

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

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NEW YORK, SATURDAY, JUNE 18, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions.....	386	Lead ores, argentiferous, testing	384
Agricultural notes.....	386	Lecture, Prof. Carhart's.....	386
Aque, amylinic acid for.....	387	Lump fish, the.....	391
Amphora of bronze, etc.....	391	Mechanical inventions.....	389
Arsenic, operation of.....	387	Needles, to magnetize (7).....	394
Book protector, new.....	390	New England exhibition.....	386
Carbonic oxide, to detect.....	389	Phonograph, cylinder for (15).....	394
Carlyle and his dyspepsia.....	386	Photo-engraving, Luckhardt's.....	386
Casting, large, another.....	386	Plants, insectivorous, in Florida.....	389
Constipation, Swedish cure for.....	383	Rein holder, novel.....	389
Copying process (3).....	384	Rubber, to vulcanize on iron (16).....	394
Corn sugar factory, gigantic.....	393	Seventy miles an hour.....	394
Cushions, making.....	392	Silk culture in America.....	389
Discoveries in S. A. Heath's.....	391	Smallpox, recent facts about.....	391
Drainage and disease, rural.....	385	Smallpox, vaccination in.....	385
Engineering inventions.....	390	Starch polish, improved.....	390
Engineers, Civil, American Soc.....	387	Steam, wastefulness in use of.....	393
Engineers, Mining, Institute of.....	385	Telegraph in Arctic exploration.....	389
Fish, strange, feast.....	386	Telephone system, new.....	389
Glass, to etch (18).....	384	Telephonic sys'm, Dolbear's* 383, 388	
Grease, to remove from clothing* 394		Telephony, a new system of.....	388
Gutta-percha (4).....	394	Timber, growth of.....	390
Harvesters, double tongue for.....	387	Vaccination in smallpox.....	385
Heath's discoveries in S. A.....	391	Varnish for violins (2).....	394
Horses, worn-out, utilization of.....	382	Voice, the, photographing*.....	389
Inventions, discolored.....	386	Waterproofing cloth (1).....	394
Inventions, engineering.....	390	Water, to test (14).....	394
Inventions, mechanical.....	389	Whales, fin-back, shooting.....	389
Inventions, miscellaneous.....	390	Wind motor, improved*.....	390
Inventions, new.....	393	Wrens as insect destroyers.....	391
Inventions, recent.....	387		
Iridium.....	392		

