at this point is 160 feet deep. It is sunk close to the western end of Shakespeare's Cliff. The shaft passes through about 40 feet of overlying *débris;* it then just touches the white chalk, which is pervious to water, after which it goes down to the beginning of the tunnel, which is here 100 feet below the surface of the sea. A heading, now three-quarters of a mile long, has been driven in the direction of the head of the Admiralty Pier, entirely in the gray chalk, near its base, and a few feet above the impermeable strata formed by the gault clay. The idea of the projectors is so to localize the tunnel, not only in the part already made, but also when it passes out under the sea, that it shall have the body of the gray chalk above it, and that of the gault clay below it, both these strata being in themselves impervious to water, and both alike having heavily watered strata on each side of them; namely, the white chalk above the gray chalk, and the lower greensand below the gault clay. This condition, together with that of providing sufficient roof between the top of the tunnel and the sea, which roof has a thickness of 150 feet, will necessitate the tunnel being turned in a curved line.

The present heading is 7 feet in diameter. Machinery is being constructed by which this 7 foot hole can be enlarged to 14 feet, by cutting an annular space, 3 feet 6 inches wide, around it. This will be done by machinery similar to that already described, but furnished with an upper bore head, suitable for dealing with chalk, to make an annular cutting, instead of acting like the first machine, which makes the 7 foot cutting. The one machine will follow the other, at a proper interval; and the *débris* from the cutting by the first will be passed out through the second machine. The compressed air, likewise, which is necessary to work the advanced machine, will be similarly passed through the machine coming behind. There will be no difficulty in speeding the machines so that they shall work along the tunnel at the same rate of progress; and the larger machine can, as well as the smaller one, do its work with a minimum of manual labor; only two men are at present needed for each machine.

The engraving shows the Beaumont & English compressed-air boring machine at work. The length of this machine from the borer to the tail end is about 33 feet. Its work is done by the cutting action of short steel cutters fixed in two revolving arms, seven cutters in each, the upper portion of the frame in which the borer is fixed moving forward five-sixteenths of an inch with every complete revolution of the cutters. In this way a thin paring from the whole face of the chalk in front is cut away with every turn of the borer. A circular tunnel is formed having a diameter of 7 feet. A man in front shovels the crumbled *débris* into small buckets, which, traveling on an endless band, shoot the dirt into a "skip" tended by another man. The skip, when filled, is run along a tramway to the mouth of the shaft. At present these trolleys, each holding about one-third of a cubic yard, are drawn by men, but before long it is hoped that small compressed air-engines will be used for traction. The rate of progress made with the machine is about one



BEAUMONT & ENGLISH'S COMPRESSED-AIR TUNNELING MACHINE EMPLOYED IN THE CHANNEL TUNNEL.

hundred yards per week, but will soon be much accelerated. As worked at present, the number of revolutions it makes is two or three per minute, which, as the advance by each revolution is five-sixteenths of an inch, amounts to boring nearly an inch a minute while the machine is at work. But Colonel Beaumont anticipates no difficulty in making the machine cut its way at the rate of three-eighths of an inch per revolution, and getting five revolutions per minute, which would give a rate of advance of two inches per minute. A very important question has been raised with regard to the supply of compressed air. Carried in four-inch iron pipes, it now reaches the machine with a pressure of about 20 lb., the pressure at the compressor at the shaft mouth being from 30 lb. to 35 lb.; but by increasing the diameter of the supply pipe to eight inches the loss of working value by friction would be greatly diminished, if not rendered inappreciable. The boring has now advanced to the length of 1,250 yards, or, say, three-quarters of a mile, and it is going on at the rate of three miles a year. Simultaneous borings from the French side at the same rate would give six miles a year, or a complete tunnel underneath and across the Channel in three years and a half.

