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THE CHICAGO POLICE TELEPHONE AND PATROL SYSTEM.

From time to time during the past year mention has been made in this paper of the inception and development of the police telephone and patrol system in operation in Chicago. A recent visit of our artist to that city enables us now to lay before the readers of the SCIENTIFIC AMERICAN the accompanying illustrations of the apparatus employed in this very important application of electricity to the mechanism of civil life and civic government.

In every American city the police departments have been prompt to make use of the systems of electric communication which have been set up for social and commercial purposes; and in several instances special telegraphic or telephonic lines have been established for purely civic uses; but Chicago takes the lead in adopting electricity and electric communication as an essential factor of the police system, making it, perhaps, the most important and efficient element of the police service. When the entire area of the city shall have been covered by the system the analogy between the civic organization and the nervous organization of an individual animal will be curiously complete. The civic organization will become sensitive, so to speak, at every point, and the transmission of intelligence therefrom to the brain and subordinate nervous ganglia—that is, the central and district police stations—will be practically instantaneous.

The object of the system is twofold: to increase the promptness and efficiency of police attendance in cases of emergency, and to lessen the number of patrolmen and the consequent expense of the police force. The urgent need of a public watchman or constable at any particular point in any American community is altogether exceptional, and the tendency is therefore to give the policeman a long beat to traverse. The chances are that he will be out of the way when an accident happens; and evil-doers may take advantage of his known absence to disturb the peace or invade the property rights of citizens. To provide against such exigencies by largely increasing the number of policemen is obviously much less economical than to quicken the working of the police system by putting every patrolman within the reach of instant communication with the substation to which he is attached; or if need be with the central station or police headquarters, at the same time giving every orderly citizen, in case of need, the means of calling upon the same authorities with the least delay.

This is just what the Chicago system aims to do. At convenient points district stations are established, with relays of policemen and a horse and wagon always in attendance. The wagon carries a stretcher, blankets, and other appliances for receiving and properly treating sick or injured persons, lost children, or persons accused of crime. In telephonic connection with the district stations are public alarm stations, like sentry boxes, placed at suitable points along the streets. As will be seen in the large illustration, the alarm boxes are just large enough to hold one man, who may lock himself in should privacy or special security be an object. Keys to these alarm boxes are furnished to respectable citizens and are carried by all policemen, who also carry a releasing key, by means of which the general key can be withdrawn from the lock. This is to secure the attendance of the person giving the alarm and prevent possible trifling with the system, each key being numbered and the holder's name registered.

The artist has chosen an accident for illustration. The moment of such an occurrence the nearest citizen holding a key hastens to the alarm box, and by depressing the lever which projects from the signal box transmits the arbitrary call for help to the district station. Instantly a detail of three men with the patrol wagon hasten to the point whence

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THE CHICAGO POLICE TELEPHONE AND PATROL SYSTEM.

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NEW YORK, SATURDAY, APRIL 23, 1881.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 277.

For the Week ending April 23, 1881.

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LEGISLATING AGAINST PROGRESS.

That particular phase of unwisdom which shows itself in opposition to departures from the beaten track of custom is not confined to any locality or greatly influenced by geographical lines.

Two striking illustrations of this unpleasant fact appear in the news columns of a single morning paper. One hails from Mississippi, the other from Connecticut. The first announces that a certain Mississippi planter wanted to turn his land into a stock farm. His cotton growing neighbors protested against the change on the ground that the grass of the stock farm would spread over the adjoining plantations and spoil the land for cotton. They did more; they applied to a court for an injunction to restrain their innovating neighbor from sowing grass seed, and got it! This decidedly reverses the proverbial saying about the beneficent character of the man who makes two blades of grass grow where but one grew before. The Connecticut illustration of anti-progressiveness is even worse.

Along the Connecticut shore the succulent oyster furnishes the most important and remunerative crop, though but comparatively a small portion of the Long Island Sound bed suitable for oysters *is* yet under cultivation. The chief obstacles to the greater extension of the oyster industry lie in the expense of handling the crop in deep water, and the impossibility of protecting the deeper beds from the inroads of star fish and other vermin, that is, by the old-fashioned means of dredging. Accordingly the more enterprising oystermen have lately substituted steam power for sails and wind in navigating their boats, and the same motive power in place of human muscle for hauling the dredges. The consequence is that oyster cultivation can be economically carried on in deeper water, and a great deal more can be done at all times in handling the crop and fighting its enemies since the workmen are not dependent on favorable winds, which may fail or become unfavorable just at the critical moment. The time is surely coming when the bed of Long Island Sound will be covered with oyster farms for the supply of half the continent, perhaps half the world, the cultivation being done, as it only can be, by steam; the oyster farmers uniting most likely in maintaining a steam patrol whose chief business will be the destruction of the vast swarms of star fish which periodically invade the Sound and ravage the oyster beds, whose owners are unable to cope with them single handed. It is manifest destiny that steam will be and must be relied upon in the development of this great industry. Yet the State Legislature of Connecticut has just passed a bill substantially prohibiting the use of steam dredging, on the ground that it tends to create a monopoly and drive out of the business the men who cling to the slower method of dredging with sail boats.

Ostensibly the bill, we believe, does not undertake to suppress steam dredging on private grounds, that being clearly impossible; but the practical working of the law, if it is enforced, will be nothing less than that. In dredging an oyster bed in water of any considerable depth, the dredging vessel must of necessity pass beyond the boundaries of the bed even where they are clearly marked. Accordingly the steam dredger is always liable to the charge of working "off his ground" and to the risk of having his vessel restrained from operating at a time when cessation from work will be fatal to his crop, when an invasion of star fish is to be combated for example.

If steam dredging is to be prohibited because it gives the steam user an advantage over the man who runs a sail boat, then the latter should be restrained for the advantage he enjoys over the man who has only a row boat; and the oarsman because of his advantage over the man who has no boat and gets his living by "treading." There is no logical halting place between original barbarism and the largest possible use of all the working appliances which invention and art can furnish, whether in oyster culture in Long Island Sound or in the cultivation of Mississippi plantations.

With all due deference to the Mississippi court and to the Connecticut Legislature, we are inclined to think that their attempts to arrest necessary and inevitable progress will be no more successful in the long run than they are momentarily creditable.

OUR CITY SEWERAGE.

How to utilize the feculant matters discharged by our sewers is as yet an unsolved problem, although it has received the close consideration of the best engineers and sanitarians. The fecal and other matters of manurial value discharged into them is so diluted with water as to be of but comparatively small value. To save its most valuable products would require the transportation of the water in which they are dissolved. If this could be done cheaply, one of the most powerful and useful manures known to agriculturists would be utilized. As at present constructed, the sewers discharge their contents into the salt water rivers on either side of the city. Now, it is a well known fact that water, holding in mechanical solution or suspension any substances, will precipitate them when coming into violent contact with any body of greater density than itself. Consequently the fresh water from the sewers when discharged against the salt water at the docks immediately precipitates the material which it holds in mechanical solution, what it holds in chemical solution being carried off, lost, and unutilized. This action is greater at the influx of the tides, and is proportional to the momentum of the movement of the tide and the rapidity of the flow of water in the sewers. It is this which mainly causes the enormous deposits of mud in our docks, and necessitates a large expenditure of money for dredging and its removal seaward. It, in fact, makes enormous silt basins of our docks.

The consumption of croton water in this city is about 100,000,000 gallons daily, equal to 400,000 tons weight (2,000 lb. to the ton). As this enormous weight is immensely increased by the fecal and other matters discharged into the sewers, it will be seen that it would require an enormous amount of mechanical power to remove the whole. To let the fluid matters flow off, and retain the solid matter in silt basins for manurial purposes, would scarcely pay, as the most valuable fertilizing salts in the sewerage are so readily soluble in water, that what is left of them in the silt is but of comparatively little value. If the fluids could be saved it would be necessary to provide some absorbent for them; this might be found in the dry ashes when screened from the cinders intermixed with them. But the great outlay in preparing the silt basins and the other mechanical arrangements necessary for the purpose will probably always remain a bar to the solution of the question. Yet, the experiment might be worth trying with one of the sewers, in order to ascertain whether it would pay. In such an experiment the silt should also be saved and its manurial value properly ascertained. The salt water would have to be carefully excluded.

An Eight Thousand Dollar Bible.

The third part of the sale of the collection of books of the late George Brinley, of Hartford, Conn., was completed in this city April 7.

The most notable book sold was the Gutenberg or Mazarine Bible, which brought $8,000. Though this copy bears no date it is supposed to have been printed between 1450 and 1455, the printing probably occupying the greater part of the five years. For four centuries the book lay buried in the obscure library of the Predigerkirche, at Erfurt, where it was discovered some fifteen years ago. It was purchased by Mr. Brinley in 1873.

This Bible belongs to the extraordinarily rare first edition, and may properly claim to be the first book ever printed with types. The text is the vulgate of St. Jerome. The type is Gothic, and not only the hundreds of illuminated capitals, brilliantly colored and decorated, but the paucity of typographical errors and the nice execution of detail evince its title to precedence of many other copies in point of origin, and its production as an exemplar. The capitals are many of them emblazoned with ornamentation in gold, and the two volumes are in the original binding—thick oak boards sheathed in calf, beautifully stamped, protected at the corners with ornamented shields of brass, and decorated at the center with designs in the same metal and bosses. The edges of many of the leaves are uncut, and show traces of the cues of the rubricator. They are very broad, measuring 15⅛ by 11½ inches on the leaf.

The book is without title pages; there is no pagination. The 641 leaves are printed in double columns, of 42 lines each, and the initials and rubrics are in manuscript. The large folio volumes are of nearly equal thickness, the first, of 324 leaves, ending with the Psalms, and the second, of 317, completing the text. One leaf of the first volume is in facsimile and sixteen of the second. The copy is in an excellent state of preservation, unstained by time or mildew, and has evidently never been washed. The decoration is arabesque, and Dr. Trumbull infers from its general sumptuousness that it was originally intended for the library of some prince or nobleman—possibly some kindly patron of the struggling inventor.

The Cuban Exhibition.

The International Exhibition at Matanzas was opened April 3, in the state of general unreadiness characteristic of such shows. The most complete display of industries is that of Cuba. Spain is sparingly represented, probably because the mail company refused for a long time to transport gratis goods intended for the exhibition. The United States is fairly represented, principally in hardware and machinery, though its agricultural products have also received some attention.

The Scio Earthquake.

Great damage was done by an earthquake in the Island of Scio, one of the best known of the isles of the Grecian Archipelago, on Sunday, April 3. In the chief town, Kastro, with 15,000 inhabitants, three or four thousand persons were killed and wounded, and but fifty houses were left standing. Later reports state that thirty villages, in other parts of the island, were wrecked, and as many as 40,000 people were made destitute. The entire number of victims is estimated at 5,000. The shocks were widely felt among the islands and along the coasts of the mainland.

The Cohahuila Aerolite.

The University of Rochester has lately purchased from Dr. J. Lawrence Smith, of Louisville, Ky., a portion of the celebrated aerolite found in the Mexican town of Cohahuila in 1866. Originally it was a mass of iron, weighing 434 pounds, and was remarkable on account of the fact that it was cracked almost through and through, so that when sawed the pieces fell apart. It was irregular in shape, but was substantially a foot square. The piece bought by the university is a chunk cut out of the middle, and is a beautiful specimen.

PERMANENT PICTURES ON THE RETINA.

Immediately after the discovery of the visual purple by Professor Boll, and the ascertainment of the fact that it is possible to produce pictures on the retina which can be examined after the death of the animal, the question was discussed as to whether these pictures could be made use of by the legal profession in cases of murder, etc. Dr. W. C. Ayres, who has made more than a thousand experiments in the laboratory of Professor Kühne, at Heidelberg, in obtaining optograms on the retina of animals, has an article in the New York *Medical Journal*, in which he answers the question negatively.

After explaining the photo-chemistry of the retina and describing the *modus operandi* of obtaining optograms in the eye of the living animal, Dr. Ayres goes on to state that while he was working in the laboratory at Heidelberg, Professor Kühne proposed that he should make a picture of Helmholtz and send it to the latter as an acknowledgment of the value of his researches in physiological optics. Dr. Ayres, therefore, provided himself with a large negative of Helmholtz and set about making an optogram from it, according to the most approved methods. The negative was placed over the eye, which had been dosed with atropine. The animal was in the dark room for hours. The sun was shining brightly, so that there was the best of light; and every precaution having been taken, the retina was exposed for four minutes. There was a dull picture on the cornea, and when the retina was examined there was found an image of Helmholtz's shirt collar and of the end of his nose. The light was not bright enough, or rather there was not enough transmitted through the negative to bleach the visual purple. As there is always an active rhodogenesis in the living retina, and it might have been strong enough in this case to restore the visual purple as fast as it was bleached, Dr. Ayres cut off the head of a rabbit and waited until all such power on the part of the retina was certainly done away with, and then repeated the experiment. The result was a little better than the preceding, but the optogram was by no means sufficiently distinct for one to recognize even that it was intended for a picture. Dr. Ayres, therefore, came to the conclusion that such an optogram was impossible and gave up the plan.

In conclusion, he adds that since the above-described experiment failed so signally, he believes it utterly idle to look for the picture of a man's face, or of the surroundings, on the retina of a person who has met with a sudden death, even under the most favorable circumstances.

PICKETT'S CAVE.

BY H. C. HOVEY.

Every one who visits Colorado is surprised at certain features of scenery, so to be accounted for only by considering the peculiar geological structure of the region.

The vast plains, sweeping from the Missouri Valley westward to the foot-hills of the Rocky Mountains, have a gradual upward slope from an altitude of only 770 feet above the sea, at Kansas City, to an elevation of 6,000 feet, at Colorado Springs. The underlying rocks, resting on one another in broad sheets, are varieties of sandstone, limestone, slate, and shale, mostly belonging to the cretaceous formation.

A glance at the geological map of Colorado shows that large areas of the mountain region are marked as "eruptive," which means that, at some period later than the formation of the plains, there was a great upheaval of the earth's crust, causing the lower rocks to appear at the surface, sometimes by volcanic violence, and at others by the slower process of denudation. These rocks are granite, gneiss, trap, and other hard species, capable of resisting the ordinary action of the elements.

Along the border line, between the plains and the mountains, is a comparatively narrow but highly interesting region, lying nearly north and south, where the rocks of the plains, instead of being flat, are turned upward and broken off by the same force that lifted the mountains themselves. It is the opinion of the geologists that these sedimentary beds once extended much further up the mountain sides than now, being gradually worn down by the retreating waters of the primeval ocean, and the subsequent erosion by running streams.

One of my summer vacations, not long ago, was spent amid the mazes of this border land, and I found it a geological paradise, where the explorer may, by guiding his course intelligently, cross the edges of all the strata, from the Archæan rocks to the Tertiary, studying the entire history of their folding and erosion, to better advantage perhaps than anywhere else on the continent.

The Monument Group of red sandstones has been repeatedly described by pen and pencil. The fanciful columns of loosely cemented sandstone, each capped by a layer of tough ironstone, that are, in Monument Park, only 10 or 20 feet high, rise to lofty castellated forms in the Garden of the Gods and Glen Eyrie, some of the needle-like spires shooting 300 feet above the green meadows at their base. These grotesque pillars are produced not only by the flowing water, but by the cutting action of whirling sand blown about them by the dry winds of summer.

Frequently, instead of standing in isolated masses, the red sandstone runs in ribs parallel to the chain of adjacent hills. These ridges are cut through at intervals, by arches, gateways, caves, and tunnels, with very picturesque effect.

The width of this border region varies from one to twelve miles. Nearest the Granite Hills its rocks seem to have been sufficiently modified by heat to acquire an obscure columnar structure, thus opening lines of weakness, which have been sought out by the water, aided by insinuating roots and the power of frost, until one columnar mass after another has been pried off and finally removed by the further action of the elements. This process results in a deep and narrow valley known as a *cañon*.

Hundreds of cañons are found in various parts of the Rocky Mountain region, some of which are of enormous dimensions. But those visited by me lie along the course of Fountain Creek, at the base of Pike's Peak, and are interesting, aside from their wonderful scenery, because affording such an excellent opportunity to examine not less than 4,000 feet of sedimentary rocks. In many of them the torrent had plowed down into the underlying feldspathic granite, giving an amazing exhibition of aqueous energy.

Williams' Cañon, near Manitou, was the last one visited, and on some accounts I found it the most interesting of all.

The mouth of this cañon is cut through the red sandstone to a limestone, at first yellowish and sandy, but improving in quality as one goes deeper into the gorge, until it is of a good quality for all purposes to which limestone is ordinarily put, and large quarries have been opened, to which a wagon road leads.

The walls rise for 400 or 500 feet on each side, in many places absolutely perpendicular, and sometimes so close to each other that both wheels of the lime carts would graze the walls in passing.

I found but few fossils, and they seemed to belong to the Silurian formation; a conclusion verified by Hayden's report, which speaks of these beds as being decidedly referable to the Silurian group. Professor Hayden adds: "I have never known of any Carboniferous fossils being found here, but am confident that there are 1,000 to 1,500 feet of these beds between the Silurian and Triassic."

On his geological map, 1876, he assigns a portion of these rocks to the Carboniferous, and also marks high ridges of Silurian limestones on the side of the mountain about four miles north.

The existence of heavy deposits of nearly homogeneous limestone under circumstances so favorable for excavation excited my curiosity as to the existence of caves in that locality. But after following the cañon for two miles or more, toward its head, nothing of the sort presented itself, except an open gorge, to which visitors had given the name of "The Cave of the Winds."

An entrance was discovered, last June, through this very gorge to a cavern of large dimensions, named for the boys who found it, *Pickett's Cave*, and described by Rev. R. T. Cross in the *Congregational News* for March, 1881.

Some progress in underground research was made last fall by an organization known as "The Boys' Exploring Association," of which the young Picketts are members. They found numerous obstructions, but noticed in one of the rooms entered a peculiar chimney-like aperture nearly closed by dripstone.

Through this chimney a passage was forced, last January, by Messrs. Reinhart and Snyder, who now own the cave. They found at its upper end a spacious hall about 200 feet long, decorated with a profusion of stalactitic formations, in some instances translucent and in others varying in color from red to pure white, sometimes coated by delicate frost-work.

A canopy was observed on one side of this hall perforated by the rotary action of water, near which was a pit partly filled, on whose sides there were singular markings caused by calcareous deposit from the evaporation of water.

Crawling for thirty feet through an "auger-hole," admittance was gained to a series of rooms containing many curious and beautiful objects, including a set of *musical* stalactites!

Through a deep pit they descended by means of a rope into other apartments; while to reach others still they had to climb steep acclivities, or worm their way through passages nearly filled by *débris* or obliterated by dripstone.

Forty rooms in all have thus far been explored; and according to the account given the attractions increase as exploration penetrates the mountain side. Shining crystals, tufts of satiny fiber, slender arms mimicking growths of coral, rams' horns twisted and intertwined in every conceivable way, pillars and pendants, statuettes and grotesque resemblances of life, are among the charms of these enchanted halls.

Vandals have, of course, despoiled the rooms first opened, and the discoverers had a right to take a few choice specimens to be placed in college cabinets, where they could be seen by the public. But now we are pleased to see that the rules forbid any one's taking specimens, or even entering unaccompanied by a guide.