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 285,

For the Week ending June 18, 1881.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS. —The Plattsmouth Bridge.—Purpose.—Location.—General Description.—Time.—Foundations.—Masonry.—Viaducts.—Deck spans.—Channel spans.—Steel floor.—7 figures and map showing the location of the Plattsmouth Bridge over the Missouri River.—Perspective view of bridge.—Diagram of bridge (to scale).—Biers—Caissons, etc.....	4535
Building Concrete Walls.—Stability and economy of concrete walls.—Preparing to build.—Preparing the concrete.—Concrete walls under old buildings.....	4541
The Gyrograph, 2 figures.—A novel and useful instrument for drawing curves.....	4549
II. ELECTRICITY, LIGHT, ETC. —Practical Uses of Electricity. By Prof. CHAS. A. YORKE.—Electricity as a factor of social and business life.—The nature of electricity.—Electric measurements.—Importance of electric communication.—Magnitude of the telegraphic interest.—Efficiency of the telegraph.—The telephone.—Electricity in automatic machinery.—In scientific observations.—Electric time service.—Electric signaling apparatus.—Industrial uses of electricity.—Applications of dynamo electric machines.—Methods of electric lighting.—Multiplication of "arc" lamps.—Incandescent electric lamps.—Various types of electric lamps.—Electro-magnetic engines.—Electric transmission of power.—Flowing by electricity.—Electric railways, pile-drivers, hammers, etc.—Electric horticulture.—Household uses of electricity.—Electricity in medicine and surgery.—The Paris Electric Exhibition.....	4542
Illuminating a fish by electricity. 1 figure.....	4544
Telegraph transmission of electric light.....	4544
Newton's Anticipation of Franklin's Discovery.....	4544
Curious Optical Illusion. 1 figure.....	4549
III. TECHNOLOGY AND CHEMISTRY. —On So-called Rusty Gold. Losses in the Plattsmouth Chlorination Process.....	4544
On the Formation of a Chemical Compound of Ammonia with silver Bromide. By J. V. ELDEN. 2 figures.—Forms of crystals of silver bromide in ammonia.....	4548
The Basic Dephosphorizing Process.....	4549
The Cyanamide Compounds of Succinic Acid. By Dr. H. MOLLER.....	4549
IV. NATURAL HISTORY, ETC. —Killing weeds.....	4539
Prof. Huxley's Lecture on the Herring. Inquiries of Fishery Commissions.—Characteristics of the herring.—Food of the herring.—The herring's ancestry and physiology.—Propagation.—Allies and relatives of the herring.—The spawning of herring.—Development of the young.—Abundance of herring.—Geographical range of the herring.—Impossibility of exhausting the supply.—Capricious movements of herring shoals.....	4545
The Shad Fishery of the Atlantic Coast.....	4547
The Relative Food Value of Fish.....	4547
V. ARCHITECTURE, ETC. —Peterborough Cathedral. History of Peterborough. 1 full page illustration of Peterborough Cathedral. Drawn by S. Read.....	4541
Work of the Sculptor. Preparation of clay.—Source of sculptor's clay.—Putting the work in plaster.—Difficulties of casting in bronze.....	4541
VI. HYGIENE AND MEDICINE. —The Death Odor.....	4547
Grindelia Robusta as a Remedy in Asthma. By Dr. T. M. ROCHSTER.....	4548
Oleate of Mercury for the Hair. By Dr. A. H. DE YOUNG.....	4548
VII. MISCELLANEOUS. —Alabama Coal and Iron.....	4549
City Supplies of Charcoal.....	4549
Natural Wealth.....	4550
Interesting Postal Statistics.....	4550
Newark, N. J., as a Manufacturing Center.....	4550
American Butter in England.....	4550
The Great Wall of China.....	4550

A NEW TELEPHONE SYSTEM.

We illustrate this week a new and remarkable system of telephonic communication, which by its originality and efficiency promises to be of great value to the public. It embodies the discoveries of A. E. Dolbear, Professor of Physics, Tufts College, Massachusetts, whose interesting contributions to the SCIENTIFIC AMERICAN during several past years have rendered his name familiar to our readers. His additions to the general stock of knowledge pertaining to the useful arts and sciences have been very extensive, and he ranks among the most prominent of American scientists. In the department of electricity his indefatigable researches have generally kept him in advance of his contemporaries; and had he been more observant of Patent Office formalities, it is probable that the speaking telephone, now so widely credited to Mr. Bell, would have been garnered among his own laurels. Experimental philosophy and common-place business are, however, seldom conjoined in the same individual; and the professor's contest to establish his priority in the discovery of the magnetic telephone has not yet, in law, culminated in his favor. But the world is probably the gainer, for Professor Dolbear now brings forward a new and independent system, which has important advantages over the Bell and other telephonic methods.

Prominent among the advantages of the Dolbear system are its capability of transmitting speech over long lines of wire, and its freedom from the troubles of induction. It has not yet been fully ascertained how far the Dolbear system will successfully operate; but judging from the principles on which it works and the practical experience had with it on limited circuits, it seems capable of doing effective business on lines of far greater length than heretofore have been employed. The Dolbear telephone is a silent instrument. The words and voice of the speaker come clearly to the ear without the bubbling, crackling, sputtering, and whizzing noises that so seriously curtail the use of the Bell method.

Every practical form of electric telephone heretofore brought before the public has, at some point or other, been claimed as touching the Bell system, and subject to the Bell patents.

We have said that the Dolbear is an independent system, by which we mean that, in its principles of operation, it is an absolute departure from the Bell method. For example:

In order to receive messages by the Bell system it is necessary to use, between the ear and the line wire, an electrical machine, consisting of a magnet, a metallic diaphragm near the magnet, a magneto-coil to influence the magnet, which coil is connected with the line wire and with the ground.