The shape which the completed tunnel will assume will probably be a circle 14 feet in diameter, but flattened at the bottom to receive the rails. It will be lined with two feet thickness of cement concrete; not that this is necessary to insure the stability of the work, but to prevent accidental falls of chalk. The concrete will be made of shingle from Dungeness, and of cement formed from the gray chalk excavated from the tunnel itself. In this manner the tunnel will afford the means of its own lining at a cheap rate. The gradients will be 1 in 80, on each side, until the depth 150 feet below the bottom of the sea is reached; after which the line may be said to be level, subject only to a very slight inclination from the center outward, to prevent the lodging of water.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court—District of Maryland.

THE AMERICAN BALLAST LOG COMPANY OF NEW YORK *vs.* BARNES *et al.*

In equity—before Judges Bond and Morris.

PATENT No. 126,938—BALLAST LOGS—PATENT.—The complainants' device is essentially a combination of two counterbalance weights, and cannot be construed to cover all methods by which vessels may be kept in an upright position while in port, by means of contrivances fastened on the outside and floating in the water, but only such as are substantially identical with the device described in a patent in construction, form, and principle of operation.

Defendant having dispensed with one of the essential elements of the combination, and having substituted therefor a new mode of accomplishing the same object, not a mechanical equivalent, and not similar in principle of operation, there is no infringement.

Bill dismissed.

Financial and other Results of the Recent International Exhibition of Electricity at Paris.

Mr. Cochery, the Minister of the Post and Telegraph Department, lately addressed a report to Mr. Grevy, President of the French Republic, giving a recapitulation of the financial results of the exhibition held last year in Paris, and this summary has just been published. Some of its most essential points will be of interest to American inventors and other participators in the Exhibition. Mr. Cochery says:

"In face of a recess of the Chamber of Deputies we were unable to engage the state in eventually paying certain sums in case of debts being incurred; at the same time it would have been impossible to wait till the assembling of the deputies before beginning the preparatory work.

"Some people having liberally offered to guarantee the state against any losses which might be entailed by the Exhibition after deducting the receipts it produced, we were enabled to accept these propositions, which protected the state against any eventuality, and were happily able to invite the different nations to take part in the Exhibition.

"The association formed for the purpose of carrying out this Exhibition, guaranteeing the state against loss, at the same time stipulated besides, that in case the receipts of the Exhibition be greater than the expense incurred the balance should be remitted to the government, to be employed by the same in works profitable to the electric light.

"The Exhibition was opened on the 10th of August, and though in the beginning all was not finished, fifteen days had not elapsed before the completeness of arrangement was perfect.

"From the 27th of August the Palais of Industry was illuminated by electric light every evening.

"The number of exhibitors was 1,764, of which 937 were Frenchmen and 827 were foreigners.

"The number of visitors who bought cards of entry was not less than 673,473. Free entry was permitted to a great many. Cards were distributed most liberally to schools, workshops, etc., and the two last days of the Exhibition were devoted to the public gratuitously. During these two days more than 80,000 people were able to profit by this liberality.

"The law of the 27th of December, 1880, accorded a subvention of 200,000 francs, and to this sum 25,000 francs were added by the city of Paris; to this add the receipts, and we find the sum total of the Exhibition's treasury to have been 1,048,417.68 francs; actual expenses, 689,490.84 francs. From this it results that a net profit of 358,926.84 francs was made, and after having settled a few debts still unpaid the remainder will not be less than 325,000 francs. It is this sum, the subvention by the state of 125,000 francs deducted, that will be returned to the government with the prayer that the same be used in creating a laboratory of experimental electricity."

Mr. Cochery then proceeds to recommend that this petition be granted, as he considers that the signature of the President affixed to a deed or decree carrying out the idea the petition designates, will be a perfect completion to favorable results attained by the Exhibition, and thus be an encouragement for those who in future undertake to carry out exhibitions.

The collection of electrical machines and implements at the Palace of Industry proved what immense progress has been made in electricity within the last few years, and the establishment of a central laboratory of electricity will furnish the means, in France at least, to develop this science, the future of which is so vast.