It is stated that "after entering the cave it takes about two miles of travel to explore every part of it." But the proprietors are building stairways and enlarging the narrow places, so as to enable visitors to go the round without serious fatigue. They promise also to improve the wagon road to a point near the cave, and to make steps up the wall of the cañon, to facilitate the ascent of nearly 200 feet that has to be made at an angle of 40° to gain the entrance to this subterranean realm.

If Pickett's Cave is, as I infer, excavated from Silurian limestone, that itself is a remarkable circumstance; for some of the most celebrated geologists in America have recently expressed "grave doubts whether in a single case Silurian caves extend much beyond the light of day." I have, in previous articles in the SCIENTIFIC AMERICAN, referred to Hanover Cave, a mile and a half long, and Howe's Cave, three miles long—both of them Silurian caves; and now we may add Pickett's Cave, said to be two miles in length.

It must be admitted that such cases are exceptional, the rule being that most Silurian caves, at least such as I have examined, are considerably wider at their entrance than at any point within.

It also remains to be ascertained if Pickett's Cave really is in Silurian rocks, or pierces through to the Carboniferous formation famous the world over for its cavernous structure.

Further particulars may hereafter be given as new discoveries are made. But it cannot be doubted that one more great attraction is added to the wonderful region that boasts of Monument Park, Glen Eyrie, the Garden of the Gods, Manitou Springs, Pike's Peak, and other glories, all within a radius of ten miles!

The Concord Summer School of Philosophy.

That remarkable and characteristically American expression of interest in philosophy, the Concord summer school, proved so successful last year that it is likely to become a permanent institution. Nearly six hundred different persons were in attendance, the average number present being about seventy.

The term for the coming season will begin July 10, and continue five weeks, with upward of fifty lectures in all. The following lecturers and subjects have been decided upon, and others will probably be added:

Mr. A. Bronson Alcott, dean of the faculty, five lectures on "The Philosophy of Life;" Mr. Alcott will also deliver the Salutatory and Valedictory. Mr. E. C. Stedman will read a poem at the opening session, July 10, 1881. Prof. W. T. Harris, five lectures on "Speculative Philosophy," and five on the "History of Philosophy." Dr. H. K. Jones, five lectures on "The Platonic Philosophy," and five on "Platonism in its Relation to Modern Civilization." Miss Elizabeth P. Peabody, two lectures: (1.) "Dr. Channing;" (2.) "Margaret Fuller." Mrs. Julia Ward Howe, two lectures. Mrs. E. D. Cheney, a lecture on "Color." Rev. J. S. Kidney, D.D., three lectures on "The Philosophic Groundwork of Ethics." Rev. W. H. Channing, three lectures. Mr. S. H. Emery, Jr., two lectures on "System in Philosophy." Mr. F. B. Sanborn, three lectures on "Literature and National Life." Dr. E. Mulford, three lectures on "Political Philosophy." Mr. Denton J. Snider, five lectures on "Greek Poetry and History." Mr. H. G. O. Blake, readings from Thoreau: Mr. John Albee, two lectures; Rev. Dr. Bartol, a lecture; Prest. Porter, of Yale College, a lecture; Mr. D. A. Wasson, a lecture.

The secretary desires that all who propose to attend should send their names to him at Concord. No preliminary examinations are required, and no limitation of age, sex, or residence in Concord will be prescribed; but it is recommended that persons under eighteen years should not present themselves as students, and that those who take all the courses should reside in the town during the term.

Beet Sugar in New York.

The first beet-sugar company in this State has just been organized, and contains some well known New York and Boston names. The factory will probably be located at Schenectady, on account of its nearness to the rich lands of the Mohawk Valley and the facilities which the Erie Canal affords for transportation. Last year about 200 acres were planted with beets in different sections of the valley to test the adaptability of the soil, and the results were entirely satisfactory, both as to quality and quantity per acre. In some cases the percentage of saccharine matter in the roots was extraordinary, reaching as high as 16·86 per cent. This excels the best beets raised in Europe, 10 per cent being the usual yield there, while 13 per cent is considered high. The farmers of the valley are said to look with favor upon the new enterprise.

Locomotives for Mexico.

About the first of March four trial locomotives were shipped from the Baldwin Locomotive Works to the Mexican National Railway, a bid to supply the road with 200 engines having been tendered some time before. A contract for the proposed two hundred has since been signed and the work of construction has been begun. The locomotives are to be shipped as wanted, and all finished before January, 1883. They are to be of exceptional power, and half of them for passenger trains, the rest for freight and general use.

A Novel Dispatch Boat.

A ship which sailed from England for Australia recently took a four-foot "life" boat, designed not to save the passengers but the records of the ship in case of accident at sea. This would seem to be a decided improvement on the conventional bottle, since it will carry more information and be more likely to be seen and picked up. The boat carries a sail, and is expected to make four or five miles an hour in favorable weather.

An Electric Fence.

Dr. J. H. Connelly, of Pittsburg, Pa., has applied to cattle the old device employed by country druggists to keep loungers from thrusting elbows through their showcases, namely, a wire fence charged with electricity. The electricity is to take the place of the barbs now used on wire fences, the aim being to repel the cattle by a slight shock, instead of by pricking with the risk of severe laceration. It is to be presumed that the doctor is not a practical farmer.

Don'ts for the Varnish Room.

The *Coach Painter* compresses a large store of valuable advice in the following brief article:

Don't use the bucket for a washbasin, or the "shammy" for a towel.

Don't touch your work with sweaty hands.

Don't flood your floor with water; have it *clean and dry every time.*

Don't wash off your work in the same room you finish it in.

Don't fail to use plenty of clear, soft water in washing off, for if the work won't stand a thorough washing, *you understand why,* and will not look for a lasting job.

Don't apply your finishing coat, or any other, until you have completely cleaned your work, and are sure it is perfectly hard and free from moisture.

Don't let the pumice in corners, and around and under the mouldings, escape your notice.

Don't apply a cold varnish on a warm job, or a warm varnish on a cold one.

Don't keep your varnish in a damp or cold place.

Don't overload your work by laying two coats in one. A full coat *laid on evenly is all-sufficient,* and will give you a finer looking and more durable job.

Don't work your varnish too long, or leave it too soon. Become acquainted with it, and it will obey you first and last.

Don't say you haven't got a good, dry, tight, clean, clear, high-studded, and well-ventilated varnish room—*don't.*

Don't pour your varnish back into the can taken from; it will cause you trouble. Have a clean can for the purpose, and use it only after time is given to settle.

Don't keep your brushes in oil or turpentine; keep them in the varnish you use them for.

Don't use any but the best rubbing varnish (it is the cheapest in the end), and follow it with the best finishing.

Don't you know that a job turned out with a *fine finishing* varnish over a *poor rubbing*—although it may please you for the time being—will soon return to you for repainting and revarnishing?

Don't attempt to be a varnish maker by diluting your stock with oil or turps; don't meddle with it, but, if unsatisfactory, send it back to the maker, explaining the trouble.

Don't *always* lay the blame of a bad job on varnish, brushes, weather, and many other things; but look at home *—once.*

Verea's Calculating Machine.

The utility of a really practical calculating machine can scarcely be overestimated. A great deal of time has been devoted to this subject, and no little money has been spent in endeavors to perfect a usable machine of this character; but hitherto the machines have been too complicated, too bulky, and too expensive.

A short time since Mr. Ramon Verea, of 88 Wall street, New York city, patented a calculating machine involving an entirely new principle. It is comparatively simple and inexpensive, and is very compact. This machine cannot be intelligibly explained without engravings, but it may be stated that the essential features of the invention are a series of prisms perforated with holes of different sizes, and a series of tapering prisms which enter the holes more or less according to the size of the hole.

With this machine Mr. Verea can not only add and subtract readily, but he is able to perform multiplication and division with equal facility.

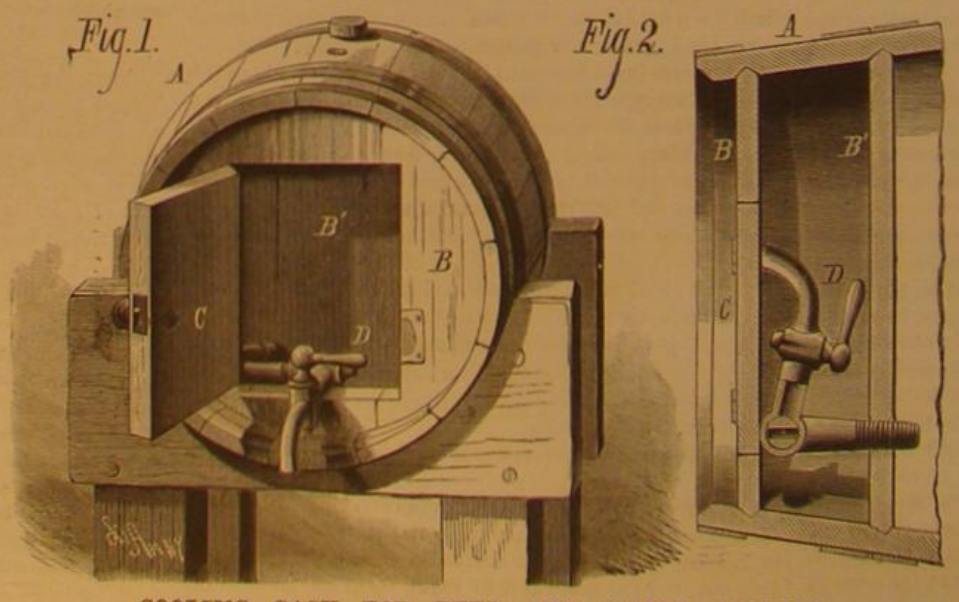
NEW COOLING CASK.

The engraving shows an improved cooling cask recently patented by Messrs. William Mainzer and John Singer, of this city. The improvement consists in providing the cask with two heads at one end, the outer head, B, being provided with a hinged door, C, which shuts the compartment inclosed by the outer head, B, the inner, B', and the sides of the cask.

The faucet, D, differs from those in common use by having a joint which permits of folding it up into the compartment between the inner and outer heads. With this construction filled casks can be furnished to consumers with faucets applied to them, and can be returned to be refilled without detaching the faucets, so that the consumers will have no trouble in applying faucets, and waste of the contents by unskillfulness will be avoided.

The chamber between the two heads is wholly or partly filled with ice, which cools the liquid contained by the cask. Small kegs to which this improvement is applied may be used instead of bottles.

Further particulars in regard to this invention may be obtained by addressing Mr. William Mainzer, 200 Chrystie street, New York city.



COOLING CASK FOR BEER AND OTHER LIQUIDS.

AN EXPENSIVE FOX.—Six months ago a party of hunters tried to smoke out a fox that had taken refuge in a hole ten miles west of Somerset, Ky. In so doing they set fire to a bed of coal which has been burning ever since.

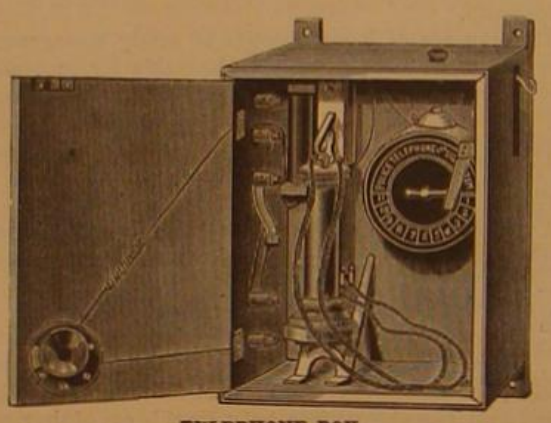
THE CHICAGO POLICE TELEPHONE AND PATROL SYSTEM.

[*Continued from first page.*]

the signal came. If the policeman of the post is near he unlocks the inside signal box, shown in Fig. 2, and communi-

SIGNAL TRANSMITTER.

cates with the district station by means of the telephone hanging within. The specific character of the disturbance which gives rise to the alarm, whether fire, accident, riot, or what not, can also be signaled mechanically by moving the lever to the proper position. It is proposed ultimately to have an alarm bell at each signal station, so that in cases of emergency the police may be instantly called to the telephones for instructions from the district or central stations.



TELEPHONE BOX.

In the meantime every officer while on duty is required to report by telephone, hourly or half hourly, the state of affairs on his beat; and his movements can be readily watched or directed by the chief of his station.

The system contemplates also the placing of signal boxes in private houses and places of business, either with or without telephonic connection. In the latter case the directions for the mechanical signals are given on the dial, as shown in Fig. 3. When a signal box is placed in a private residence a key of the house is left at the station under seal. When a night call is made—for burglary, for instance—the policeman answering the call takes the key and is thus able to surprise the intruder.

At present the number of alarm stations established in Chicago is about one hundred, and it is expected that the number will be more than doubled during the year. The practical working of the system is said to be in the highest degree satisfactory. The efficiency of the police in the districts covered has been nearly doubled, judging by the number of arrests made, while there has been a marked decrease in the number of crimes reported.

The system requires no great outlay in its first establishment, and its running expenses are very small. This makes it especially desirable for small towns having few officers for the territory covered. By means of the house and street alarm boxes the citizens can summon instant assistance should it be needed, thus enabling a few officers to do the work of many.

Boiler Explosions in 1880.

To the Editors of the Scientific American:

Messrs.: We notice in a late issue of your valuable journal a report of the number and kind of steam boilers exploded during the past year, taken from the Hartford Boiler Insurance Company's *Locomotive.* We saw the report in that paper and took no notice of it, but when it is given the widespread circulation of your paper, we feel as if a simple statement of facts should accompany it. In that report, locomotive and steam fire engine boilers are classed together, and come third in the list in number of explosions. The boilers used in the two engines are entirely unlike in construction, and out of the large number of steam fire engines in use in this country, we know of but one explosion occurring last year. That was a "drop flue" boiler in a *test trial* where the rules permitted "unlimited steam." No explosion of a steam fire engine boiler occurred last year while the engine was doing fire duty. As the report is given, it would convey the impression that steam fire engine boilers are dangerous, and thus discourage their use, while the facts prove the contrary. None of the fire engine boilers manufactured by us have ever exploded, and probably the *three* explosions of the kind that have occurred since the introduction of steam for that purpose (we believe there have been only three in all) are the results of culpable carelessness and not due to the construction of the boiler. An experience of twenty years, under a great variety of circumstances and conditions, convinces us that they are as safe as any that are made.

Very truly yours, L. BUTTON & SON.

French Gunboats for the Pacific.

The Nukahiva, the first of a fleet of gunboats building at San Francisco, Cal., for French naval service at the Tahiti Station, Pacific Ocean, has just been launched. The Nukahiva is built of Oregon pine, and is 72 feet over all; 64 feet on the keel; 20 feet 2 inches breadth of beam; 6 feet depth of hold; and will register 75 tons. She is copper fastened, and coppered 7 feet above the keel. Her draught will be about 8 feet, and it is expected that she will sail 10 knots an hour under a fair breeze and spread of canvas. Another boat of the same type and material is to be finished in the same yard by April 20, and others are contemplated.

RECENT INVENTIONS.

An improved bouquet holder which can easily be attached to a coat or dress, and which holds the flowers securely without requiring them to be bound or held with a string before being inserted in the bouquet holder, has been patented by Mr. Thomas W. Ryder, of Terryville, Conn.

An improved bucket for chain pumps has been patented by Mr. Stephen F. Lockwood, of Stapleton, N. Y. It consists of the conical elastic disk having a flat top, straight inclined sides, and a circular recess in its lower face, the line of greatest circumference of the bucket being below the top of the recess.

Mr. Willis Carter, of Nanaimo, British Columbia, has patented an improved washing machine having two curved roller washboards, one fixed and the other pivoted at the bottom, and a rubber on the end of a pivoted bar arranged to vibrate between the washboards.

An improved shaft coupling has been patented by Mr. Charles E. Marston, of Dover, N. H. It consists of two semi-cylindrical blocks longitudinally grooved in their flat faces, and having midway in their grooves rectangular or flat seats that serve to hold the correspondingly flattened and shouldered ends of the coupled shafts. Interiorly tapering locking rings fit over the correspondingly tapering ends of the blocks to hold the latter together, and are held and adjusted in place by screws.

An improved muff has been patented by Alice Pass, of New York city. The invention consists in making a satchel muff with a gathered satchel opening upon the top, and with hand apertures below, arranged at right angles with the satchel opening. The outside of the muff is provided with a pocket.

Mr. P. A. O'Malley, of Brooklyn, N. Y. has patented a package fastener which facilitates the tying and untying of packages of mail matter and other materials. In this invention a flat plate is provided, to one end of which the tying cord is attached. The face of the plate is provided with fastening pins and a pivoted clamp, the arrangement of the parts being such that in tying a package the plate is laid upon the package, and the cord then passed around it, then under the head of a fastening pin on the plate, then around the package in a contrary direction, the extremity of the cord being then fastened on the plate by means of the pivoted clamp. We are informed that this invention has been used with great satisfaction in the City Delivery Department of the New York Post Office.

RICHARD'S REGISTERING BAROMETER.

This instrument is provided with a series of superposed vacuum shells or drums, similar to those of aneroid barometers, which are screwed together at their centers. They are each furnished with an internal curved spring to resist the atmospheric pressure. These drums are distended or flattened under this pressure, and their motion is transmitted to a large needle by a very simple system of levers. This needle carries at its extremity a metallic pen of special form, containing a certain quantity of ink whose base is glycerine.

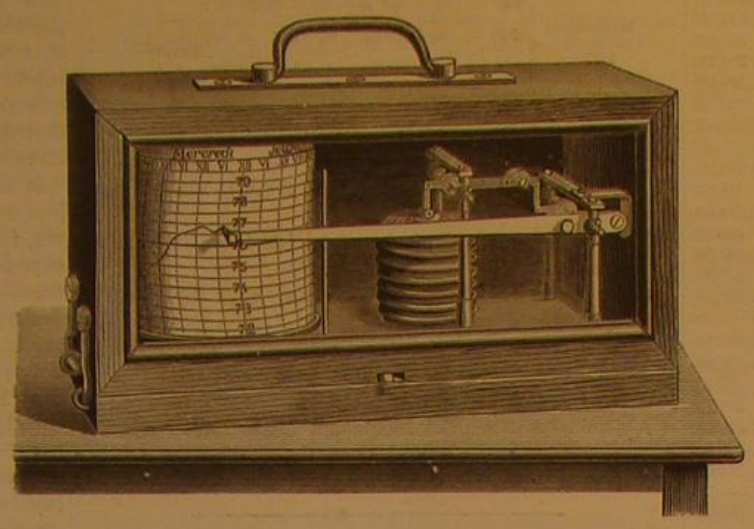
A cylinder carrying a barometric scale revolves in front of the pen, and in light contact with it. The cylinder makes a revolution in a given time, a week in the present instance. The pen is made to rise and descend by the dilatation and contraction of the drums of the barometer, leaving an interrupted tracing upon the paper. In this manner a diagram of barometric height is obtained, the reading of which is rendered easy by the arrangement of the barometric scale.