Take out this machine and we take out the Bell telephone system. This, substantially, is what Dolbear does. To receive a message he takes out the machine, and puts the end of the telegraph wire directly to the ear.

For convenience of ordinary use Mr. Dolbear provides the receiving end of his telegraph wire with a small handle, in which he arranges a couple of thin diaphragms, one of them attached to the wire—contrivances that improve the vocal delivery of the line wire.

Our illustrations are taken from the actual working apparatus and line as recently set up in the SCIENTIFIC AMERICAN office by Mr. Dolbear's able assistant and enthusiastic coadjutor, Mr. H. C. Buck, of Massachusetts. The practical working of this line in our office was admirable in all respects and gave us the utmost satisfaction.

The description of the new system which we publish elsewhere, written by Prof. Dolbear, apart from the instruments to which it relates, constitutes a clear, instructive, and interesting essay, in which are embraced, in concise form, the leading laws that govern all forms of electrical action.

Professor Dolbear has prepared a number of splendid exhibits of his new system, destined for display in the great International Electrical Exhibition at Paris, this summer. The invention will doubtless attract its full share of attention in that extraordinary assembly of wonders.

MEDICAL PATENTS AND TRADE MARKS.

At the recent meeting of the American Medical Association in Richmond, the report of the section on medicine contained the following curious resolution, which was referred to the Judicial Council for report at the next annual meeting:

"Resolved, That the spirit of the Code of Ethics forbids a physician from prescribing a remedy controlled by a patent, copyright, or trade mark. This, however, shall except a patent upon a process of manufacture or machinery, provided patent be not used to prevent legitimate competition; and shall also except use of a trade mark used to designate a brand of manufacture, provided that the article so marked be accompanied by working formulae, duly sworn to, and also by a technical, scientific name, under which any one can compete in manufacture of same."

It would manifestly be unfair to hold the medical profession of the United States responsible for the sentiments of a resolution not formally passed upon and adopted by the association. So far as appears the resolution expresses the mind of perhaps only a small part of the section in medicine; nevertheless the fact that a resolution so worded could be presented to the association and obtain any countenance whatever, too clearly shows that some of the members at least are sadly in need of enlightenment with respect to the policy and ethics of patents, copyrights, and trade marks.

Certainly the man that draughted the resolution betrays a degree of ignorance of the function and practical working

of patent rights, copyrights, and trade marks as thorough-going as his inacquaintance with the usages of English speech.

The wisdom of the general policy of refraining from prescribing any of the secret compounds misnamed "patent" medicines, is beyond question. But that class of alleged remedies for disease is entirely without the scope of this resolution as it stands. A patented medicine cannot be of secret composition, since one of the prime conditions of granting letters patent is that the matter patented shall be fully and explicitly published to the world.

That a physician ought to know the ingredients of whatever he offers a patient goes without telling; it is desirable also that he should know what effect the several ingredients alone or combined are likely to have upon the human economy under any given circumstances; but it is gravely to be feared that if the general practice of physicians were strictly limited to the administration of remedies under such conditions the majority would find their practice amazingly restricted—possibly to the advantage of their patients. Be that as it may, it is obviously the physician's duty to administer to his patient in any instance the remedy best suited to the case, so far as he knows; it is his duty also to widen his knowledge of probable or approved remedies to the utmost; and he has no moral or professional right to accept or reject a proposed remedy for any other consideration than the best interests of his patient. The fact that the manufacture or sale of a remedy is controlled by patent, label, or trade mark has nothing to do with the medical aspects of the case. If the remedy is better calculated to benefit the patient than any other remedy known or available, the physician is morally bound to use it, whatever the Code of Ethics or the resolutions of any professional association may have to say in the premises.

For the enlightenment of the draughter of the resolution under criticism it may be proper to remark here (1) that it is impossible for a patent to be "used to prevent legitimate competition;" consequently the exception cuts the ground from under the first clause of the resolution so far as it relates to patented remedies, and the subsequent exceptions do the same with respect to labels and trade marks. (2) That the sole function of a trade mark is "to designate a brand of manufacture." (3) That a trade mark in no way hinders competition in the manufacture of any article.