The laboratory will in a modest way continue the work of the Exhibition, and will be under the supervision of the Department of Post and Telegraph, the department that organized the Exhibition of Electricity. Mr. Grevy has signed the necessary decree, and has thus established the new laboratory of electricity, sanctioning the use of the net balance of 325,000 francs produced by the Exhibition to found and support this new branch of the Post and Telegraph Department.

This is the way science and art are encouraged in the Old World. People are willing to pay high taxes when the state makes some show of generosity in such public matters as appertain to science, art, and the industries. G.

Insuring the Insurance Companies.

Edward Atkinson and William B. Whiting send the following timely suggestions to the members of the Boston Manufacturers' Mutual Fire Insurance Company:

It is impossible for any man who takes an interest in the profession of mutual underwriting not to endeavor to cope with the dangers of great conflagrations, which are day by day becoming greater in our large cities, even though the factory mutual companies have no direct interest in the matter. The only drawback to the pleasure of conducting a system of insurance—the objective point of which is not merely to pay an indemnity for loss, but much more to save property from destruction by fire—is that it becomes a habit to look at every building in process of construction with a critical eye, and one is apt to lose patience in witnessing the waste of money in unsafe methods, where the simplest rules of safety would save large sums even in the cost of building. The handsome and well composed fronts of warehouses and hotels, and the apparent solidity of churches and schoolhouses, cease to give any pleasure or satisfaction, even as works of artistic design, when we know that every part of the interior is so constructed as to assure heavy damage or complete destruction if a fire happens in any part of the premises; while the surveys which we have occasionally been asked to make, with a view to preventing the destruction of insane asylums and hospitals, leave an unpleasant impression of almost criminal stupidity and ignorance in their mode of construction, and in the arrangements of the fire apparatus. Not only does the danger to property demand attention, but the danger to life compels it; and any true man would lose all self-respect who did not use what little influence he might possess, and urgently present the lessons learned from his experience, in an endeavor to prevent disasters which may occur at any moment—such disasters as have lately occurred at the destruction of the theater in Vienna, at the recent fire in New York, and in other recent instances which need not be mentioned.

Destructive fires in theaters almost invariably begin amidst the combustible materials upon and over the stage; the scenery is not only of necessity combustible, but the materials which are in constant use, such as paints, oils, light wood, canvas, and also the processes of use, of renewal, and of repair, are all of a nature which the mutual underwriter would regard with the utmost distrust, and would only insure at all when every available means of precaution have been taken for extinguishing the fires which experience has absolutely proved will occur at comparatively short intervals in such stock, either from accident from without or spontaneous combustion within the mass. We believe this danger may be guarded against with almost absolute certainty by placing automatic sprinklers over and around the stage of any theater, and we hope we may have so impressed the Police Commissioners of Boston with the probable efficacy of this apparatus as to cause them to make its use compulsory under the authority recently given them.

But inasmuch as every member of this company has a money interest in the safety of the commercial districts of Boston, New York, and Philadelphia, no apology is needed for again enforcing the necessity of more adequate means of preventing loss, especially in New York. A computation has recently been made that in one small section, comprising an area little, if any, over two acres, there is seventy million dollars' worth of property at risk; this may be an exaggerated estimate, but there are many acres upon each of which five to ten million dollars' worth of property is at risk. During the daytime there is no head of water immediately available in this district, and the multiplication of wires is daily rendering it more difficult to raise ladders at the right places; this again causes great delay in carrying up lines of hose and in getting the water upon the fire in such a way as to do any good.

In view of these facts, attention may again be called to the entire feasibility of attaching permanent 4-inch iron pipes to the corners of blocks, and carrying a 4-inch iron pipe service with hydrants at every party-wall over the whole area of the roofs constituting a square or block of buildings; such apparatus to form a part of the public fire service, and to be used by the public fire department only, couplings being attached to the base of the vertical pipes by which a connection may be made with the steam fire engines. It may be useless to repeat this suggestion, but in view of the accumulation of wires, and the possible new dangers from electric light wires, a quick supply of water upon the roofs of our high buildings is becoming more and more necessary. At the time this suggestion was first made such a roof hydrant service, with the necessary vertical pipes, could have been put up, ready for use, at a cost of $1,600 to $2,000 an acre; it might now cost a little more.