The rotating motion of the cylinder is obtained in this instrument in an entirely novel manner. The clockwork, instead of being fixed and communicating motion to the cylinder by gearing, is placed inside the cylinder and moves with it, and is revolved by means of a pinion projecting outward; the pinion has an epicycloid movement around a fixed wheel, placed upon the frame of the instrument.

Every week the observer changes the paper upon the cylinder, puts a little ink in the pen, winds up the clock movement, and the apparatus will work for another week without being touched.

The same system is applied to thermometers and hygrometers. The motive power of the pen is the only change that has to be made.

The indications of this instrument are exact, it is convenient to use, the operation of setting it in motion and of changing the paper may be accomplished in a few seconds and without any difficulty, and the pen will record for a month if necessary without being touched.—*Gaston Tissandier, in La Nature.*



REGISTERING BAROMETER.

REVERSIBLE TOOLS.

The engraving shows an improvement in the class of tools in which the bit or working part of the tool is pivoted in a forked handle and has two working ends, either of which may be used by turning it on its pivot in the handle.

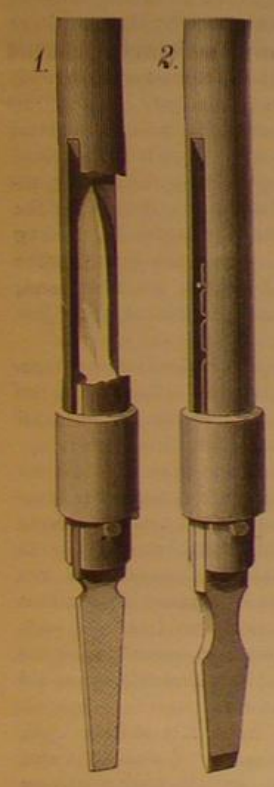


Fig. 1 shows a bit of steel having on one end a penknife and on the other a file. Fig. 2 shows a combined gimlet, bit, and screwdriver. These tools are held in position in the handle by the ferrule. When it is desired to reverse them the ferrule is moved upward on the handle.

This invention has been patented by Mr. W. A. Wales, of Newton, Mass.

Oxygen Gas Works, Paris.

The question of the economical production of oxygen has much occupied the ingenuity of chemists. According to the *Revue Industrielle*, this problem is now in a fair way of being solved. There is at present in Paris an oxygen gas works which is capable of supplying nearly 11,000 cubic feet of oxygen daily. This is, of course, a small beginning; but it is a great advance from the scale of laboratory production to which this gas has long been confined. No details are yet available concerning the process adopted in the manufactory, nor is the lowest selling price stated. The cost is, however, said to be moderate, and capable of reduction if the gas is largely consumed. Our contemporary remarks on the importance of this subject, as a cheap supply of remarkably pure oxygen, such as is said to be that produced at the new establishment, will probably exercise a very considerable influence on the question of lighting as well as on the progress of metallurgy and practical chemistry. The gas as sold in Paris from this first factory on the new system is said to be very cheap, although the works may be considered somewhat as of an experiment. The most important thing about the present announcement is the fact that, under any circumstances, the production of good and cheap oxygen in abundant quantity is established.

Close Writing.

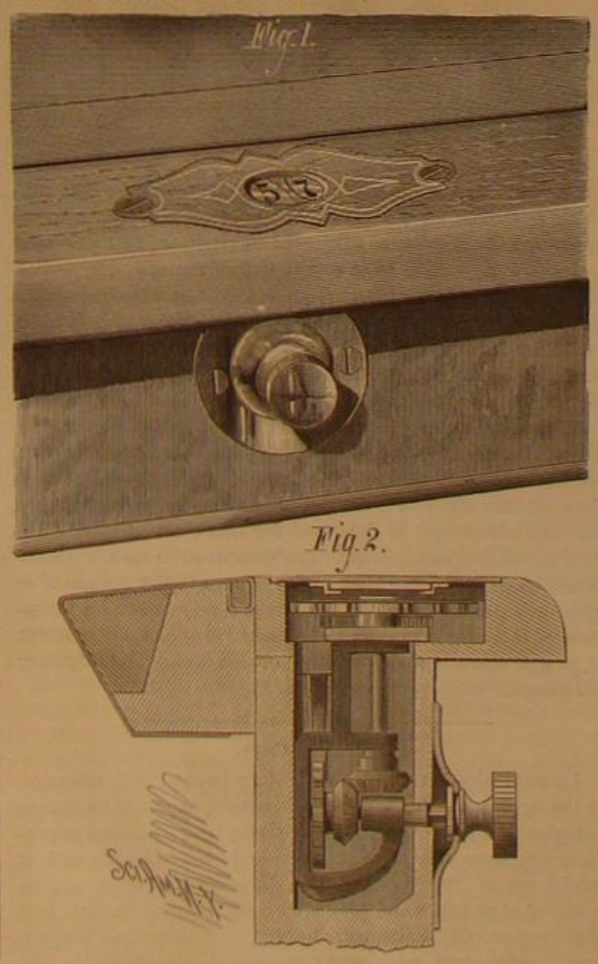
A German having "written" on a postal card an incredible number of words (25,000, we believe) in a style of stenography used in Germany, the author of the system set up the claim that it was superior to any other in use. The claim was disputed by the disciples of Pitman in England, and a prize was offered for the largest number of words written in Pitman's style on an English post card, the writing to be legible to the naked eye. The card of the winner, Mr. G. H. Davidson, is said to have contained 32,363 words, including the whole of Goldsmith's "She Stoops to Conquer," an essay on John Morley, and half of Holcroft's "Road to Ruin." It will be understood that probably not one of all these words was *written*, that is, had all its sounds expressed or even indicated. Such shorthand hints at words, but does not write them.

NEW GAME COUNTER.

The engraving shows a novel game counter which may be let into the top of the cushion rail of a billiard table, and is operated by a knob or handle at the side of the table.

The registering mechanism is much like that used in engine and other speed counters; the units wheel is provided with a single tooth, which, at every revolution, engages the tens wheel and moves it forward one place. The units wheel receives its motion from a vertical spindle, which, in turn, is actuated through miter gearing by a horizontal spindle having at its outer end a milled knob and at its inner end a notched wheel, which is engaged by a detent spring retaining the numbers in the dial aperture in the proper position or bringing them into that position after the hand is removed from the knob.

The apertured plate through which the figures are seen is formed so as to answer as one of the angle sights usually connected with the cushion rail.



COLLENDER'S GAME COUNTER FOR BILLIARD TABLES.

Fig. 1 represents the device in perspective, and Fig. 2 is a vertical section showing internal parts.

This invention was lately patented by Mr. H. W. Collender, the well known billiard table manufacturer of 788 Broadway, New York city.

The Longest Span of Wire.

The longest span of telegraph wire in the world is stretched across the Kistnah River from hill to hill, each hill being 1,200 feet high, between Bezorah and Sectanagrum, in India. The span is a little over 6,000 feet in length. The only mechanical contrivance used in stretching this cable across the river was a common windlass.

ENGINEERING INVENTIONS.

An improved car coupling has been patented by Mr. Thomas Noble, of Todd's Point, Ill. This invention relates to that class of couplers that are self-couplers; and it consists of a coupling link having a rack prolongation which is entered into the draw head and operated by a pinion, and of a swinging coupling pin operated in a vertical plane by a lever, wheel, or other suitable device.

An improvement in that class of steam vacuum pumps called "pulsometers," which are operated by steam pressure brought directly upon the liquid as the forcing element, while the subsequent condensation of the steam furnishes the lifting power to supply the pump, has been patented by Mr. Gardiner F. Badger, of East Orange, N. J. The invention consists of an improved valve seat designed for the induction and eduction water ways, and of improved devices for holding the valve seats and valve guards in place.

An improved car axle box has been patented by Mr. William G. Raoul, of Macon, Ga. The object of this invention is to provide an axle box for car journals of such design and arrangement as to dispense with the use of the wedge or key heretofore used over the journal brass, and to dispense with the button or collar heretofore used on the ends of the axle to receive the end thrust, and to provide the axle box with a close fitting lid or cover that can be opened and closed easily and quickly.

An improved furnace for locomotive and other steam boilers has been patented by Mr. John Alves, of Dunedin, New Zealand. The grate bars are set out from the tube sheet to leave an air passage between them, and a fire bridge is supported by the grate bars, and is provided with a vertical and inclined and horizontal slots and flange surmounting the air chamber.

An improved dumping scow, which can be dumped very easily, and will float well, has been patented by Mr. Francis Pidgeon, of Saugerties, N. Y. The invention consists in a dumping scow formed of two independent floats, which are connected by means of chains or ropes which pass from the bottom edge of the longitudinal side of one float to the bottom edge of the corresponding opposite side of the other float, which chains or ropes are attached to a windlass, by which the floats can be united or separated, as may be desired.

CANE WITH TOILET COMBINATION.

The annexed engraving represents a very handy combination of comb, brush, and mirror, with a hollow-headed cane intended especially for travelers' use. The comb and brush are confined in the tubular head of the cane by a screw cap in which is placed a convex mirror.

This invention was lately patented by Mr. Richard Lamb, of Norfolk, Va.

The Adirondack Survey.

Shortly before the ice broke up on Lake Champlain, the Superintendent of the Adirondack Survey completed a task in civil engineering which will rank among the most important and interesting feats of the kind ever performed in this country. A number of long lines have been run from the western shore of Lake Champlain back into the wilderness, some of them more than a hundred miles long, and involving several thousand stations. Two of these run from Mount Marcy to points on the lake at Westport and Ticonderoga, and it being found desirable to connect and compare them while the lake was frozen, arrangements were made to have observations taken at the water level at ten stations along the lake on the same day. The work was successfully accomplished, and a line of stations for levels was secured from Whitehall, 126 miles northward, observations being taken at Whitehall, Ticonderoga (Mount Defiance), Crown Point Landing, Port Henry, Westport, Willsboro, Port Kent, Plattsburg, Rouse's Point, and Fort Montgomery.

The Siamese Twins Outdone.

An Italian couple, Tocci by name, are at present exhibiting at Vienna a most remarkable specimen of their progeny, a pair of twins named Jacob and Baptiste. These boys are grown together from the sixth rib downward, have but one abdomen and two feet. The upper part of the body is completely developed in each; their intellectual faculties are of a normal character. Each child thinks, speaks, sleeps, eats, and drinks independently of the other. This independence goes so far as to admit of an indisposition of the one without in the least affecting the other. They are over three years old, in perfect health, and seemingly in excellent spirits.

The Annual Fire Loss.

During the past five years the United States and Canada have burned up, in 55,775 fires, property to the value of $403,269,700, the loss for 1877 footing up $100,000,000 nearly. The New York (insurance) *Chronicle*, which gives these figures, finds that the fires of 1880 were distributed as follows:

States and Territories.	Total Losses.	States and Territories.	Total Losses.
Alabama	$708,600	Montana	$34,500
Arizona	38,500	Nebraska	617,200
Arkansas	326,400	Nevada	394,200
California	2,841,200	North Carolina	1,089,300
Colorado	741,100	New Hampshire	773,100
Connecticut	1,374,300	New Jersey	2,605,400
Dakota Territory	102,400	New York	12,751,003
Delaware	372,600	Ohio	3 529,000
District of Columbia	72,600	Oregon	435,500
Florida	471,800	Pennsylvania	7,714,400
Georgia	321,100	Rhode Island	420,100
Illinois	3,912,400	South Carolina	1,232,300
Indiana	2,400,000	Tennessee	467,600
Indian Territory	19,000	Texas	1,337,600
Iowa	1,186,100	Utah	67,000
Kansas	658,000	Vermont	651,400
Kentucky	1,197,600	Virginia	1,238,700
Louisiana	874,800	Washington Territory	160,600
Maine	1,784,900	West Virginia	271,100
Maryland	1,065,800	Wisconsin	1,558,900
Massachusetts	4,890,100	Wyoming Territory	9,400
Michigan	2,348,000	Canada	5,194,600
Minnesota	2,872,800		
Mississippi	245,830	Total	$79,838,000
Missouri	3,190,800		

In round numbers the fire tax last year, in property destroyed, was $80,000,000, a very large portion of the loss being chargeable to our neglect of simple and obvious means of making houses less combustible. It would appear from the insurance statistics that liquor stores are most apt to burn, and groceries and hotels follow closely after, there being twice as many fires in these classes of buildings as in sawmills and drugstores, which come next in the list. It would be interesting to know the relative percentages of fires in different sorts of houses calculated on a numerical basis. The more hazardous classes of buildings, with the number of fires in each during the past five years, are given in the following table:

Groceries	2,984	Tanneries	225
Hotels	2,198	Vessels in port	240
Liquor stores	2,315	Photo galleries	235
Sawmills	1,098	Paint shops	222
Drugstores	1,019	Meat markets	218
Livery stables	858	Feed stores	213
Restaurants	830	Woolen mills	202
Flour mills	635	Confectioneries	204
Furniture factories	585	Shingle mills	180
Gin houses	614	Breweries	183
Carpenter shops	489	Cigar factories	168
Carriage factories	464	Grain elevators	171
Churches	434	Sash and blind factories	166
Blacksmith shops	468	Harness factories	158
Bakeries	462	Butchers' shops	141
Planing mills	448	Fancy notion stores	145
Lumber yards	381	Tobacco barns	149
Grist mills	341	Oil refineries	140
Iron foundries	315	Cotton mills	135
Ice houses	309	Grain warehouses	131
Railroad depots	308	Paper mills	137
School houses	304	Box factories	132
Oil derricks	300	Billiard saloons	127
Newspaper offices	262	Agricultural implement factories	120
Cooper shops	260	Slaughter houses	115
Machine shops	291	Tobacco factories	112
Public halls	256	Theaters	74
Printing offices	252	Meat Packers	86
Shoe factories	255		

The Fish Supply of New York.

The following statement, compiled by G. M. Lamphear, was read at the recent meeting of the American Fish Culturists' Association in this city. It shows the amount of the various kinds of fish received in the wholesale markets of New York for ten months from March 1, 1880, to January 1, 1881:

	Pounds.		Pounds.
Flounders	1,186,469	Pickerel and pike	516,317
Halibut	2,211,742	Yellow pike	151,001
Cod	5,269 607	Cisco	435,988
Pollock	611,295	Whitefish	872,144
Haddock	1,643,554	Brook trout	5,995
Frostfish or tomcod	58,831	Salmon trout	35,720
Blackfish	184,171	Catfish	36,267
Mackerel	3,236,197	Small fresh water fish	394,358
Spanish mackerel	345,678	Terrapin	1,219
Weakfish	1,213,141	Green turtle	2,494
Kingfish	10,732	Lobsters	1,311,981
Sheepshead	55 586	Scallops, Gallons,	29,499
Porgies	1,565,836	Turbot	86
Sea bass	284,602	Redfish	22,854
Striped bass	478,716	Perch	143,332
Bluefish	4,284,613	Buffalo fish	3,398
Smelt	575,005	Pompano	1,768
Salmon	150,642	Swordfish	1,285
Shad, Counts,	925,474	Small salt water fish	299,325
Herring, "	463,884	Mullet	11,658
Eels	993,248	Bonita	67,231
Sturgeon	46,170		
Black bass	36,943	Total	26,605,524

Needles by Heredity.

All sorts of physical and moral (sometimes immoral) traits have been charged to heredity. The problem of inheritance *in utero* now includes needles. The Louisville *Courier Journal* gravely tells of the wanderings of a needle which entered a young lady's foot nine years ago, and lately made its appearance in the thigh of her year-old baby. The needle was much corroded.

The Solar Parallax.

In a recent communication to the French Academy M. Faye tabulates the results obtained by different methods of determining the sun's mean parallax, as follows:

Geometrical methods. 8·89″.	8·85 by Mars (Cassini's method)	Newcomb.
	8·79 by Venus, 1769 (Halley's method)	Powalky.
	8·81 by Venus, 1874 (Halley's method)	Tupman.
	8·87 by Flora (Galle's method)	Galle.
	8·79 by Juno (Galle's method)	Lindsay.
Mechanical methods, 8·83″	8·81 by the lunar inequality (Laplace's method)	—
	8·85 by the monthly equation of the earth	Leverrier.
	8·83 by the perturbations of Venus and Mars	Leverrier.
Physical methods, 8.81″.	8·799 Velocity of light (Fizeau's method	Cornu.
	8·813 Velocity of light (Foucault's method)	Michelson.

Touching the relative accuracy of these results M. Faye concludes:

1. That the method of the physicists is superior to all others, and ought to be substituted.

2. That the value of solar parallax, $8\frac{8}{10}''$ (by physical methods), is now determined to about $\frac{1}{100}$ of a second.

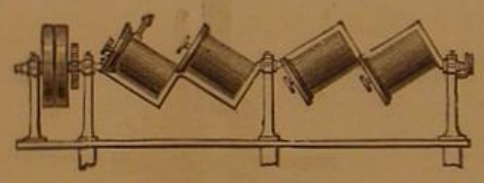
3. That the seven astronomical methods of procedure converge more and more toward that value, and tend to confirm it without equaling it in precision.

A detailed statement of Lieutenant Michelson's work will be found in his paper published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 193.

Testing Broken Stone.

The *Bulletin du Ministère des Travaux Publics* describes in its current number a series of investigations conducted by the French Administration for ascertaining the resisting power of different classes of broken stone employed in the formation and maintenance of roads. These experiments were directed toward two objects; to ascertain the resistance of different classes of stone to wear and to shock; and their resistance to crushing. With regard to the first a standard of comparison is employed, and the stone is submitted to treatment in a testing machine of the form shown in the annexed sketch.

This machine consists of two groups of four cylinders each, mounted side by side on a bent frame, which terminates in horizontal shafts, at one end of which on one group are mounted pulleys and gearing for transmitting motion to the other group. The axial distance apart of these shafts is 16 inches, and the cylinders are about $7\frac{3}{4}$ inches in diameter and 14 inches long. In one of these chambers is placed a standard sample of porphyry, and in the other the stone to



be tested; the charge averages about 11 pounds. The machine is driven with a speed of about 2,000 revolutions an hour, and the stones are subjected to attrition, and also to a to-and-fro movement from end to end of the cylinder. After about five hours the cylinders are emptied and their contents are carefully washed, the fragments precipitated being divided by sifting into three classes—those which will not pass through openings 0·39 inch in diameter, those decreasing from this size to 0·07 inch, and the dust smaller than 0·07 inch. The first portion is returned to the stone being tested, and the third is weighed, the relation it bears to the original charge indicating the value of the material tested. Experiments showed that the best samples yielded 2 per cent of their weight in dust, and for this class of stone a coefficient of 20 was adopted. The compression tests were obtained by submitting cubes 1 inch square to the action of a hydraulic press. The best specimens rarely showed a resistance of more than 20 tons per square inch, and a coefficient of 20 was also adopted for stones of this quality. Altogether 637 samples of stone were tested.

Metallic Cars.

An enthusiastic writer in a Western journal calls attention to the urgent need of fireproof passenger cars, and expresses surprise that some of our enterprising iron and steel manufacturers have not already furnished the railroads with a model car of this description. He says that cars can be made of steel tubes and plates with the greatest facility, and that they would be stronger, lighter, and safer than the present wooden cars, with many incidental advantages in the way of heating, lighting, etc.