Stripped of its errors of fact and misconceptions with regard to the purpose of patents, trade marks, and copyrights, there is left of the resolution but one possible idea, which may be expressed in this wise:

"Resolved, That a physician should not prescribe an alleged remedy, the composition of which he does not know."

Should the association entertain and wish to express a disapprobation of patents, copyrights, and trade marks a resolution to that effect might take some such form as this:

"Resolved, That professional bigotry and prejudice forbid the physician to use any patented remedy, or any remedy obtained by the use of any patented implement or implements manufactured under any patent; or any remedy manufactured by any patented process or machinery, or put up in any package tainted by patent rights, or bearing a copyrighted label, or transported in any vehicle so tainted; or to use any patented surgical or other implement, or any device or implement in the manufacture of which patented tools or processes have been employed; or to make use of any copyrighted book or treatise for study or reference; or (in short) to make use of any modern means or methods in the practice of the healing art, or in preparation for such practice."

We have no fear that the associated physicians of the United States will deliberately commit themselves, even by implication, to any such absurdity.

TESTING ARGENTIFEROUS LEAD ORES.

The following will serve as an answer to a number of our correspondents asking information respecting the simplest reliable method of testing lead ores for silver:

Take out the front grate of an ordinary cooking stove with a good grate space and draught, and put in a piece of thin earthen drain pipe about nine inches in length and three inches inside diameter, supporting it on bits of brick so that it rests about two and a half or three inches above the grate. The tube should be heated in an oven or otherwise as hot as possible before setting it, so that when a fire is built under and around it, it will not snap or break into fragments. Build the fire so that the air may pass through the tube from front to back and escape through the fire without danger of the coals falling into it. Let the fire gradually increase until the greater part of the tube is at a bright red heat, the front of the tube being loosely stopped with a piece of fire brick trimmed to fit.

Weigh out on an apothecary's balance about one-tenth of an ounce of the ore reduced to a very fine powder by grinding it in a mortar; also two separate lots of one-half ounce each of granulated lead free from silver. Mix one part of the lead with the ore in the bottom of a small scorifier; cover the mixture with the rest of the lead, put the scorifier into the extemporized muffle. Close the mouth of the muffle until the lead has melted, then partly open it to let the air flow in. If the muffle is hot enough the lead will soon begin to scorify the liquefied litharge formed collecting as a ring around the sides of the vessel and gradually increasing in quantity until the whole surface of the melted metal is covered. It is well to add to the contents of the scorifier two or three pieces of borax glass (borax that has been melted in a crucible and poured out on a plate of iron to cool)

the size of peas, if any of the gangue of the powdered ore remains floating on the top of the metal and is not slagged and absorbed by the litharge. As soon as the ring of slag closes over the metal remove the scorifier, let it get cold, then break it, and by pounding separate the slag from the button of metal.

Put a dry bone-ash cupel, weighing about the same as the button of metal obtained from the scorification, in the muffle, let it get red hot, then drop in the clean button and close the muffle until the metal has liquefied, then open it partly.

Lead under such slags off into litharge, the latter carrying with it all base metals and impurities. It is absorbed almost as soon as formed (if the muffle is properly heated) into the porous bone-ash cupel. The button gradually decreases in size, and as it gets small it must be watched, so that when the last of the lead passes off into slag and the silver (if any is present) "brightens" or assumes the luster and color of the pure metal, the cupel may be removed to avoid loss by volatilization. If the ore contained any silver a small bead of that metal will be found in the cupel; if none the cupel will be empty. Sometimes, in poor ores, the bead will be almost microscopic, so that the cupel must be carefully examined before setting it aside. Weigh the bead if found on a fine balance and multiply the weight in grains by 291,600, the result being grains of silver (with possibly a little gold) in a ton of the ore. Error may arise from the presence of silver in the test lead, so that it is always best to test it for that metal (by scorification and cupellation as above). If it is found to contain silver, and a purer sample cannot be readily procured, determine by duplicate tests as accurately as possible the amount present, and make proper allowance for this in calculating other assays in which the lead is used.