If there are acres upon which the insurable value of the property ranges from five to thirty-five million dollars, then a sum ranging from $25,000 to $250,000 a year is paid out in premiums of insurance upon each of such acres, and if from one to ten such acres were burned, then from ten to fifty per cent of the indemnity promised under these policies of insurance would not be collected; witness the value of similar policies after the fires in Chicago and Boston. It may well be asked if it would not be worth two or three thousand dollars an acre for a service of roof pipes and hydrants, for the mere purpose of *insuring* the *insurance companies*, which may otherwise be made bankrupt by a fire covering only a small part of either of the great commercial districts of the cities named.

It may also be a matter of interest to observe the fact that if there are acres in the crowded part of the dry goods district of New York upon which a sum even approximating $250,000 is annually paid for insurance, a single year's premium might suffice to pay the cost of a pumping station on one of the docks, and of a special main pipe leading to that specific acre only.

The first answer to these suggestions always is, that no concessions can be had in the rates of insurance now charged if these precautions are adopted; to which it may be answered that no concessions ought to be made upon rates which are already so low as to preclude the accumulation of any adequate reserve, and which are depleted from 30 to over 50 per cent by the mere expense of conducting the competitive system of insurance as now practiced. But the more complete reply is this: that the man who accepts or rejects provisions for the safety of the premises in which he has a money interest, merely on the single issue of the rate of premium charged, is not a safe man to be insured at any price. The difficulty, which really lies in the way of adequate measures for protecting the concentrated hazards of cities, is in the difficulty of promoting co-operation among owners. City governments, as now constituted, are almost unfit to do the necessary work, and individual owners seem almost incapable of making the necessary combinations. If a conflagration exceeding the Chicago and Boston fires should happen to precede a financial crisis more severe than that of 1857, if not as much prolonged as that of 1873, some action may possibly be hoped for in the protection of warehouses already built.

In the meantime it is a satisfaction to note that more attention is being given to safer methods of construction in many of the more recent buildings, while the old stock of combustible churches, hotels, schoolhouses, hospitals, and asylums is being consumed at an accelerated rate; the normal rate of destruction of previous years of one church per week, and one almshouse, insane asylum, or schoolhouse per month, having been considerably exceeded during the year 1881 in the United States. The period of combustible architecture appears to be near its end, and in another generation the masters of that art may have yielded place to the better instructed graduates of the present day.

The Telephone for Finding Springs of Water.

A new use for the micro-telephone has been devised by Count Hugo Von Eugenberg, at Castle Tratzberg, in the Tyrol, namely, for finding underground watercourses. At several different places on the declivity of a hill, he buries a number of microphones in the soil, and connects each of them with a battery and a separate telephone. In the night, when other sources of disturbances are wanting, or less noticeable, he listens at the telephones, and is enabled to detect in this manner the faintest murmur or gurgling of water within the earth to a considerable depth. The microphone plays the part of the sensitive ear of hunter or savage, who is often able to detect the presence of water in the same way.

The Pioscope—Prof. Heeren's Milk Test.

This newly invented instrument, the "pioscope," consists of a disk of black vulcanized caoutchouc, having in its middle a very flat, circular depression. A few drops of the milk in question, well mixed, are placed in the hollow and covered with the second part of the apparatus—a plate of glass painted with six shades of color radiating out from a small uncolored circular spot in the middle. The colors range from white gray, to deep bluish-gray. The layer of milk is seen through the uncolored spot in the center, and its color can thus be compared with the radiating colors, and its quality is judged according to the color with which it coincides. Thus the whitest color stands for cream, the next for very rich milk; then follow, in succession, normal, inferior, poor, and very poor.