The question of employing steel and iron as material for the construction of freight and passenger car bodies is not a new one. There was quite a stir made about it a few years ago. It was not only discussed very generally in the newspapers and technical journals, but quite a large number of freight cars were actually built in order to test the different theories as to how these materials should be used for car bodies to the best advantage. These included box, gondola, and refrigerator cars, the floor and body framing of which consisted of iron tubing and iron and steel rods, held in position by bands and tie blocks, the outside being covered with sheet iron, and the inside sheathed with wood. Another form of construction consisted of channel iron I beams for floor frame, and heavy wrought iron bars for the superstructure. The cars were from 30 to 34 feet in length, and weighed from 22,000 to 25,000 pounds. What kind of record these cars have made we are unable to say, but the inference is that it is not a very encouraging one, or it would by this time have been spread before the world. There has doubtless been some progress made as compared with the ruder constructions of an earlier period, but this improvement, so far as we can learn, has not been so much in diminished weight and greater proportionate carrying capacity as in a better constructive use of the material. It must, we think, be admitted that the results thus far are not such as to make metallic freight car bodies popular, and until they shall begin to supersede wood in this class of rolling stock there is not much chance for metallic passenger cars.

It is a common remark, even among railroad men, that iron or steel cars will some time or other come into general use, for the reasons that timber is getting scarce and more expensive, and that iron is already extensively used for truck frames and body bolsters. But the question of iron body construction does not depend upon the way in which trucks are built. The two are essentially unlike, and are subject to different conditions. It does not necessarily follow that because iron makes a good axle or crowbar, it will also make an equally good flagstaff or ax handle. Railroad cars, as compared with stationary structures, are subject to peculiar conditions inseparable from the uses they perform. These are rapid movement, a minimum of weight, liability to violent concussion, and the necessity of being easily and readily repaired. With respect to these, wood has the advantage over iron at the start. It is lighter, more compressible, will resist shocks better, and, in case of breakage, repairs can be made with less difficulty. Iron, it is true, will not splinter nor burn; a car made of it may not weigh more than a wooden one of the same size and capacity; it may last longer, resist shocks quite as well if rightly constructed, be worth more as scrap when worn out, and be repaired with less difficulty than is generally supposed. These arguments, however, amount to little so long as they are not sustained by a record of performance.

It would be no very difficult thing, as it strikes us, to make a model passenger car body entirely of iron or steel—frame, panels, roof, flooring, and seat frames, with no inside wood finish even. It could be beautifully ornamented inside and out with paint and varnish, and made to look very light, cheerful, and attractive. It would make a few beautiful "runs," and after a few rose-colored local notices in the papers would be lost sight of and forgotten, and the roads would go on ordering new wooden cars as before, without the least regard to the wonders performed by the model car in the way of somersaults down embankments, with no roasting or scalding of passengers as an accompaniment.

One great obstacle in the way of iron body construction is the fact that it can not be carried on without special shops, machinery, tools, and workmen. A new and distinct department would be necessary upon every road using, repairing, or building such cars. Machinery and tools for the purpose would have to be perfected by degrees, according to the methods of construction that experience should prove to be best. Wood working machinery, on the other hand, is already perfect, or nearly so, and car builders know just what kinds to put into a shop.

Another obstacle is the tendency to make iron construction conform to that of wood, when the difference in the two materials seems to require that the construction should also be essentially different for each. Our freight cars are designed almost exactly upon the same principles as our passenger cars, and with special reference to wood construction. It is manifest, however, that if iron cars are ever to be a success, the material must be used constructively *as* iron, and without reference to the peculiarities of wood construction. The design for a model iron passenger car that would really be a model for imitation would involve such a wide departure from present practice in order to meet the requirements of the new material that a first attempt could hardly be a success except by a miracle.

Meanwhile, railway passengers must rely mainly upon safety stoves and safety lamps in cases of collisions and overturns. An ordinary passenger car, with only a narrow door at each end for exit, allowing only one person to pass out at a time, is a regular trap whenever panic stricken occupants want to get out in a hurry. The material of the inside finish is also so extremely combustible that only a spark is necessary to set it in a blaze. The ends of the car are almost sure to be fired first, thus cutting off access to the doors. In shops and other buildings means are provided for extinguishing fires when they first break out, but no such means are at hand in the case of cars, unless from pure accident. The need of iron as a material of construction, or of some means by which wood may be rendered less combustible, is very great in respect to cars. But we do not expect any immediate revolution in the construction or warming of cars in order to secure greater safety. The mass of people seem to like things pretty well as they are, and will stick to the stoves, good, bad, and indifferent, and to the varnished and painted cabinet woods a while longer.—*National Car Builder.*

MISSISSIPPI SANITARY COUNCIL.—The third annual meeting of the Sanitary Council of the Mississippi Valley will begin at Evansville, Ind., April 20. Questions relating to quarantine and the transportation of contagion will be the chief subjects of discussion.

An Outfit for Mining Machinery.

A complete plant for mill and leaching works for the Rosario Mining Company, Mexico, was lately shipped by Parke & Lacy, of San Francisco, Cal., the engines, batteries, and, in fact, all the iron work having been made there by Prescott, Scott & Co of the Union Iron Works. The mill is a forty-stamp one, but so arranged and with sufficient power to be increased to eighty stamps. The whole reduction works, when ready to run, will have cost $150,000. The mines being about 100 miles from the sea coast, the contractors had made to order ten sixteen-mule wagons, with harness and all necessary appliances for handling the machinery. The engine frame weighing 11,000 pounds, a special wagon was made for it, and special wagons with saddles were made to take the two steel boilers, which weigh 7,500 pounds each.

As this outfit is exceptionally complete and expensive, the *Bulletin*, of San Francisco, has taken pains to obtain the following details with regard to the construction of the leaching works and other machinery, as well as of the processes to be employed in them.

The ore when delivered to the mill is first dried in the improved Stetefeldt drier. As soon as the ore is dried it falls into cars and is taken to the Eclipse feeders at the batteries. Two large dust chambers are arranged above the batteries, provided with sheet iron hoppers, and are connected with a Sturtevant exhaust fan, which draws the dust into them, where it is deposited at the bottom of the sheet-iron hopper.

From the battery the pulp is taken by screw conveyors and an elevator, first, into a hopper provided with a sifter or revolving screen, where coarse particles are sifted out and returned to the battery. The hopper is provided with a Standish feeder by which the pulp is discharged into the conveyor and elevator, which takes it to the Stetefeldt furnace. This furnace is of the largest size, with a shaft 6 feet square and 43 feet high, and a system of twelve dust chambers.

The building to cover the furnace, dust chamber, and cooling floor will be 46 feet wide and 102 feet long. The furnace will be built in the most substantial style, with a great many improvements in construction, which are the result of the experience at the Ontaro mill, Utah. It is calculated to roast from forty to fifty tons of ore.

The ore, after cooling, is taken to the leaching house in cars. The leaching house will be 104 x 38 feet. There are eight leaching tanks, of 12 feet in diameter, and the necessary tanks for precipitating and for the solutions. For the conveyance of the solutions back to the upper tank again for reuse, a novel method is employed, the usual pumping system being dispensed with. Below all the leaching tanks and vat is a tank connected with an air compressor, the pressure of air driving the liquid to the upper vat or reservoir. For the drying of the silver precipitate a centrifugal machine will be used.

The roasted precipitate will be melted in a reverberatory furnace with charcoal gas fire, this furnace being constructed with a peculiar removable hearth, so that the hearth can be readily repaired if it becomes injured by the matter which results from the melting of the bullion.

The plans for the furnace, drying kilns, leaching tanks, etc., were all made by C. A. Stetefeldt, and the position of the batteries and engines had to conform to these more or less.

The engine, which is now set up at the Union Iron Works, where it may be seen, is of the most improved design, having a box frame and being compact and neat in design. It is a 24 x 60 inch. The eccentric rods, valve rods, and cut-off rods all have first-class bronze for journals, thus giving a better bearing surface, with no liability to heat. The fly-wheel is 18 feet in diameter, and weighs 30,000 pounds. The main pulley is 16 feet in diameter, 43 inch face, and is made in eight separate pieces bolted together. The valves are made of bronze, and all the working parts of the cut-off are steel, and every nut used in construction is case hardened. The engine is fitted with Phillips' improved metallic packing. The valve motion and cut-off is that invented by Eugene O'Neill, chief draughtsman at the Union Iron Works.

There are also two 9 x 13 Eclipse ore crushers, eight swivel dump cars, and a No. 5 Knowles pump.

There is one pair of 54-inch diameter steel boilers, 16 feet long, with 46 tubes, 3½ inch, and with double steam drums, 40 inches in diameter and 12½ feet long. The stack will be 42 inches in diameter and 80 feet long. The Crosby steam gauge, water gauge, revolution register, locomotive clock, and the Edson time recording and alarm gauge will be set up in a handsome case in front of the engine. A set of tools, tube scrapers, extra shoes and dies, and a lot of miscellaneous articles, not procurable in Mexico, go with the plant.

Among other improvements forming part of this machinery is the feed water heater, which was devised at the Union Iron Works recently. It is 30 inches in diameter, 9 feet 8 inches high, and has 157 square feet of heating surface.

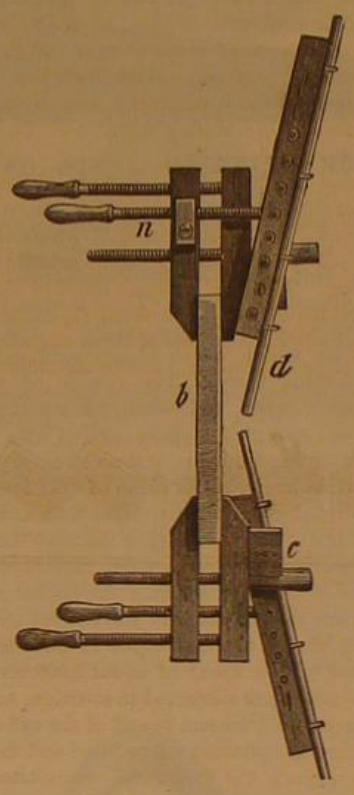
The mines of the Rosario Mining Company are located in the Rosario Mountain, a spur of the Sierra Madre, a distance of one hundred miles from the port of Ajuavampo, on the Gulf of California. The Rosario mines were discovered in 1852. They consist of a group of nine mines, under the following names: Dulces Nombres, San Jose, Bueno Fe, Carmen, San Genovera, Providencia, San Rafael, Sonorense, and Discubridora. They are on one vein, and together embrace a distance of 9,600 feet. The vein is 4,000 feet above sea level.

A MECHANICAL FINGER FOR USE IN THE PHOTOGRAPHING OF ENGRAVINGS.

Occasions frequently arise when it is necessary to have reproduced in *facsimile*, or to any determined scale, printed matter or engravings bound up in a large and thick volume. In order that the photographer to whom such work is intrusted may be enabled to accomplish it successfully, it is indispensable that the special page being operated upon be held in a firm and flat position in front of the camera. In the case of loose engravings or unbound sheets no difficulty is experienced; but when these form part of a book which is thick, heavy, and somewhat rigidly bound, then arises the difficulty of complying with the first condition in reproduction by aid of photography, viz., a position of flatness, rigidity, and rectangularity to the axis of the lens, by which it is to be reproduced.

At the last meeting of the Photographic Section of the American Institute Mr. Oscar G. Mason, of Bellevue Hospital, submitted for the examination of the members a piece of apparatus he had devised for this purpose, and which in practice he had found to answer in a most effective manner. He designated it "the photographer's compressor or mechanical finger," on account of the firmness with which it could be made to hold anything presented to it for the purpose of being copied, whether that were an anatomical or physiological preparation, or, as in the case now before us, a page in a bound volume.

To construct the mechanical finger or fingers—for two are required in most cases—is an operation within range of the powers of every one possessing even a modicum of mechanical ability. Three pairs of small cabinetmaker's handscrews are necessary. The size of those that will prove most useful for ordinary gallery work is that known in the tool stores as



"eight-inch handscrews." One of the three pairs is taken asunder, and each jaw sawed across in such a manner as to leave the threaded ends to form nuts for the lever screws of the two completed "fingers." The piece so removed by the saw should be left long enough to admit of being held in position on the lower jaw of the "finger" by a strong screw through one end, while the short end of the nut—which in small handscrews is usually too short for a second hole—may be held in position by a short dowel pin of one-eighth inch wire. This nut, as fixed in its place, is shown at *n* in the accompanying diagram, in which the whole arrangement is represented.

In this diagram *b* represents an edge view of the board upon which the volume is to be fixed while being photographed. Upon the upper jaw of the handscrew portion of the finger is firmly screwed a block, *c*, through which several holes are bored in a straight line, to admit of raising or lowering the fulcrum point of the finger to suit the thickness of the book or whatever other object is to be held in position. These, however, are very seldom required, as the lever motion is such as to accommodate the point of the finger for all thicknesses up to two inches. To this block, *c*, is attached by a strong screw or loose pin the finger box or lever, along the upper surface of which is a row of ordinary screw-eyes as used for the suspending cord of picture frames. Through this row of the "eyes," four of which is a sufficient number, is run a small rod of hard wood of such thickness as to slide easily, although not too loosely, through the screw-eyes, so as to admit of its being pushed out or withdrawn to the proper part of the book on which it is desired to make it bear. This point is then depressed to any desired degree by the action of the supplementary screw, attached as before described and as shown in the diagram. The finger rods of the apparatus exhibited at the meeting of the Institute were formed of round dowel pin wood of three eighths inch thickness.

When the book is large and heavy, to prevent the rod from making an indentation by its pressure, slips of stiff wood the length of the page are laid along the opposite margins, and upon these the full pressure of the finger is brought to bear. The board itself may be of any dimensions to suit the class of work for which it is required, from a pocket volume up to a large plan or map.

The numerous practical photographers who were present when this piece of apparatus was exhibited and described welcomed it as supplying a want that had long been felt, and that welcome was none the less cordial from the conviction that each of them could construct it for himself at a small cost. The board itself may be sustained in a vertical position on any convenient stand, or it may be suspended on the wall. When used by Mr. Mason in Bellevue Hospital it is erected on the adjusting rod of an ordinary head rest.

A New Type of Embroidery.

The attention which has been drawn to the novel style of embroidery, exhibited first in Boston and now in New York, by Mrs. Oliver Wendell Holmes, Jr., of the former city, would seem to be justified by the originality, boldness, and artistic promise of the work. The effects are produced by combining filoselle, worsted, silk, and cotton thread on a ground of satin. There is no regularity of stitch, no parallelisms of threads, no inclinations of an exact series of darnings, none of the usual formal methods in embroidery; yet the effects are striking and pleasing. There may be something of haphazard, hit-or-miss, about the work, says the art critic of a morning paper, still the effect is impressive, if not startling. "It is, in fact, the vigor of the work which gives the pleasure. Here is one striking piece, perhaps the best: On a dark blue silk ground, imitative of an evening sky, there stands out in the foreground the gnarled limbs of a New England fir tree. Dark masses of foliage, made by the thick laying on of masses of worsted, indicate the irregular growth. The sheen of the moon on the water is expressed by silvery lines of white thread, and off in the distance is the red lamp of some lighthouse. These are the conceptions of an impressionist, only instead of the facile brush and paint there is substituted for them needle and thread. Here are fields all aglow with the autumn weeds, where the golden russets form a rich, warm mass of color. Here is quite the opposite: A storm, a blizzard, with the stinging snow, expressed by driving lines of white thread. It is all realistic, with some little of a Japanese method, for there are water pieces with tumbling waves that look almost as if they had been made at Yokohama. Some of these embroideries shock just a little by the effects of the cold, clear skies, produced by the hard silk backings, for there may be criticism, for the work itself enters from its cleverness quite into the domain of art. Perhaps this new method of expressing things with a needle is only tentative so far, for other effects might be more happily produced by taking a softer worsted back, and not the hard silk background. Mrs. Holmes has certainly produced most novel effects, quite incomprehensible to masculine minds when the methods are understood. One would suppose, however, that no tyro could ever produce this kind of work, for the requirements to make such embroideries would be a keen eye for form, outline, and a very perfect appreciation of color and contrast. Of the originality of the work, even of the pleasant impressions derived from Mrs. Holmes' embroideries, there can be no doubt."

Buggy Beans.

Recently several cases of sickness occurred in Kingston, N. Y., it was supposed, by eating diseased pork. Specimens of the pork were sent to Dr. George F. Shrady, of this city, for examination, at the request of Dr. E. H. Loughran, Health Officer, Kingston. Dr. Shrady reported that he could discover no evidence of disease in the pork, and that it was entirely free from trichinæ. All of the persons who were made sick, as supposed, by the pork, also ate heartily of beans, the dish being baked pork and beans. After the report of Dr. Shrady the subject was allowed to rest, as the sick persons all recovered, though for a time it was feared that several of them would die. It was afterwards discovered that the trouble was caused by the beans, they being infested with small black insects. The bean which is thus infested presents on its surface a faint, black spot, underneath which one or more of the insects may be found. Persons who have eaten heartily of such beans have been taken violently sick with vomiting, accompanied by general weakness and prostration, which continues for a few days only.

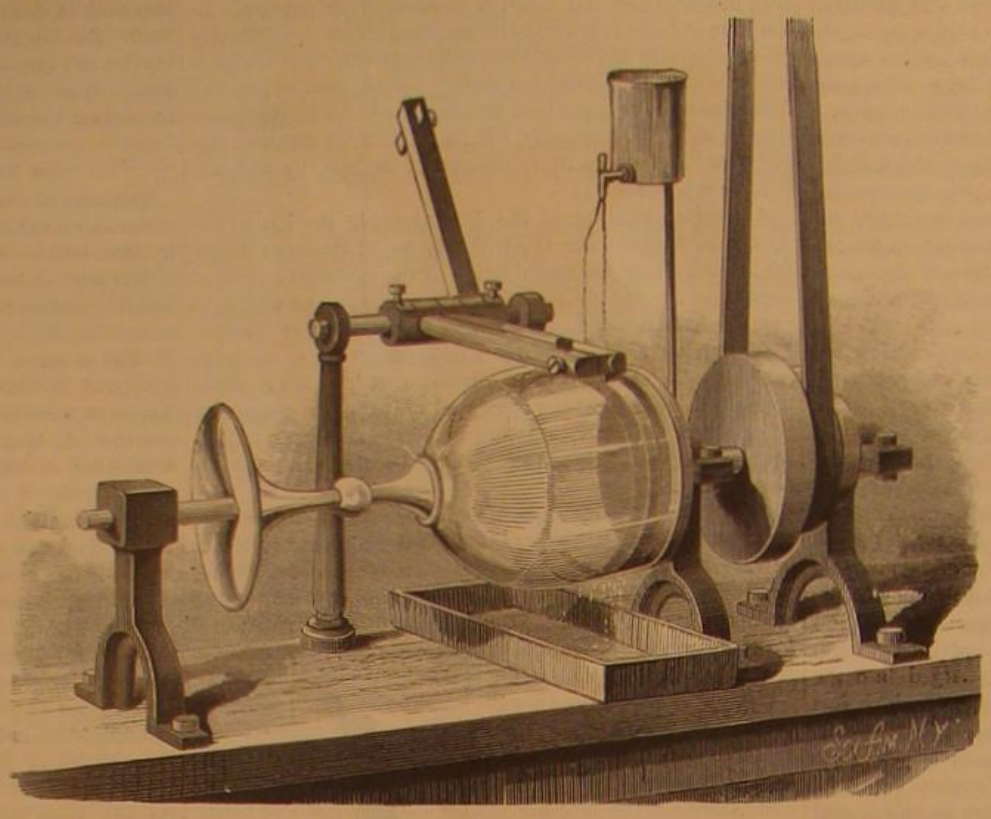
James Tennant.