Good scorifiers and cupels can be obtained from any dealer in chemical apparatus, etc. In some instances a large French clay or even Hessian crucible with a hole knocked in the bottom can be made to serve as a good muffle for such tests instead of the clay pipe. In this case the side of the crucible becomes the bottom of the muffle, and if a little dry sand or bone-ash is spread over it, it can be made level enough to support the scorifier without tipping.

Under favorable conditions such tests can be made in an hour or an hour and a half.

RURAL DRAINAGE AND DISEASE.

BY H. C. HOVEY.

It has been estimated that more than half the deaths occurring in cities are due to preventable causes. The vital statistics of farming regions are not so easily obtained, but statements of responsible physicians, having each a large country practice, in widely separated portions of the United States, prove the importance of judicious sanitary measures in rural as well as municipal localities. One observes that "one-third of the autumnal sickness of this region might be prevented by systematic drainage of farm lands, without detriment to their agricultural value." Says another, "about fifty per cent of our sickness might be obviated by suitable sanitary precautions." All agree that a large proportion of the maladies coming under their notice are attributable to the insidious poison emanating from decomposing animal and vegetable matter.

The purest country air is less pure than is commonly supposed; a fact demonstrated to visitors of Mammoth Cave, who, on emerging after breathing for several hours the air of the cave, which is almost absolutely free from noxious gases, find the outer air laden with oppressive odors, and depressing in its influence on the system.

Miasmatic exhalations arise from every swamp, and wayside pool, from the decaying forest leaves, and many other objects that are hardly thought of as prejudicial to good health. This particular form of the evil reaches its minimum in hilly regions, where the tilted strata supply natural drainage; while its maximum is found in such extensive areas as exist in Indiana, Illinois, and other portions of the West, where vast deposits of alluvial and lacustral soil cover nearly level sedimentary beds, allowing but very sluggish removal of marshy accumulations.

The cultivation of the surface soil, and the drainage made for agricultural purposes, have gradually redeemed large tracts of wet land in the regions mentioned; yet much remains to be done, and it is gratifying to see that steps are being taken by some of the States embracing prairies and broad river bottoms, to investigate the relation between the hydrographical features of the country and the prevalence of malaria and zymotic diseases.

State and local health commissions are instituted with authority to collect vital and sanitary statistics, and to have charge of public measures for removing the causes of disease from all parts of the State; omitting, however, two very important links from the chain of a perfect organization; namely, police power to enforce good health laws in rural districts, and means to defray expenses of straightening crooked streams, to increase the velocity of the current, digging canals to relieve wet lands from overflow, and doing other things that might cost a considerable sum of money, but would add largely to the reputation of the State for salubrity, and thus bring a rich reward.

The first annual report of the Health Commission of one of our largest and most populous interior States has lately appeared, full of facts as to the deficient sewerage of cities, and its almost utter neglect in smaller towns and villages, and in rural localities; also showing the inevitable connection between these causes and the prevalence of forms of sickness that might be entirely avoided by a comparatively

small outlay. And what is true of Indiana would also be found to be true of other States similarly situated as to a lack of natural drainage.

Look at the still more level State of Illinois, with its vast prairies and fertile bottoms. The sewage of all the cities is emptied into the adjacent streams, which have usually a sluggish flow, and it is hardly asked whither the reeking mass is distributed.

Often this seems to be the only available mode of getting rid of it, all experiments looking toward other methods meeting with but slight success. It is to be hoped that some apparatus like the "garbage destructor and carbonizer" described in a late number of the SCIENTIFIC AMERICAN, will be introduced into all large cities for the consumption of refuse without sending it down some stream to contaminate the surrounding country.

About ten years ago the course of the Chicago River was artificially reversed, so that instead of running as it had done for ages into Lake Michigan it emptied itself and its accumulation of street filth and offal into the Illinois River, coursing completely across the State. The beneficial result to the city was very great; but for 150 miles down the Illinois River loud complaints were made of a marked increase of zymotic diseases, and a remarkable mortality among the fish in that stream seemed to prove that the water had been poisoned. The fact is worth noting, in passing, that the fish appeared to grow used to the changed condition of affairs; but during the past winter the ice bound water not being properly oxygenated for a long time, many fish died, while others in immense numbers congregated below the dam at Henry, where the constant agitation of the falling water would favor aeration. And at the same time there was an alarming prevalence of diphtheria at Peoria and other places along the river.