Professor James Tennant, F.G.S., of King's College, London, one of the best known of British mineralogists, died February 23, having just completed his seventy-third year. His celebrity as a mineralogist was universal, and his special acquaintance with gems secured him the honor of recutting the famous Koh-i-noor diamond for Her Majesty, and the permanent appointment of Mineralogist to the Queen. Professor Tennant was the teacher of most of the eminent geologists and mineralogists of to-day, and was the author of several valuable works in his department of science. Among his writings are: "Catalogue of Fossils Found in the British Isles," "Art Gems and Precious Stones," a "Description of the Imperial State Crown Preserved in the Jewel House of the Tower of London," "Iceland Spars," and a "Stratigraphical List of British Fossils," with remarks on their character and localities. He was likewise joint compile with Professors Ansted and Mitchell of the "Treatise on Geology, Mineralogy, and Crystallography," published in 1857 in Orr's "Circle of the Sciences."

MACHINE FOR GRINDING BANDS ON GOBLETS.

The engraving shows a very simple and effective device for grinding bands on the surfaces of goblets, wineglasses, and other glass vessels of circular form. It will be understood by a glance at the illustration without a great deal of explanation. The larger end of the goblet is carried by a slightly conical chuck revolving on the lathe mandrel. The bottom of the goblet is supported by a tail spindle pressed outward by a spiral spring. A rod, supported by two posts, carries three or more arms having mortises in their free ends for receiving grinding pencils of copper or other suitable metal which are pressed on the glass by the weight of the arms. The pencils are supplied with emery and water or other abrading material, and as the goblet revolves circumferential lines are very quickly formed on the glass. The distance of the lines apart is regulated by moving the arms and fixing them in position on the pivotal rod by means of movable collars fastened to set screws.

This machine was recently patented by Mr. J. B. Higbee, of Pittsburg, Pa.



MACHINE FOR GRINDING BANDS ON GOBLETS.

A Botanist in the Field.

It is announced that the very capable field botanist, Mr. C. G. Pringle, of Charlotte, Vt., has been selected by Prof. Sargent, of Harvard University, to make a tour for botanical exploration and collection during the next one or two years through New Mexico, Arizona, California, Oregon, etc. In addition to work in the forestry department of the census, in which Mr. Pringle has been engaged the past year, and the study and observation in their living state of certain critical genera of plants, Mr. Pringle is to superintend the collection, for the new American Museum of Natural History, New York, of specimens (including trunk sections, flowers, leaves, fruits, etc., as well as the principal commercial and economic products of each) of the more important species of trees found in the regions which he is to visit. Mr. James Kelly is to accompany him as principal assistant.

BURSTING OF FLY-WHEELS.

BY GEO. M. HOPKINS.

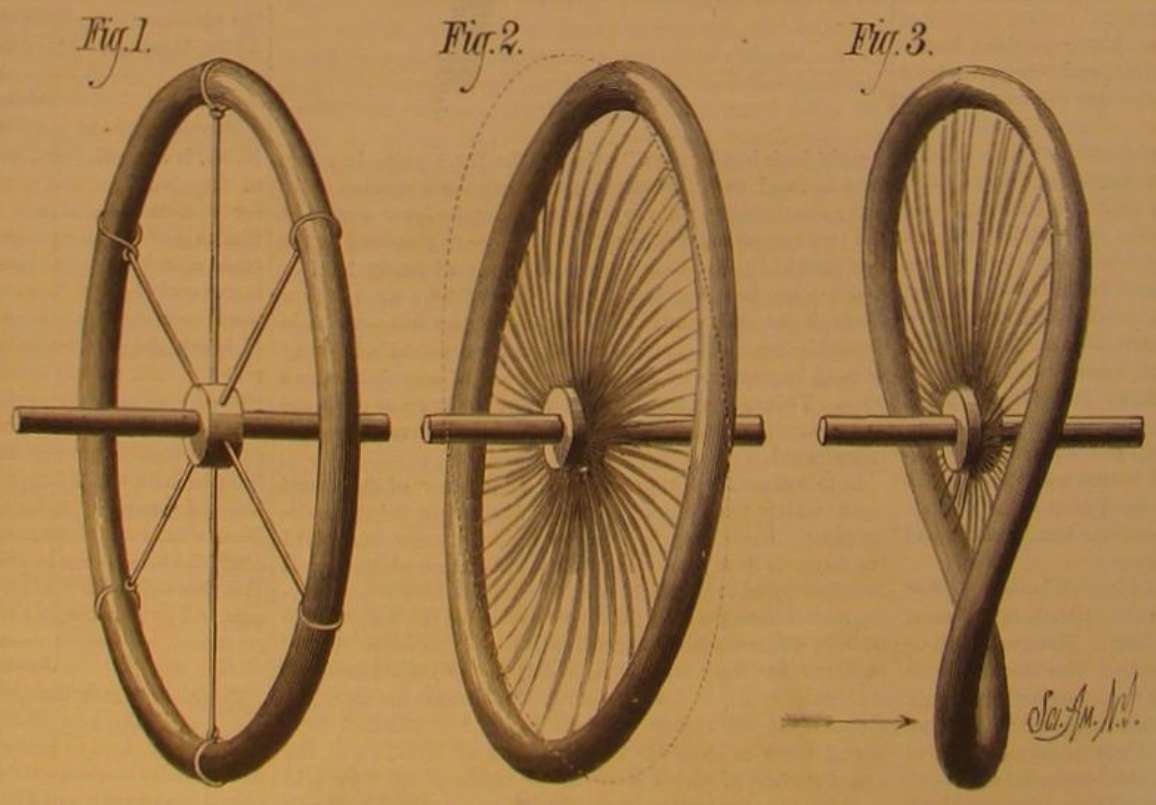
The theory of the bursting of fly-wheels, which has been accepted in the majority of cases, is that the centrifugal force due to a high velocity overcomes the cohesive force of the particles of the material of which the wheel is composed.

Of course this explanation is entirely inadequate when applied to a wheel whose strength is sufficient to resist any tendency to fly to pieces from purely centrifugal action under the conditions of its use; but of the fact that such wheels burst no evidence is needed, and some cause other than centrifugal force must be assigned for the bursting.

Supposing the fly-wheel to be perfectly balanced and without defects in material or design, it may be driven without danger at any velocity usually considered within the limit of safety, so long as it continues to rotate in a plane at right angles to its geometrical axis. And it may be moved in the plane of its rotation or at right angles to it, that is, in the direction of the length of the shaft, without creating any more internal disturbance than would result from moving it in the same way while at rest. But when a force tending to produce rotation at right angles to the plane of the wheel's rotation is applied, the effect will be vastly different, and the result will be a tendency to rotate about a new axis between the other two, and the centrifugal strain upon the wheel is supplemented by a twisting strain, which is an important and generally unnoticed factor in the destructive action.

To bring this idea to a practical application, the shaft and fly wheel of a high speed engine may be taken as an example. Let the wheel be correctly designed, well made, and well balanced, and if its shaft is properly lined and supported in rigid journal boxes, the wheel will perform its office without danger of bursting; but support the same wheel and shaft upon weak plummer blocks, and allow one or both of its journals to move laterally at every stroke of the engine, or even less frequently, and a disturbing element will have been introduced which will strain the wheel laterally, and which, together with centrifugal force, will effect molecular changes in the structure of the iron, and the result will be that if the wheel is not immediately broken it finally becomes weakened, so that it will yield to the forces that tend to destroy it.

Any wheel whose axis is swung in a plane at right angles to its plane of rotation, either occasionally and irregularly or frequently and regularly, tends to turn laterally on an axis between that of the normal rotation and that of the extraneous disturbing force. This tendency exists in ordinary wheels, although not visible. The engraving shows a flexible wheel, which clearly exhibits the effects of these disturbing forces. The rim is of rubber, the spokes of spring wire, and when the wheel is revolved very rapidly and moved in a plane parallel with its plane of rotation, no disturbance results, and no effect is produced by moving it at right angles to its plane of rotation; but when the wheel is turned even slightly on an axis at right angles to its geometrical axis by swinging the shaft laterally, the rim, while preserving its circular form, inclines to the plane of the rotation of its shaft, bending the spokes into a concave form on one side of the hub and convex on the other, showing the effects of the disturbing force on the figure of the wheel, as in Fig. 2.



FLEXIBLE FLY-WHEEL.

When the disturbing force is rhythmical the wheel sets up lateral vibrations and wave motions in the rim, which are out of all proportion to the extraneous force applied.

From this experiment it is evident that the lateral swinging of the shaft of a fly-wheel (for instance when its journal boxes are loose, or when the frame of the machine of which the fly-wheel forms a part is yielding) tends to weaken the wheel even when the lateral movement is slight; and where it is great, as when the shaft is broken, the twisting effect is correspondingly great, and the wheel or its support must yield.

No rotating machines are more subject to bursting than grindstones, and generally no rotating bodies of equal weight are mounted upon such small shafts or on such weak supports. The suspended ones are especially liable to the destructive action above described, as their frames are generally far too weak.

Fig. 3 illustrates the effect of a lateral blow on the rim of a fly-wheel. Of course the effect is much exaggerated in the flexible wheel, but it shows the form taken by the rim under a blow, the blow producing a much greater effect on the wheel while in motion than when at rest.

NEW INVENTIONS.

An improvement in the manufacture of embroidery has been patented by Mr. John Wiget, of Arbon, Switzerland. The object of this invention is to embroider eyelets, spiders, sprigs, dots, or any other figures in such a manner that the figures shall be connected together only by embroidery thread.

Mr. Daniel Aubert, of Sainte Croix, Switzerland, has patented an improved musical box. This invention relates to mechanism for musical boxes to increase the time of working, and admit of their being placed in a clock case in connection with a clock, for example, only to be wound up every eight days, at the same time as the clock is wound.

An improved rotary registering measure for linear measurements has been patented by Mr. Lewis W. Brown, of Osage City, Kan. The invention consists of a circular case or frame containing a unit and a tens wheel of equal diameters, provided with suitable figures on their rims, and holding between them a pinion, which is attached to the handle of the device, and of a larger circumferentially toothed wheel secured upon the hub of the unit wheel that they may revolve together, so that as the device is moved over the face of an object the larger wheel is made to revolve and turn the unit wheel once in each revolution, while at each revolution the unit wheel causes the tens wheel to move through a tenth of a circle, both the unit and tens wheels presenting, as they revolve, figures that indicate the measurements of the object over which they have been moved.

Mr. George W. Healey, of Jackson, Mo., has patented an improved horse detacher. The invention consists of a forward curved stud inserted in each end of a singletree to receive the rear ends of the traces, of springs secured on the face of a singletree and bending down in contact with the studs to prevent the traces from accidentally slipping off, and of a wire or rod connecting the springs, by which the springs are raised from the studs so that the traces may become disengaged.

An improved mosquito-netting frame for bedsteads, which is simple, light, durable, and convenient, has been patented by Mr. Alfred H. Bailey, of Palestine, Texas. The invention consists of a mosquito netting frame formed of two longitudinal rods fastened to uprights attached to the bedposts, and held by cords or wires passing from the outer ends of each of the rods to the top of each upright.

An improved toy pistol which is to contain a certain quantity of ammunition, fed every time the trigger is pulled, thus permitting repeated firing without reloading, has been patented by Mr. Henry Klassert, of Buffalo, N. Y. The invention consists of a pistol frame with a removable side, in which frame the trigger and hammer are mounted on the same pintle, the hammer having a forked lever pivoted to it in such a manner that when the pistol is cocked the forked lever rotates a friction wheel around which a percussion tape passes.

An improvement in that class of devices that are designed for opening, closing, and locking blinds and shutters, has been patented by Mr. Joseph S. O'Brien, of North Wilbraham, Mass. It consists of the combination of an improved spring hinge for throwing the blind out of a locked position, a spring catch, and attached cord for pulling the blind fully open or closed, and locking it in both positions.

A CURIOUS INHABITANT OF THE SARGASSO SEA AND ITS NEST.

What is generally known as the Sargasso Sea is the vast area of 260,000 square miles, more or less, to the west and southwest of the Azore Islands, reaching to the Bahamas westward, and finding its northern and southern boundaries in the 36th and 19th degrees of latitude. Other areas, notably that in the Pacific, five hundred miles E. S. E. of New Zealand, and, again, one thousand miles west of San Francisco, possess the same characteristics, but the former is the best known and defined. The great Atlantic currents form a gigantic eddy, thus collecting the algæ that forms its component parts. The vegetable fauna is generally comprehended in the two genera, *Fucus* and *Sargassum*, of the latter two species, namely, *vulgare* and *baciferum*.

The disconnected masses of weed that make up the "Sargasso Sea" are usually "from a couple of feet to two or three yards in diameter, sometimes much larger; we have seen, on one or two occasions, fields several acres in extent, and such expanses are probably more frequent nearer the center of its area of distribution. They consist of a single layer of feathery bunches of the weed (*Sargassum bacciferum*), not matted, but floating nearly free of one another, only sufficiently entangled for the mass to keep together. Each tuft has a central brown thread-like branching stem studded with round air vesicles on short stalks, most of those near the center dead and coated with a beautiful netted white polyzoon.

After a time vesicles so incrusted break off, and where there is much gulf weed the sea is studded with these little separate white balls. A short way from the center, toward the end of the branches, the serrated willow-like leaves of the plant begin; at first brown and rigid, but becoming, further on in the branch, paler, more delicate, and more active in their vitality. The young fresh leaves and air vesicles are usually ornamented with the stalked vases of a *Campanularia*. The general color of the mass of weed is thus olive in all its shades, but the golden-olive of the young and growing branches greatly predominates. This color is, however, greatly broken up by the delicate branching of the weed, blotched with the vivid white of the incrusting polyzoon, and riddled by reflections from the bright blue water gleaming through the spaces in the network. The general effect of a number of such fields and patches of weed, in abrupt and yet most harmonious contrast with the lanes of intense indigo which separate them, is very pleasing."

The animal life of this area is characteristic and has certain peculiarities well worthy the attention of the student. It consists of shelless mollusks, as the *Scillæa pelagica*, a short-tailed crab, the *Nautilograptus minutus*, quantities of membranipora, and a peculiar fish, the subject of our illustration, known as the *Antennarius marmoratus*. The writer was fortunate in observing the latter on the outskirts of this vast area. It forms one of the most interesting examples of the many creatures that find safety in protective resemblances. As above mentioned, the weed as it floats assumes all shades of olive, and the fish in color is its exact prototype, flecked with irregular patches of darker and lighter shades. Not only in color does it mimic the weed, but in general appearance, the head and fins being dotted here and there with fantastic barbels of flesh that to the ordinary observer seem bits of weed growing upon it. Even the white polyzoon growing on the algæ is imitated, and a careful examination is necessary to distinguish the fish from its surroundings. It was oftener found lying in among the weed, but where the patches were small, was frequently seen lazily swimming around in clear water. Its nest, seen in the accompanying illustration is, no less a curiosity. It is a round or oval ball of weed, intwined and wound together in a most complicated manner by an invisible viscid secretion from the fish. The pieces of weed are first roughly caught together, and the eggs deposited among the branches; then the invisible bands are wound around, gradually drawing them into the oval form, about as large as a base ball. The instinct, and its peculiar endowment by nature, place this fish among the most interesting of the finny tribe.

A CURIOUS INHABITANT OF THE SARGASSO SEA AND ITS NEST.

The Number of Botanical Species.

Dr. Muller, of Geneva, has recently made the following calculation as to the total number of existing botanical species: We have at present described in our books about 130,000 species; and if we suppose that, in round numbers, 30,000 belong to countries like Europe and North America, where there are hardly any species, excepting some cryptogamic ones, to be discovered, the remainder, or 100,000, representing exotic plants, more or less tropical and southern, we may double the latter for new species, giving 200,000 for these less known regions, and altogether 230,000 for the whole globe, with the exception of countries still quite unknown botanically. Adding only 20,000 species for the latter, we reach a minimum sum of 250,000 species of plants.

SEVRES VASE.

We give an engraving of a vase from the manufactory at Sèvres. It is of the *pite dure* variety, and has all the finish and beauty for which the productions of the Sèvres factory are noted.

SEVRES VASE.

The Musk Ox as a Geographical Clew.

Until recently it has been supposed that Wrangell Land—where Lieut. De Long hoped to spend the first winter of the Jeannette expedition—had never been visited by civilized man. It has now come to light that a German trader, Capt. E. Dallmann, made two landings there in the summer of 1866. His neglect to claim public credit for his discovery till now would appear to be due partly to his ignorance of the geographical significance of Wrangell Land, and partly to the fact that he has been away from Europe since that region came into prominence in connection with the Jeannette expedition.

On his first visit Captain Dallmann landed in latitude about 70° 4′ north and longitude 178° 30′ west. The land formed on the southern side a rather deep, wide, open bay, lying west of a ridge about five hundred feet high. To the eastward of this ridge the land stretched more to the northeast. The land, as far as he could see, had a narrow and level beach, like the northeastern coast of Siberia, behind which it rose to heights of from five hundred to one thousand feet, the last named elevation, however, occurring rarely. He saw no signs of human habitations, but found a great many tracks of animals, apparently those of polar bears, foxes, and musk oxen.

Speaking of the reference to the last named animal, and of the statement made elsewhere by Captain Dallmann, that he purchased the horns of musk oxen from native hunters in Northern Siberia, Mr. George Keunan (who is soon to lead a government expedition to the north coast of Alaska) says:

"The musk ox is a native of Arctic America and Greenland, and is entirely unknown in Siberia. If, therefore, that animal exists on Wrangell Land, the fact points to an extension of that land across the Pole, or to its junction with Arctic America at some point north and east of Point Barrow. The fact, so far as it goes, tends to corroborate other evidence, or at least indications, which we have, that the Arctic Ocean north of Behring Strait and east of Wrangell Land is a partially inclosed sea, with Wrangell Land and perhaps a chain of islands for its western and northern boundaries. The fact that natives of the North Siberian coast were in possession of the horns of musk oxen is significant in still another way, since it shows that those natives must have crossed Long's Strait and hunted the animals where Captain Dallmann saw their tracks, viz., on Wrangell Land. Finally, Captain Dallmann's statements, taken in connection with that of Captain Long, of the bark Nile, prove that during two consecutive seasons—1866 and 1867—the southeastern coast of Wrangell Land was easily accessible, and the adjacent sea entirely free from ice."

Lethe and the Gardens of the Hesperides.

At the recent meeting of the American Geographical Society in this city, Lieutenant Commander Gorringe read an entertaining paper entitled "A Cruise along the Northern Coast of Africa." Describing a trip from the Gulf of Gabes to the site of the proposed "Inland sea"—a desert area of about 3,000 square miles, which the French talk of flooding by means of a canal, over a hundred miles long, through the Chotts of Algeria—the reader said:

"In the neighborhood of Benghazi the surface of the ground is frequently broken by precipitous chasms, fifty or sixty feet in depth; at the bottom there is invariably a surface of rich soil, and also an abundant supply of moisture. The change from the arid and barren surface of the surrounding desert to these spots of luxuriant vegetation is very striking. The gardens of the Hesperides are believed to have been in the vicinity of Berenice, and many are of the opinion that these fertile spots at the bottom of the chasms are what remains of them. In one of the chasms, about seven miles from Benghazi, is the entrance to a cave which leads to an extensive sheet of water, believed to be identical with the river Lethe. I transported a boat across the desert on the backs of two donkeys side by side, and launched it on the waters of this famed river, which we found clear and cool and fresh as if constantly supplied by springs. It appears to run through a series of chambers, with very narrow passages connecting them, in which we observed a sensible current. The walls of the chambers are in part at least artificial, and on them are engraved many inscriptions. No extended exploration of this curious subterranean stream has ever been made; no one knows where it comes from or where it goes to, and it would be very interesting to find out, and instructive to copy the inscriptions, some of which are believed to be in Punic characters. I can very well understand the extravagant terms in which the ancients described the Lethe. In the spring there prevails along this coast a hot air blast—it cannot be called a wind—that comes from the great desert further south. The air is laden with insects and fine particles of sand, and is hotter and drier than any one who has not experienced it can conceive of. I have observed a temperature of 131° Fahr. in the shade during one of these blasts, called by the natives *giblehs*.

On one occasion I was indiscreet enough to wet my head with salt water, in my efforts to allay the intense suffering caused by necessary exertion. In a few moments my head was covered with a crust of salt, so rapid had been the evaporation. These winds rarely last through the night, and usually return each day for three or five days. My theory in regard to the Lethe is that it was an artificial subterranean retreat from the discomforts of these hot winds for the inhabitants of the ancient city, who were certainly wealthy enough to create it, if we may judge from their other works on the surface. The temperature of the air in the cavern keeps uniformly at about 65°, and that of the water about 55° Fahr. The waters of the Lethe are famed in ancient poetry for preserving youth and life; in contrast with the dry, hot blast of a gibleh, with its depressing influences on body and mind, the cool and moist atmosphere of the cavern justifies almost any assertion.

The Official Examination of Patents.

Many persons who suggest improvements in the patent law of Great Britain propose that patent specifications shall be officially examined for novelty before a patent shall be granted. A very high value is set upon this scheme; and it is commonly held that by carrying out the examination system thoroughly it would be found possible to eliminate nearly all the existing defects in the working of our patent law. Only the examination would not reduce the cost of a patent. Given low fees and efficient examination, and nothing more would be demanded by hosts of grateful inventors. It is not to be disputed that the theory of prior examination has something to recommend it. It seems at first sight to be clear that the state has no right to grant a worthless patent to an inventor in return for his fees; and it also seems to be right that the state should, in granting a patent, give the world a kind of guarantee that the invention patented was a new thing. But when, instead of glancing hastily at the matter, we carefully consider the bearings of the questions involved, and the whole theory of patent law as practiced in this country, we soon find reason to doubt that prior examination is a good thing; and if we turn to the United States, where examination is practiced, we shall find nothing to encourage the belief that the system can ever be made to work well.

The arguments in favor of official examination are very few, however cogent they may be. They are, as we have said, that the state ought not to sell to any one that which has no value, and that by stopping the intending patentee at the very outset from protecting an old invention, much trouble will be saved to manufacturers, an enormous amount of litigation will be got rid of, and the patents which pass the necessary ordeal will acquire a hitherto unknown value. As a minor consideration patentees and their agents will save the cost and time spent in making searches. If anything else can be urged in favor of the official examination it has escaped our notice. It will be seen that the examiners can do nothing more than say that a given invention is new or old. The value of the verdict when the invention is pronounced to be old is comparatively small. It is represented probably by the fees which the inventor will not spend under the circumstances. Its value as regards the invention pronounced to be new may be very great indeed. It may give a man an indefeasible title to a property worth many thousands of pounds. But it is obvious that, in order that this may be the case, the verdict of the examiners must not admit of being questioned. If they say that Mr. John Smith's invention for improvements in penny whistles is new, then it must not be open to Mr. James Brown to say that the examiners were mistaken as to the scope of the invention; nor must Mr. Green be permitted to refuse to pay Mr. Smith a royalty on the ground that he had made whistles of the kind patented for years; nor may Mr. Robinson assert that the specification is so badly drawn that the only whistles which it really covers cannot be made at all. If the verdict of the examiners is open to revision, then it is quite clear that it does not give an indefeasible title.

It is said now that no patent in Great Britain is really valid that has not been proved to be so by the result of an action at law. There is no doubt a substratum of truth in this statement. But assuming that the verdict of official examiners is not sufficient to keep patentees out of the law courts, then it is evident that the value to be attached to their verdict is much reduced; and it is easy to see that if the result of a little litigation was to overset the examiners' verdict in, say, half a dozen cases in the year, that verdict would almost cease to have any value whatever. In other words, if the verdict of the examiners is to give an indefeasible title, then the examiners must be infallible, in fact or by law. It is clear that no mortal can comply with the first condition, and it is equally clear that if it was enacted by Parliament that the verdict of examiners should invariably be regarded as final, a very wide door indeed would be opened for the entrance of injustice. It appears, therefore, that there must be in all cases a power of appeal. In other words, the verdict of the examiners as to the novelty would be taken for what it was worth, and we should have trials by jury just as we have now when disputes arise about priority of invention.

In the United States an attempt is made to get over the difficulty. There is a large number of examiners; so many, we believe, that it is possible for each to give quite half an hour to ascertaining whether an invention is or is not new. The rule is not to give the inventor the benefit of a doubt, but to refuse a patent on the ground of want of novelty. Then the inventor can apply to a higher grade of examiners, and counsel can be heard in his favor. In other words, the patentee begins with something very like a lawsuit to prove the novelty of his invention. If the verdict is in his favor, then the value of his patent is, no doubt, augmented; but the cost of the trial is very considerable. It may amount, and sometimes does, to several hundred pounds. If the case is not of such importance, the patent examiners will send for the patentee or his agent, and call on him for explanations, and in the end will grant him either the whole or part of what he claims.

Thus, to return to Mr. Smith and his penny whistle; he perhaps claims the use of a vulcanite instead of a wooden block in the mouthpiece, the making of a ninth hole, to give an extra note, and the introduction of a rivet at the lower end of the whistle, because solder sometimes does not flow well to the end of a lap joint, and ripping ensues. The examiners, after hearing all that Mr. Smith has to say, grant him a patent for a whistle with a vulcanite mouthpiece; but they will not grant one for the ninth hole, because flutes have more than nine holes; nor will they grant a patent for the rivet, because the ends of cask hoops make a lap joint and are secured with rivets. Mr. Smith has to be content with what he gets; but some one else subsequently obtains a patent for the ninth hole, and a third man secures the rivets, much, of course, to Mr. Smith's satisfaction. In saying all this we exaggerate not at all.

Every American who has had experience at the Washington Patent Office will bear witness to the truth of our statements. In all this we have really a desperate, but legitimate, effort to make examination a genuine thing, and not a farce; and it is not to be denied that if the system was properly carried out it would prove of great use. But let us consider what doing this means. As it is, the American examiner carries, no doubt, a great deal in his memory, and is able to say at once that certain inventions are not new; but this does not prevent the patenting every week of old ideas to a surprising extent. He is also able to say that certain parts of other inventions are not novel; so can every respectable patent agent in Great Britain. The American official must, however, be in doubt again and again, and he satisfies his official conscience by giving an inventor in such cases only one-half or one-third of what he asks for. But this is a very defective system. It means an indirect pleading guilty to a charge of incompetence as an examiner. It can, however, only be got rid of by making the examination really perfect, and it is impossible to do this. An examiner may know what has been patented before, but no board of examiners can be supposed to know all the devices which are and have been in use for years without being patented, any one of which would suffice perhaps to render half a dozen patents invalid.

Let us bear in mind that almost every week cases are tried in which all the skill of counsel, the acumen of a judge, and his power of analyzing the evidence of an army of "expert" witnesses, barely suffice to settle whether a certain invention is or is not new, and consider what it is that an examining tribunal must be expected to perform. Is it not obvious that the examiners must discharge the combined functions of judge and jury, and is it not evident that the value of their verdict will depend largely on the fullness and accuracy of the evidence set before them? This being so, the whole machinery of a law court, now resorted to only as a last resource and with comparative rarity, would have to be used before more than at most one-half the patents now granted could be confirmed.

It may be urged that this is going much too far with the thing—that it will suffice if the examiners are moderately diligent and careful. To this we reply that unless the verdict of the examiners is to be regarded as practically final, it possesses little or no value. Under the supposed conditions the entire system may do more harm than good by leading to the summary rejection of really valuable and novel inventions on very frivolous grounds. This is the grand objection to the scheme. If it is not perfect it is worse than useless; and to make it even nearly perfect it must be enormously expensive in its working.

The objections, on the other hand, which can be urged against the existing British system are very few. It is true that patents which are worthless are granted, and that pretty freely, but the mischief done thereby is not very great. It will be found, as a rule, that no two inventions are really identical, although there may not be any legal distinction between them. If an old thing is patented it can do no harm to any one else, unless it possesses sufficient merit to make it worth while to work it. It will then usually be found that the patented invention is really better than that which anticipated it, and the world is not the loser by the patent.

A case in point occurred some years ago. An invention for cleaning grain was patented; on inspection, however, it appeared that the new thing was neither more nor less than the old winnowing machine. As a matter of fact, however, the new grain cleaner had within it a board so set that it divided the current of wind, and did what the old machine did not, make a clean sample. The specification was beyond question bad as it was drawn, but no one was the worse of its existence.

The owners of a patent, valid or invalid, cannot prevent a man from using a machine or a process which he had used previous to the date of the patent, and any attempt to compel the payment of royalties would end in a discovery of prior user. We suspect that the instances in which royalties are paid on patents for inventions absolutely old right through are very few indeed, and that when a royalty is paid the owner of the patent has some substantial claim to it. But whether this be the case or not, and even if we concede that it is not the case, and that thousands of pounds are paid every year in royalties on worthless patents, we cannot see at all that a crude and insufficient examination would help to set matters right, even though it have official sanction.

There remains one argument to be considered, namely, that the state has no right to sell an inventor a worthless patent. It seems to us that the well recognized principle of *caveat emptor* applies accurately to this case. Let the purchaser look to his own interests. The law expects that every man shall use some caution in his dealings with others. Thus, for instance, a general warranty of soundness for a horse will not be taken to cover obvious defects, such as the want of an eye or a tail. The law says that a purchaser must see for himself whether the horse which he buys has or has not a tail. In the same way due facilities are supposed to be provided to enable would-be patentees to ascertain whether their inventions are or are not new. If they do not use these opportunities, and should discover subsequently that they have patented what was not novel, they have themselves to thank for the loss of their money.

Finally, we may add that competent patent agents are always willing to make a search for inventors which will give them quite as good a title as anything done officially in the United States can confer. But most inventors object to the cost and delay, and take their chance. We have shown, however, that if the official system of examination is to be really worth anything, it will introduce elements of cost and delay which would be regarded as intolerable by the great mass of British inventors.—*The Engineer.*

Study of Bones.

Prof. O. W. Holmes has introduced into the Harvard Medical School a decided improvement in the study of osteology. While abroad, during the summer, he purchased for the school ten skeletons, each of which has been divided into parts—skull, thorax, spine, legs, and arms. These parts are each provided with a wooden box with a sliding cover, and a handle to carry it with. The parts are distributed to those students who desire them on a stated day. Each box is lettered and numbered, and the student enters his name with the letter and number of his box in a book kept for the purpose. The parts are kept six days, a fine being incurred for each day beyond the prescribed time.

This plan of circulating bones is of great use to the student, as it enables him while reading to locate and fix various facts by actual observation, about the only way, indeed, in which the facts can be fixed. By the study of the bone a practical working knowledge is obtained, which it is not possible to gain from mere reading. Any one who has studied osteology "by the book," and then gone to the skeleton for confirmation of facts, must have been struck by the great dissimilarity of his ideas of the subject, and the facts as found. No matter how precise and carefully worded the description of an object may be, we fail to fully comprehend it, unless we see the object itself; and by seeing and handling the object we can clinch the facts about it into the memory, so that they will not easily drop out.

A system somewhat similar to this one is in use in the Columbus Medical College of Ohio. Here the bones under discussion are handed to the class during the lecture, and the various points are verified by the students as they are mentioned by the lecturer. The method of the Harvard School seems better, inasmuch as the bones are taken to the room of the student and there studied at leisure, and all their various points seen in their relation to each other.

The Longitude of the Chinese and Japanese Coasts.

Lieutenant-Commanders F. M. Green and C. H. Davis, Lieutenants S. M. Ackley and John Morris, and Surgeon Dale, of the United States Navy, have been detailed by the Navy Department to determine the exact longitude of certain points on the Asiatic coast of the Pacific Ocean. The American officers have permission from the cable companies to establish stations and use the cables at night for this purpose.

English officers are now engaged in a similar work in New Zealand and Australia. The information obtained by the observations will be exchanged by the two nations. English officers have determined the longitude as far as Madras, and Russian officers have made observations on the Siberian coast. All observations have been taken from the Hong Kong Observatory. The American party will ascertain the precise longitude of that place, there being a question as to the accuracy of the standard. The object of this movement by the Navy Department is to establish correct standards, from which true charts for the protection of maritime interests may be produced.

Natural History Notes from West Africa.

A paper on the fauna and flora of the gorilla country, written by Hugo von Koppenfels, at Corisco, West Coast of Africa, was read at a recent meeting of the New York Academy of Sciences. The writer has been exploring a little-known region in Equatorial West Africa, where the gorilla is at home. The range of the chimpanzee is much wider, including all of tropical Africa. The writer stated that it is now proved that crosses occur between the male gorilla and the female chimpanzee; also that the chimpanzee of Northern Guinea differs essentially from that of the southern part of the same country. The names *m'schigo, m'couve, kvolo, baboo, soko,* and *koolookambla* are only different designations of the chimpanzee by different tribes.

OZONIFEROUS PLANTS.

Ozone is a mysterious element found in the atmosphere under certain conditions. It long puzzled scientific men as to its nature and composition, but it is now considered to be oxygen in an allotropic state, or the property possessed by some simple bodies, of assuming different qualities when subjected to certain modes of treatment. Its varying quantity in the atmosphere is supposed to affect the health of man. By some it is supposed to be oxygen condensed to two-thirds of its bulk. It is insoluble in water and in solutions of acids and alkalies, except in potassium iodide. It possesses very powerful bleaching and disinfecting powers, corroding cork, caoutchouc, and other organic substances, and rapidly oxidizes iron, copper, silver when moist, iodine, and dry mercury; and also has an irritating effect upon the lungs when in any large quantity in the atmosphere. It has a peculiar, somewhat metallic odor. It is produced when a current of electricity is passed through dry oxygen or atmospheric air; or by allowing phosphorus to burn in contact with water in oxygen or air, and also by different other processes.

Many trees and plants are supposed to evolve ozone, or to aid in producing it in the air, and so by its powerful oxygenizing qualities to destroy the disease-breeding germs floating in the atmosphere. Not that all plants do so, for there are some which are reasonably credited with producing malaria. This power of evolving ozone is strongest in sunlight, and often quite feeble at night. Although ozone is a recent discovery, yet the power of certain trees and plants to prevent malaria was well known centuries ago. A species of thyme was in such high repute for this purpose as to be held sacred to Vishnu. The disciples of Empedocles, one of the Grecian philosophers, planted aromatic and balsamic herbs near their dwellings to ward off malaria. Our English ancestors considered camomile and fever-few to have a similar effect. Places in which the sweet bay tree grew plentifully were considered by the Romans as being secure against infectious diseases. The antimalarial powers of the *Eucalyptus globulus* and other species are fully proven by the effects they have produced in Algeria, Corsica, Cuba, the Cape of Good Hope, Australia, and other places, having rendered almost uninhabitable regions perfectly healthy. Malarial diseases are also rare in sections of country in which pine trees or other coniferæ are abundant. In places where certain odoriferous plants are grown in large quantities, for the purpose of obtaining their essential oils, all such diseases are rare. The essential oils obtained from such plants also have similar effects when exposed to sunlight; and in a lesser degree such perfumes as eau-de-cologne, essence of lavender, extract of millefleurs, etc., all attributed to their power of producing ozone. Other plants, however, which do not produce essential oils, appear to have a similar power of preventing malarial diseases, or of rendering malarious districts healthy. In some parts of the well-known Campagna, near Rome, immense areas of thistles rendered the localities where they grew quite healthy, but upon their being destroyed, these districts became again unhealthy. In this country, in Holland, in the Mauritius, and other places, the planting and cultivation of the common sunflower has had remarkably beneficial effects in destroying malarial poison.

All odoriferous plants do not produce such effects in destroying the malarial germs in the atmosphere. There are some, such as the *Daphne mezereum*, the oleander, the wall flower, the pride of China (*Melia azedarach*), and others, which are actually deleterious when planted in great numbers. Besides the plants supposed to produce or evolve ozone, and hence called ozoniferous plants, there are others which have powerful disinfectant qualities, but whether they are ozoniferous has not yet been determined. The plants we have already noticed as such give off their emanations into the atmosphere, and the malarial germs are destroyed by the oxidizing power of the ozone burning them up. The plants of which we are about to speak have the power of disinfecting water, or destroying the organisms or gases which are deleterious to health. Whether malarial diseases are produced by infinitesimally minute organisms or by gases, is a matter of dispute, but they are most probably produced by germs which our microscopes have not yet been able to detect. This is becoming more and more the accepted theory. It is very probable that these water-purifying plants give off ozone by means of their leaves and roots, and thus destroy the germs in the water in which they grow. Very few, if any of them, produce essential oils or resins, but, as in the case of thistles and the sunflower, these do not appear to be indispensable in the formation of ozone. Among such plants are nearly all of our various pond weeds, such as float on the surface as well as those that are immersed, and some that are submerged. Many of our bog plants and some of those that grow on the borders of streams also appear to have the same power. In India, the West Indies, and in Africa, there is a species of duckweed, *Pistia stratiotes*, which possesses this purifying power in a remarkable degree. It will, in a few days, sufficiently purify stagnant water to admit of fish living in it, but at the same time makes it unsuitable for drinking purposes, rendering it so acid as to produce intestinal fluxes.