This illustration shows the importance of State regulation of general drainage, so that what is borne away as a nuisance from one locality shall not be cast as an offensive burden on another.

But suppose all to have been done that can be effected by public health organizations, much will remain to be accomplished by individual effort, in response to appeals to an enlightened instinct of self-preservation.

Many farmers, otherwise well informed, do not seem to realize the fact that gases arising from stables, pigpens, and out-houses may poison the pure country air as effectually as the atmosphere in cities may be spoiled for breathing by the same effluvia spreading from neglected alleys or cesspools. And the thrifty wives of farmers, who, forgetful of cleanliness, saturate the door yard with wash water and kitchen sewage through all the winter months, should be taught that when that ground sours and festers under the summer sun, the heat will ripen the germs of disease as surely as it will ripen the grain in the harvest field.

Maladies mysteriously affecting families residing in what are regarded as healthy localities, are often explainable on opening the cellar door, whence an intolerable odor of decaying vegetables proceeds; or on lifting a board in the kitchen floor, beneath which is a shallow pool of standing water; or on observing that the well is so situated as to drain into itself some of the substances that are thrown away as utterly unfit to be retained in proximity to human beings.

The latter point is one very frequently overlooked. For example, a certain Western city, finely located and attractive, gained the reputation of being an exceedingly unhealthy spot, and was of course much retarded in its prosperity by that fact. Finally it was noticed that underlying the city, at a depth of about twelve feet, is a stratum of impervious blue clay, above which lies an extensive quicksand, affording an abundant water supply by means of numerous wells, and into that same quicksand all the vaults and cesspools of the place were also dug, thus mixing their foul contents with the drinking water that every one used! The amount of sickness was materially diminished by the proper attention being given to this one point. Every careful farmer will see that the compost heap, and other refuse stored as food for the roots of grasses and vegetables, shall be at such a distance from the house and well as not to contaminate the air and the water essential to the preservation of life and health.

In closing, I may mention a curious illustration, given in a paper by Prof. E. T. Cox, on the "Influence of Geology on Local Diseases," showing what has actually been done by rural drainage to eradicate a dreaded malady that used to prevail extensively in Kentucky and Indiana, known as "milk sickness," because, first attacking cattle, it was communicated to human beings through the milk, butter, and beef of the infected animals. Many a brave pioneer lost his life by this malady, which almost always proved fatal; and recovery was usually lingering and imperfect. At first it was supposed that the cattle had eaten some poisonous plant; but every suspected grass and weed proved harmless on scientific examination. Then it was held that mineral poisons must lurk in the springs and brooks; but hundreds of samples were analyzed without detecting the presence of the enemy. At last an investigation of the clay shales, soft rocks formed from ancient mud beds, and which are microscopic in an eminent degree, revealed the secret. These formations abound in every infected locality, and it now seems clear that they exhale some sort of miasma, when saturated with water, that originated or aggravated the disease, just as other kinds of malaria bring on chills and fever. Proceeding on this discovery, thorough drainage of the wet lands adjacent to the shale beds dried them sufficiently to terminate the conditions favorable to the spread of milk sick-

ness, so that it has now almost entirely disappeared from regions that once were cursed by that plague.

The opinion is now established that a large proportion of diseases are of germ origin; and the obvious mode of prevention is the destruction of the germs or their timely removal.

VACCINATION IN SMALLPOX.

Jenner's great discovery of vaccination for prevention of smallpox has not been wanting in opposition, and a few persons are still so stupid as to object to vaccination. These people, who refuse to be vaccinated themselves or allow their children to be, endanger not merely their own lives, but the lives of their neighbors. They furnish the fuel on which the flames feed, and render epidemics of smallpox possible. If vaccination were universal it would be as difficult to get up a smallpox pestilence as it is to start a great fire in those cities where all the buildings are practically fireproof.