Now that malarial diseases are so common and produce such a large amount of suffering and death, the mode or means of preventing the development of the germs which produce them should be carefully studied and investigated. If the planting of certain odoriferous plants about our houses, or the stocking of ponds, streams, and marshes with plants producing similar beneficial effects, will destroy them, it certainly ought to be tested in an intelligent way by careful experiment. That some plants will do it is certain; they may not be desirable to have about our dwellings, but others more desirable and ornamental will no doubt be discovered when sought for. By our strict utilitarians, the study of botany and the culture of flowers are considered to be a waste of time, producing no useful results whatever; but the time is not far distant when they will be considered as highly useful pursuits. Realizing that an ounce of prevention is better than a pound of cure, our medical sanitarians are devoting much time to the study of the prevention of disease. The subject which we have thus so cursorily glanced at is one that commends itself to their attention.

The Utilization of Refuse.

A system of destroying the noxious properties of refuse, and converting it into more or less useful matter, has now had a fairly extended trial at several towns in England, notably Leeds, Blackburn, Warrington, and Derby, and has been found fairly successful. Leeds has led the way in these improvements, and the municipal authorities are satisfied with the result. The furnaces and other appliances were designed by a Mr. Fryer, of Nottingham, and their first practical trial was made at Burmantofts, about two miles from the town hall of Leeds, by the erection of a six-celled destructor and a carbonizer. The destructor consists of six (or more) compartments or cells, built in brick, lined with firebrick, and tied together with iron rods. It occupies a space of 22 feet by 24 feet, and is 12 feet in height. An inclined road leads to a platform over the top, and another incline leads from the level of the firing-floor to the adjoining road. Each cell is capable of destroying or carbonizing seven tons of refuse in twenty-four hours, and to secure the greatest economy the work goes on uninterruptedly. The cells consist of a sloping furnace, with hearth and fire-grate covered by a reverberatory arch of firebrick, with one opening for the admission of refuse, another for the escape of gases, and a furnace door for the removal of clinkers.

The refuse is emptied on the platform, and shoveled into the cell, falling first on the incline, thence reaching the sloping hearth, whence, when sufficiently dry, it is pushed on to the fire, where, owing to the radiant heat of the firebrick arch, it burns fiercely, the products of combustion being gases, a fine ash, and clinkers. Every other cell is provided with an opening large enough to take in infected bedding, mattresses, etc., as well as diseased meat. The gaseous products of combustion pass through a flue to a boiler, which supplies steam to a horizontal engine driving two mortar mills. In these mills the clinkers are mixed with lime, and ground into an excellent mortar, which sells readily at 5*s.* a load; while the tin cans and iron are sold for old metal. No fuel of any kind is required, the cinders and other combustibles found in the refuse supplying all that is needed.

During the year 1879 the following is an account of the work performed by the Burmantofts destructor: 14,000 tons of rubbish, 190 beds and mattresses, 264 carcasses of pigs attacked by some fever, 1 cow, 10 sheep and lambs, 28 quarters and 13 cwt. of bad meat. The staff required for each "shift" comprises a foreman, who acts as engine driver, four furnacemen, and one laborer.

Besides the destructor there is also a carbonizer, which is necessarily built in a different manner, as it is used to convert street refuse and vegetable matter into a charcoal, which sells at the rate of 30*s.* a ton. The carbonizer consists of a group of brick cells, each having a separate furnace. It is 26 feet long, 12 feet wide, and 15 feet 6 inches high. The "shoot" is fitted with sloping plates, which project from its sides and form a kind of spiral eave or ledge, which, near the bottom of the cell, takes the form of a fire-block, resting on a wall which divides the contents of the cell from the gases of the fire. The vegetable and other refuse to be converted into charcoal is filled into this shoot or well in a solid mass, the eaves or ledges forming on their underside a flue, so that the matter is gradually heated as it slips down the well, until at the bottom it is surrounded by nearly red-hot firebrick. The charcoal is withdrawn at the bottom, and is placed in a cooler worked by the steam engine, and each cell is capable of treating 2½ tons of vegetable and street refuse in twenty-four hours. The cost of a complete establishment, with a six-celled destructor, an eight-celled carbonizer, boiler, engine, mortar mills, buildings, etc., is £4,500. No nuisance of any kind is experienced in the vicinity of the depots, and the refuse which might, under other circumstances, be deposited in places where it would become the hotbed of disease, is effectually destroyed or utilized.—*Building News.*

Potassic Hydric Saccharate.

Pure cane sugar is dissolved in boiling water in a wide deep test tube until a boiling saturated solution results. To this liquid an equal bulk of strong nitric acid is added, and the mixture warmed until the reaction commences. This is very violent, and results in the disengagement of voluminous brown fumes. After the evolution of gas has ceased, the liquid is boiled. It is then, while hot, divided into equal parts, and one-half neutralized with a strong solution of caustic potash. To this the other half is added, when after a short time an abundant precipitate of acid saccharate is obtained. The salt, if slightly colored, is easily purified by passing the hot solution over animal charcoal, evaporating to a small bulb and recrystallizing.—*Thomas Bayley, in Chemical News.*

BLACKFORD'S TROUT SHOW.

The annual exhibition of trout in Fulton Market, which signalizes the opening of the season for that game fish, began on Friday, the 1st inst., and lasted two days. That popular interest in the propagation and cultivation of fish for food is wonderfully on the increase was evidenced by the throngs which attended the show even during the most inclement weather. Not only was the mercantile community represented, but among the visitors were noticed many well known lights of the literary, social, scientific, and artistic world.

Beside the display of fish, there were other attractions. There was a plaster cast from the Smithsonian Institution of a brook trout (*Salvelinus fontinalis*), weighing 11 pounds, caught in Rangely Lake in October, 1880. A collection showing the different stages of the manufacture of shell fish hooks, from San Nicholas Island, California, and shell fish hooks made by the Indians of the Pacific Coast islands; a prehistoric bone harpoon from the Dordogne Cave, France; flint tools used in the fabrication of shell fish hooks; the Feuardent collection of fish hooks; prehistoric bronze fish hooks from the Lake dwellings of Switzerland; Franklin bronze fish hooks from Normandy; Commander H. H. Gorringe sent a bronze of an Egyptian sacred fish and a Græco-Roman bronze box designed after a sea crab.

But the trout stand was the magnet, for here were specimens of the speckled beauties from Canada, Maine, Connecticut, Vermont, New Jersey, Pennsylvania, the Empire State, England, and remote California; indeed to the California exhibit must be awarded the palm. There were trout in tanks and trout in banks; live trout and dead trout; big trout and little trout; trout reclining on beds of moss, and trout suspended in bowers of roses. The two principal exhibitors of California trout were B. B. Redding, Fish Commissioner, and M. T. Brewer, of San Francisco, the following specimens being specially worthy of notice: Fish Commissioner Redding sent an exhibit of Truckee River trout, a large black spotted fish which grows from six to ten pounds weight.

Lake Tahoe trout, also a black spotted fish, but much larger than the Truckee River trout. It averages about twelve pounds in weight, although they have been caught weighing as high as seventeen pounds.

The Dolly Varden trout, so called because covered with variegated blotches. It is a small but gaudy fish, and weighs from three to four pounds.

Rainbow trout, from the McCloud River. It has a brilliant stripe from head to tail, and was quite a feature in the exhibition.

Mr. M. T. Brewer's exhibit, which did not arrive until late on Saturday, was comprised of nine distinct varieties, as follows:

Truckee River land-locked salmon trout.
Lake Tahoe salmon trout.
Independence Lake trout.
Donner Lake speckled trout.
Humboldt salmon trout.
Silver Mountain salmon trout.
Pyramid Lake speckled trout.
Truckee River red trout.
Sacramento River salmon.

Among the most interesting exhibits were the following: White Brook trout, from White Brook, Richmond, Rhode Island. "Speckled trout," light color, spots very small, W. H. Robinson, Patchogue, L. I. Wild trout, color very dark, by Mr. Hogan, Quebec, Canada. South Side Club, Long Island, heavy display of cultivated trout. Fry of English trout, W. L. Gilbert, Plymouth, Mass. Clark's trout, L. A. Beardsly, Sitka.

South Side Club, L. I., dead brought one dollar per pound, alive out of tanks, one dollar and fifty cents per pound, fresh caught salmon one dollar and seventy-five cents per pound, while wild trout bring only thirty cents per pound retail.

In fish novelties were viviparous perch from California, which unlike other fish do not spawn, but bear perfect young.

Lamprey eels were exhibited, and attracted no little attention, as very few people seemed to know what they were.

An immense live specimen of marine lobster weighing 22 pounds was exhibited. It was covered with an ancient growth of barnacles and seaweeds, caught off the Massachusetts coast.

"Lump fish," "Jelly fish," "Indigo bag," so called by fishermen from the fact of its being a deep transparent blue, and in shape like the old-fashioned indigo bag used by laundresses. There was an exhibition of fresh water insects, that prey on young trout, and living natural food of trout.

TO DYE STRAW HATS BLACK.—In order to obtain a level color a solution of gluten is added to a lye of soda, which is allowed to stand for twenty-four hours and filtered. The hats are then steeped for twelve hours in the clear liquid. The straw is thus freed from grease, and the mordants of nitrate, sulphate or acetate of iron, as well as the decoction of logwood mixed with sumac or galls, is very evenly taken up by the fiber. A slight addition of bichromate of potash improves the tone of the dye, and the goods are finished with gum or gelatine.—*Baden Gewerbezeitung.*

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) G. C. asks how to restore to its original brilliancy glass or crystal ware that has been stained by sea water. A. There are two ways to accomplish this: one is to slowly heat the glassware to low redness in a muffle or seggar furnace, and then let it cool down very slowly. It requires nice manipulation, and is expensive. The other is to polish the surface of the glass all over with a piece of chamois leather loaded with finest putty powder or rouge (free from grit) moistened with water. As the discoloration is merely superficial it usually yields readily to this treatment.

(2) S. Bros. ask: 1. What quantity of lime is taken to proportion of stearine (ordinary article) to produce stearate of lime? What quantity or proportion of sulphuric acid to stearate of lime to produce stearic acid (the good quality of stearine harder than the ordinary and more gloss to it)? A. About 11 per cent pure caustic lime (equal 16 per cent hydrate) and about 2 parts acid to one of lime (theory requires 1·75). 2. What acid is most suitable to combine beef fat oil with caseine in the manufacture of cheese? A. No acid is necessary. (See page 175, current volume.) 3. What machinery is used in the refining of cotton seed oil? What is the best method to make this oil perfectly tasteless. A. A deep narrow wooden tub, provided with a stirring apparatus and pipe for injecting steam, and a wooden cylinder filled with coarsely granular animal charcoal for filtering. Heat the oil to about 120° Fah., by steam injection, and add for every 100 lb ¼ lb. bichromate of potassium dissolved in hot water; agitate violently, and add, first, 1 lb. strong hydrochloric acid, then gradually, ¼ lb. sulphuric acid. Continue the agitation for half an hour, then add a volume of water about equal to that of the oil; agitate for a few minutes, and let rest to separate. Draw off the water, blow steam through the oil for about 15 minutes, then pass through the bone black filter slowly.

(3) J. H. asks: 1. What will keep glue in a liquid state continually without injuring its adhesiveness? A. Heat the pure glue solution for about 12 hours in a Papin's digester at 300° Fah. The glue will remain liquid on cooling. 2. What number SCIENTIFIC AMERICAN SUPPLEMENT has recipe for liquid glue for wood? A. See SUPPLEMENT, No. 158.

(4) E. E. P. asks: How do you cut, or how do you prepare isinglass to be used as a varnish? A. Isinglass—fish glue—dissolves in hot water or in hot dilute wine spirit. Mica—sometimes improperly called isinglass—cannot be dissolved so as to be used as a varnish.

(5) S. P. Co. write: We are desirous of obtaining the recipe for japanning castings and goods of our manufacture. We have used coal tar and also asphaltum, but it does not leave the gloss and finish which we notice on Eastern castings and malleables which come to this coast. We judge there is a preparation for japanning in which they dip the castings. A. The following is a common method. The work is simply coated with good drying linseed oil and heated in an oven, at first just hot enough to turn the oil black. The heat is then gradually raised (as high as may be without burning it), and kept up for an hour, or until the coating, when cold, is hard enough for service.

(6) F. A. R. writes: 1. In SCIENTIFIC AMERICAN SUPPLEMENT, No. 143, page 2276, an article written by Thomas Bolas, Esq., F.C.S., upon "Printing Surfaces and Pictures by Photography," in the last line of second column he says: "Next I put some thick gum water on the stone," etc. Please inform me regarding the gum water he meant. All the other directions are explicit, but I have failed to find any gum to which printer's ink will not adhere. A. Use gum arabic dissolved in warm water. 2. I desire to make two gas bags to hold H and O of about 45 gallons capacity each. I wish to know if I can successfully make them out of heavy cotton cloth? A. See answer to F. M. W. (21), page 186, current volume.

(7) P. N. asks: 1. How are rubber stamps or type made? A. See "How to Make Rubber Stamps," SCIENTIFIC AMERICAN SUPPLEMENT, No. 83. 2. Why is it that melted lead will not take the form of letters taken in plaster of Paris? The lead does not seem to reach the bottom of the cast. Why is it? A. The metal chills too quickly. It is necessary to heat the mould. Try type metal instead of lead.

(8) A. H. M. asks: Is there a substitute for alcohol to be mixed with whiting to keep it from freezing instead of using clean water—something that will do to clean windows and glassware with? Alcohol is too costly and evaporates too quickly. A. The addition of a small quantity of glycerine to the water with which the whiting is mixed will keep it from freezing and will not interfere.

(9) W. G. asks for the process of removing the gloss from diagonal cloth, caused by wear. A. Brushing over with the following preparation will in some cases revive the appearance: Extract of logwood, 1 oz.; sulphate of iron, ¾ oz.; hot water, 1 pint. Where the nap is worn off there is no permanent remedy.

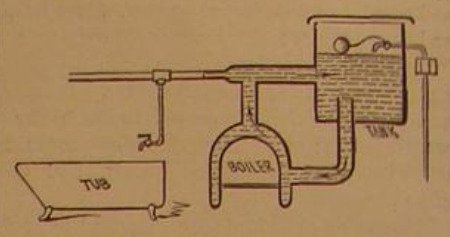
(10) J. J. H. asks: What kind of flexible paint is used in making table oilcloths? A. Size with hot soap and alum solutions, used alternately, dry and enamel with colors ground fine in oil with plenty of driers and a little turpentine. Finish with a thin copal varnish if high gloss is desired. Harden by drying at about 200° Fah.

(11) F. J. W. writes: If you can give me any information concerning what follows you will much oblige me. I presume it is settled that the freezing point of water (or melting point of ice) is 32° under ordinary conditions. Since ice, however, after being formed may suffer a further loss of heat, like any other solid, it follows that ice is often cut and stored when at a much lower temperature than 32°, say, for instance, at 12°. Now, without having made any experiment, I should suppose (as ice is a good conductor of heat) that if it had been stored for any length of time or exposed for even a short time to a temperature of 32° or above, it would abstract sufficient heat from its surroundings to raise its own temperature to about 32°. I have been told, however, that if ice is cut and stored when at a temperature of 12° that months afterward, although transported in hot weather, it would still have its original temperature of 12° instead of having risen to 32°. I do not know whether the parties themselves had made the experiment, but they claim that if a hole is bored to the center of a block it will show the original temperature of 12° no matter how hot the weather may be. As I have generally lived much further south, I have had no opportunity of experimenting, and thinking you might know something of the matter, I have ventured to apply to you. A. Ice is a poor conductor, and where the temperature prevailing at the time it was found was much below 32° Fah., the center of a large block frequently has a temperature below the freezing point even when the surface is melting. If kept at a little below 32° for some time the whole block will eventually have about the same temperature.

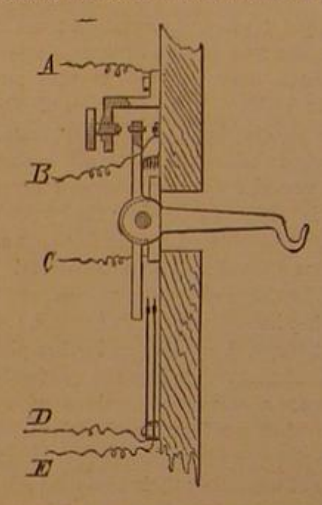
(12) E. N. T. asks: 1. How many cubic feet per minute of steam at 61 lb. pressure will flow from a nozzle, ¼ inch bore and ⅛ inch long, to where it widens out to ⅛ inch diameter? A. 18·2 cubic feet per minute, at 60 lb. pressure above atmosphere. 2. How many pounds of coal per hour will be required to generate the steam used? A. Twenty-six to twenty-eight pounds.

(13) C. A. P. writes: I have some graduated paper circles cemented to iron disks. With what shall I varnish them that they may stand the weather, without making them transparent or difficult to read? A. Dissolve 1 oz. best isinglass in about a pint of water by simmering it over the fire and strain through muslin. Try the size moderately warm on a piece of paper; if it glistens it is too thick, add more water; if it soaks into the paper it is too thin, add isinglass; when of proper consistence it should merely dull the surface. Give the paper two or three coats, letting each dry, with care (particularly in the first coat), to bear very lightly on the brush, which should be a flat camel's hair from which the size should flow freely. When all is dry give three coats of thin dammar varnish.

(14) W. H. M. asks how to supply hot water to a bath house. A. Probably the cheapest and best way to furnish hot water for a bath house, cost of plant and maintenance considered, is to set up a small cast iron boiler (saddle or any other good hot water apparatus boiler) and connect the same with an open tank, the latter to be at least large enough to contain four times the water that can be used at one time in all the tubs. The tank should be furnished with a water connection and ball cock to keep the same level of water always. The height and diameter of the tank should be about the same; wood will do, iron is better. The following diagram shows the connections and their positions. A boiler connected this way will not fill with lime or magnesia soon; it will be found in the bottom of the tank.



(15) J. H. S. writes: The sketch shows a commutator which can be applied to such a telephone as was recently described in the SCIENTIFIC AMERICAN.



A, to line through secondary and receiver. B, to line through bell magnet and signal key. C, to ground. D, to battery. E, to battery through primary of induction coil and transmitter.

I have used it more than a year in my house and it works very satisfactorily. It will be noticed that it is automatic to open as well as to close the telephone and bell circuits, and also operates the local battery circuit. The weight of the receiving telephone when suspended from the hook makes contact with the anvil and closes circuit from line through bell to ground, and the instrument is in a position to receive a call. In this circuit and outside of the bell is placed an ordinary spring key having top and bottom contact, by depressing which the current of the call battery is sent into line and operates the bell at other station where a similar instrument is placed. When the receiver is taken from its hook the small coiled spring causes the instrument to release the anvil contact, thus cutting out the bell, and through the top contact puts into line the receiver and secondary. The lower arm of the lever presses the two light springs together and closes circuit of local battery through transmitter (microphone) and primary. These springs should be very thin, so as to give less resistance to the movement of the hook than the coiled spring, otherwise they might prevent a proper contact of the upper arm of the lever.

(16) O. L. C. asks: 1. Would two Daniell's batteries be sufficient to ring a bell on a circuit of 250 yards, the bell being that distance from the batteries? A. Yes. 2. If by using the city water pipes as another return wire, would the bell ring equally as well so as to enable me to ring from either end, and leave the batteries at one end of the line? A. Yes. 3. In making a telephone does it make any difference which pole of the bar magnet the spool is on, or what direction it is wound on the spool? A. No.