While the efficacy of previous vaccination with good virus is well known to be a preventive, the uses of vaccination after the disease has been contracted are less understood. Some years ago a Virginia physician, Dr. Alban S. Payne, conceived the idea of vaccinating a smallpox patient with the kine-pock. It took at once. The next day he repeated the vaccination, and that also took effect. And what was the effect upon the smallpox of having another similar disease in the system at the same time? The eruption was less extensive, but few pustules appeared, no scars were left, and in a surprisingly short time (three or four days) the patient was able to be about the room. In hundreds of cases where the system of daily vaccination was practiced by Dr. Payne, the duration of the disease was shortened, and no deaths occurred. Why, one would ask, is not this simple precaution always taken, if by its means life may be saved, pitting prevented, and suffering diminished? We should be glad to hear from other practitioners who have tried the method above described.

Institute of Mining Engineers.

The American Institute of Mining Engineers met at Staunton, Va., May 30. The members present included President William Metcalf, of Pittsburg, Penn.; Dr. R. W. Raymond, of the School of Mines, Columbia College, New York; Dr. Thomas Egleston, of the School of Mines, New York; Dr. Dudley, chemist of the Pennsylvania Railroad Company; Professor P. Frazer, of Philadelphia; Dr. T. Sterry Hunt, of Montreal; J. A. and J. T. Burton, of Troy, N. Y.; W. P. Ward, of Savannah, Ga.; and F. S. Witherbee, of New York.

In his annual address President Metcalf spoke of the advance of science and its results, and of the education of engineers. Special stress was laid upon the continuous study of the higher mathematics and practical observation as means of self education and professional success. A paper by J. H. Mackintosh, on "The Electrolytic Determination of Copper," was read by Prof. Egleston, and discussed by several members. Dr. Frazer read a paper on "The New Geological Map of Chester Co., Pa."

The opening paper of the second day was by Professor Egleston on "The Ore-Knob Copper Process," employed at the mines of the Ore-Knob Copper Company in North Carolina. The belief was expressed that a great amount of copper lay dormant in the South, which, if properly worked, would be as profitable as the lake copper. Major Hotchkiss, of Virginia, thanked Professor Egleston for drawing attention to the copper deposits of the South. Very few persons are aware of the great wealth in this mineral with which this State abounds. Forty years ago Richard Taylor made explorations and reported on this class of ore. The only difficulty in its development then was the lack of transportation facilities. That objection does not now exist, and this industry may be expected to be seen coming prominently to the front.

A paper prepared by F. H. Williams, of St. Louis, Mo., on "A Volumetric Method of Estimating Manganese in Pig Iron and Steel," was read by the secretary. It was an adaptation of the known processes. In connection with it was presented a paper on "Manganese Determinations in Steel," prepared by William Kent, of Pittsburg, Pa. These papers were discussed by Drs. Drown, Sharpless, and Dudley. In reference to the subject of steel rails letters were read from Richard Akerman, of Stockholm, Sweden, and C. P. Sandberg, of London, England. The latter showed a preference for the mechanical over the chemical tests of steel rails, though he recognized the full importance of both. Considerable discussion ensued upon this subject, the principal participants being Drs. Raymond and Dudley.

At the afternoon session Dr. Sharpless, of Boston, made a statement with reference to the black band iron ores of West Virginia. F. P. Dewey, of Tennessee, read a paper on "Rich Hill Iron Ores." O. J. Heinerich, of Drifton, Pa., explained the practical working of the ammonia soda process, and Stuart M. Buck, of Virginia, read a paper "On the Hard Splint Coal of the Kanawha." After an explanation of the geology of the valley by Major Hotchkiss, the institute adjourned.

At the night session Professor Frazer, of Philadelphia, read a paper on "Observations on some of the Ores of the Upper James River." This was followed by Major Hotchkiss in a description of the topography and geology of the Virginia Valley.

The programme for June 1 was devoted to an excursion over the Shenandoah Valley road to the Luray Cavern, with an examination of the rich mineral deposits of the valley.