(17) W. P. M. asks: Can you tell me how to prepare a cheap colorless varnish for iron pans, such as bread pans? A. Wine spirit, 1 qt.; pale shellac, 2½ oz.; digest and agitate until dissolved and strain through a fine cloth. Warm the clean article and apply quickly and evenly with a soft brush. Varnish of any kind should not be used on the inside of culinary vessels. A trace of oil will usually keep the metal clean under ordinary circumstances.

(18) P. J. writes: I wish to establish telegraphic communication between two points separated by a body of water of 200 feet in width. Only signals, produced on electric bells at each end of the line are to be used. What I wish to know is this: 1. Will the wire used to connect stations have to be insulated? A. Yes, they will be submerged. 2. If insulation is necessary, what is the best wire to use? Would like it as small in diameter as possible. A. Kerite or gutta percha insulated. No. 18 copper wire will answer. 3. Will there have to be two lines of wire, or is one sufficient? A. With a good ground one wire is sufficient. 4. Will there have to be a battery at each end of the line? A. For open circuit, yes. For a closed circuit you may use a battery at one end of the line. 5. Is there any form of small and compact electric generator of any kind which could be used at one of the stations instead of a battery? A. There are magneto-electric calls in market which take the place of batteries.

(19) J. A. W. writes: 1. I wish to construct a small sectional boiler for an engine 3x6; please inform me whether common gas pipe is suitable for the

purpose. A. Common gas pipe not suitable; you should use sap-welded tubes. 2. At what speed of said engine can I attain the greatest power? A. With the same pressure, the higher the speed the greater the power.

(20) W. S. K. asks: With a given cylinder, say 12 inches diameter, why will one engine cut off at ¼ stroke and another at ⅛ or ¾ stroke; that is, what different conditions must exist? Will not the one which cuts off at ¼ stroke use less steam and thus result in a saving of fuel? Understand that both engines are same horse power. A. The one with the short cut off will be most economical, but will not give out so much power as the other with a given pressure of steam.

(21) J. H. C. W. writes: About two months since I moved into a new house, and although, of course, we are constantly using hot water, the water is sometimes very thick and muddy with iron rust, always darkly tinted; it is worse when the range fire has been fiercer than usual, ironing days, etc. Can you tell me any way of stopping the trouble? A. We know of no better method than heating up the water in the tank and then running it off as rapidly as possible, repeating the operation till the pipes and water back are cleaned out.

(22) C. L. J. asks for a receipt for coloring white soap a light yellow. I am making an excellent soap, but find it difficult to sell it because it is not yellow. I have added rosin, but that makes it too dark. A. Color with solutions of annatto and turmeric.

(23) P. J. B. asks how to tin light wire work, and wants a metal that will run freely and smoothly and not leave any drops, as there is no opportunity to brush or rub off any superfluous metal. I have used all ordinary alloys used in tinning, to wit: pure tin, tin and lead; tin, lead and bismuth; tin, lead, antimony, and bismuth; and have cleaned my work (before dipping) in dilute sulphuric acid, then thoroughly rinsed in pure cold water, then dipped in muriate of zinc, then into my bath of metal, which is covered with tallow to the depth of one-eighth of an inch. I have frequently found wires with a scale that I cannot remove with the sulphuric acid. In dipping a piece of straight work, the wires being about ten inches long, if I draw it out lengthwise of the wire the metal will remain on too thickly, and if I attempt to shake it, it will cool and set in ridges. Do you know of any method for doing away with these difficulties? A. Pure tin, or tin with a little bismuth, will answer about as well as anything. Try dipping the tinned article in very hot grease until the coating is equalized. In such work the wire is usually tinned in the coil and finished in the grease pot or by passing through a loose draw-plate on cooling. If the wire is much oxidized use a stronger pickle, or give a longer exposure in a dilute hot pickle. If oily, dip in hot potash solution and rinse in plenty of water first.

(24) J. T. W. writes: 1. I propose laying a two inch wrought iron pipe, 5,000 feet in bed of a stream which falls in that distance 20 feet. How much water would said pipe deliver by natural flow? A. 16 cubic feet per minute. 2. How high would it rise vertically from lower end? A. As a jet, not over about 12 feet, but in a steady pipe the height of the head. 3. With a stream pump attached how much could be drawn through it? A. 2·66 cubic feet per minute.

(25) A. W. D. writes: We have a backlash in the bevel gearing on crank shaft and upright shaft in a flouring mill. Some say that it is caused by the governors on engine, and some say it is caused by mill machinery; and to test the governors I weighted down the stem so as to use boiler pressure, and regulated speed by the throttle valve, and it backlashed just the same as it did when running with the governors. Increase of speed increases the trouble alike in both cases. Was that a sufficient test for governors? We have an irregular feed on one of the burrs. Do you think that would cause a backlash? A. Your fly wheel is too small. Increase its diameter at least two feet.

(26) A. S. F. asks: 1. Can you tell me how many pounds (troy) of metallic sodium and water are required to produce ten cubic feet of hydrogen gas (at 60° Fah.)? A. 1 lb. 6 oz. sodium and 1 lb. 2 oz. water. 2. What are the relative weights of ten cubic feet of hydrogen and a like volume of atmospheric air (at 60° Fah.). A. Ten cubic feet of hydrogen weigh about 0·77 oz.; the same volume of air under like conditions about 11·16 oz. 3. What measure and weight of oxygen gas will this quantity of hydrogen requfre to form water? A. 5 cubic feet, equivalent to about 6·16 oz. 4 How much oxygen does atmospheric air contain on an average? A. About 20 per cent. 5. How much oxygen can be obtained from chlorate of potash A. 16 oz. will yield about 5 cubic feet of the gas.

NEW BOOKS AND PUBLICATIONS.

ILLUSTRATED CATALOGUE OF THE PLUMBING AND SANITARY DEPARTMENT OF THE J. L. MOTT IRON WORKS. 1881.

Contains upwards of six hundred engraved illustrations of as many styles of plumbing and sanitary appliances, lamp pillars, and stable fixtures. The high character of the products of this establishment, both with regard to artistic design and the quality of the iron and enamel, is known everywhere. The scientific construction of the various sanitary devices here illustrated will commend them to prudent house owners and architects. The stable fittings in cast and wrought iron show some remarkably artistic designs.

BRIGHT FEATHERS. By Frank R. Rathbun. Auburn, N. Y.: the Author. Part I. Quarto, paper, pp. 24. $1.

Mr. Rathbun has chosen the purple finch for the initial number of this series of ten or more illustrations of the most attractive of the birds of our northeastern States. Each number will carry a plate figuring the male and female of the species described. The figures are carefully drawn from nature and colored by hand.

MODERN ARCHITECTURAL DESIGNS AND DETAILS. New York: Bicknell & Comstock. Parts IV. and VI. $1.

Part IV. comprises plates 25 to 32; store fronts and details; plans and elevations of a country house by Cabot & Chandler, Boston, with many details of porches, windows, gables, etc.; cornices and belt courses. Part VI., plates 45 to 48, contains perspective views, plans, and elevations of two country houses, with many exterior and interior details. Part V. was noticed some weeks since.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 22, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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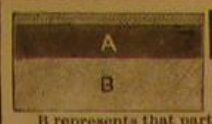

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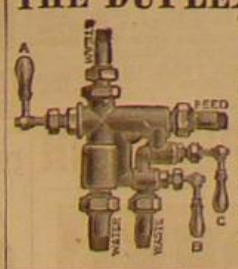

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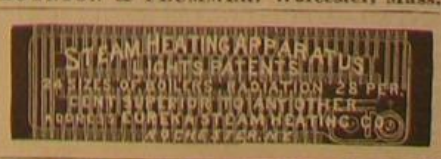

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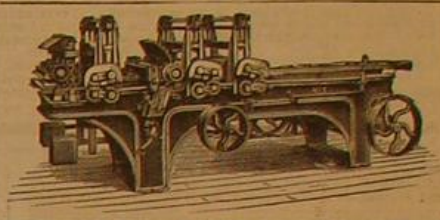

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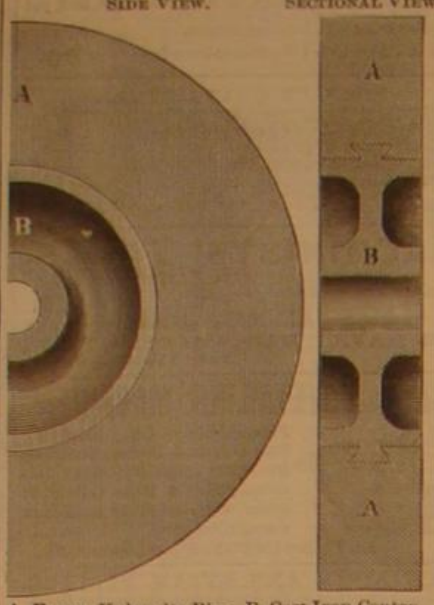

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THE MANUFACTURE OF WRITING PAPERS.—OWEN PAPER COMPANY HOUSATONIC MASS.—[See page 275.]

Scientific American.

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NEW YORK, SATURDAY, APRIL 30, 1881.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 278,

For the Week ending April 30, 1881.

Price 10 cents. For sale by all newsdealers.

THE DIVISION OF LABOR.

Since Professor Babbage wrote for the "Encyclopædia Metropolitana," a generation ago, his celebrated chapter on the economic advantages of the division of labor, the principles he laid down and illustrated have been discussed with endless iteration in every sort of industrial publication, and demonstrated over and over in every department of the mechanic arts.

They are fundamental truths, which each generation of artisans and manufacturers must learn, and learn to apply to the ever-changing needs of new trades, new processes, and new social and industrial conditions.

But when we have proved that division of labor is an essential condition of successful and economical production on a large scale, we have not by any means exhausted the subject. The workman is worthy of consideration as well as the beauty and cheapness of the article he helps to manufacture. Hence the subject of the division of labor may be approached from two opposite and to some extent irreconcilable positions; and since the exigencies of social and industrial life require a perpetual adjustment of and compromise between the more or less conflicting lines of policy dictated by the two divergent interests, it is to be expected that the problems involved in the division of labor will never be shelved as thoroughly settled and done with.

If regard is had only for rapid, perfect, and economical production, the utmost specialization of labor is to be desired, if need be with the extremest limitation of the operative scope of the workman. If the well-being of the artisan, and through him that of the society he helps to form, are the main consideration, a very different aspect of the case appears.

It is for the interest of society that every man shall be of the manliest sort; to this end there is no theoretical limit to the knowledge and skill desirable in the artisan, who would be at his best only when he knew everything worth knowing, and was able to do everything worth doing, or that society might need to have done. The natural limitations of human capacity and the brevity of the time at command for acquiring knowledge and skill compel a material scaling down of the theoretical standard. Except under the lowest and simplest conditions of living no man, however well endowed by nature, can make himself an epitome of his tribe. The savage, the requirements of whose life are few but imperative, must know everything and be able to do everything that his fellows know and do. To a less degree the same is true of the member of any primitive community. In such a social state no man varies far from the "average man," and each must be able to fill any place or perform any duty that may arise. There are but few things to be done; the scope of the life is narrow, and every man's knowledge and skill must be substantially coextensive with that of the community as a whole.

A corresponding capability on the part of any member of our more complex social and industrial communities would make him a prodigy of learning and trained ability as admirable to think of as impossible to realize. Division of industrial function, with a corresponding limitation of individual skill, must of necessity go hand in hand with progress toward civilization, and still more markedly through all the rising grades of civilization. So infinite in scope and variety have modern arts become that the division of duty and the narrowing of individual function are something marvelous. In many instances the skilled workman seems now to be but little more than a living link in some great chain of industrial processes, a little piece of some huge organization of men and machines. In this capacity the ideal workman is not the man who knows most and can do the greatest variety of work, but he who can perform his own allotted task quicker, surer, and altogether better than any one else. And to do the required duty with the speed and skill demanded may be possible only by such close and protracted application of the man to that one monotonous operation as to measurably spoil him for any other industrial duty.

Here the tendency of the division of labor would be fatal to humanity within the range of its influence were it not constantly being restrained and corrected by inventions which substitute machines of wood and metal for human machines.

In the classic illustration of Professor Babbage—the manufacture of pins—the division of labor had become so minute that each pin required the work of four men, four women, one boy, and one girl, or ten different operatives, each performing some one specific and sharply limited task. At this stage the American pin-making machine came in to do the work of all except the wire-drawers, setting the rest free for more comprehensive and, it is to be hoped, less monotonous labor. The same process of increasing specialization of labor, ultimately mitigated by inventions which take the place of special skill and make the specialist a machine tender instead of part of a machine, is going on in every branch of the industrial arts. The invention of automatic machines thus becomes the salvation of the laborer, relieving him of the narrower and more brutalizing forms of toil, and at the same time, by cheapening products, putting within the workman's reach and enjoyment such food and clothing, conveniences and luxuries as would otherwise be beyond the reach of the richest.

The division of labor is thus a necessary evil and the means of much good; and it rests largely with the artisan himself to determine whether the minute specializing of labor, which the perfection and highest economy of manufacturing necessitate in so many departments, shall dwarf him or help him to higher manliness. If the daily pressure which the factory brings to bear upon the workman, tending to reduce him to the industrial condition of a cog in a great wheel or a wheel in a great machine, is not resolutely offset by an effort on his part to broaden his mental life and increase his knowledge and skill in other divisions of industry than the one he is specially engaged in, the chances are that his manhood is doomed. If his ambition is satisfied by the ability to perform one operation, or one limited round of operations fairly well, and he is willing to spend his life in that way, he must not expect to enjoy much of the life of a free man.

One of the great industrial problems to be solved by the American people is how to adjust the relations of machinery and minutely divided labor, so as to secure on the one hand the best and cheapest productions, and on the other hand to counteract the tendency of specialization to narrow the scope and value of the workman's life. Our operatives are also citizens and sovereigns; and society cannot afford to spoil the citizen to save a fraction of a cent on a yard of cotton or a few dollars on the price of a ship or an engine.

THE STUDY OF ANIMAL MOTIONS.

The instantaneous photographic views of horses and other animals in motion taken for ex-Governor Stanford of California, by Mr. Muybridge, of San Francisco, have been illustrated and repeatedly referred to in this paper. Mention has also been made of the zoogyroscope, devised for studying the pictures taken. Improvements in this instrument have brought out several curious features in the phenomena produced. For instance, a larger number of slits in the zinc disk than there are figures on the glass one will increase the rapidity of the motion of the figures. Owing to this peculiarity, two figures may be placed on the same glass disk and will appear to be traveling at different rates of speed.

It is announced that the photographs taken at Palo Alta are being prepared for publication in a large and costly volume, which cannot fail to be an extremely valuable contribution to the science of animal motion.

Facsimiles of the photographs are also being prepared for use in the zoogyroscope, for presentation before the scientific bodies of this country and Europe.

These investigations have a practical as well as scientific value. The revelations which they have made in relation to the position of the feet of a horse while running, the San Francisco *Bulletin* says, have persuaded some California trainers and horse breeders to make important changes in their methods, from which they expect to get much faster time. They represent that the results thus far have been very satisfactory. By the construction of a track around a large tent, and the arrangement of cameras so as to take an impression of the animal moving over the track from various points at the same moment, some valuable pictures for the guidance of artists have been obtained. All degrees of fore-shortening of the same animal are represented in these pictures. A perfect skeleton of a horse was also imported from the East, which was taken apart and supplied with artificial ligaments to its joints. This skeleton was then made to assume the position of the living horse, as shown in the various photographs of the latter taken, and it was then exposed to the camera. Through the aid of the zoogyroscope, this skeleton is made to go through all the movements of the living animal in his various gaits of cantering, pacing, running, trotting, and walking, presenting a peculiar but intensely interesting picture, especially to the veterinary surgeon, who is thus afforded a practical opportunity of determining the effect of motion on the various joints.

THE ELECTRIC LIGHT IN AKRON, OHIO.

A novel, and thus far successful, experiment in electric lighting, was inaugurated in Akron, Ohio, April 9.

The town is lighted by two groups of lamps, one supported by an iron tower rising 208 feet above the street, the other by a wooden mast on the observatory of Buchtel College, about 40 feet higher than the tower lamps. Each group consists of four lamps of 4,000 candle power each, or an aggregate light of 32,000 candle power.

The chief novelty of the system is the tall tower, made of boiler plate in 55 sections, each 50 inches in length. At the bottom the diameter of the tower is 3 feet; at the top, 8 inches. The tower is steadied by six wrought iron guys reaching to the top. Over the lamps is a five-foot copper reflector, which serves also as a hood. Thirty feet from the street is a wrought iron balcony, to which the lamps are lowered for trimming.

The entire electric circuit is 9,110 feet, the conducting wire being of copper. The total cost of setting up the system, including boilers, engines, etc., was $11,317, and the cost of running the lights a year is estimated at $1,580. The cost of the iron tower was $1,609.

The light promised from these two centers is to be equivalent to bright moonlight, over a circuit of half a mile radius from each group of lights, or two circular areas each one mile in diameter. It is thought that four more centers of illumination would supply the entire city. From 300 to 400 or more street gas lamps will be displaced by the electric lamps now in operation.

THE *American Architect* refers to a surveyor's blunder, by which a substantial brick hotel has been built in the suburbs of Philadelphia on a lot distant forty feet from the one bought for the purpose.

MORE ABOUT PICKETT'S CAVE.

BY H. C. HOVEY.

In reply to inquiries concerning the new cave found in Williams' Cañon, Colorado, the following particulars are given:

"The Boys' Exploring Association," to whose diligence this discovery is due, is an organization of young mountaineers living in the vicinity of Pike's Peak, whose laudable purpose it is to combine the enjoyment of camping out with the study of botany, geology, and mineralogy, amid the hills and valleys of that remarkable region. In this they have been encouraged by Rev. R. T. Cross and President Tenney, of Colorado College, who have accompanied them on some of their excursions.

One of their earliest fields of exploration was Williams' Cañon, into whose crannies and crevices the boys penetrated under the direction of their leader; and two brothers, John and George Pickett, climbing up a path no one had ever tried before, crept into an opening only four feet high and ten feet long, which proved to be the antechamber of a cavern of huge dimensions.

Fortunately the boys had candles and matches along, and proceeded at once to explore room after room, each decorated by beautiful stalactitic folds and pendants. The largest then entered was about 60 feet high, irregular in shape, and described as resembling the bed of some river that had suddenly frozen while leaping down successive cascades. In a room to the right of this the boys were dismayed to find themselves on the brink of a pit, 50 feet deep, into which they were not prepared to descend.

Retracing their steps, they found a narrow passage leading up to the chimney-like opening described in my last; and here ended their first underground tour, whence, with great difficulty, they made their way back to the bottom of the cañon.

The report they gave of course stimulated further exploration, with results already described, most of which are similar to those with which visitors to other caverns are familiar.

The presence of extensive beds of ocher indicates that the subterranean stream flowed from the granite mountains above, bringing the decomposed materials of the feldspathic rocks in the form of these ferruginous clays, which are so hard and compact as to take a fine polish.

Other evidences of former streams are furnished in the beds of rounded pebbles, often coated by stalagmitic deposits. It is an interesting fact that similar smooth pebbles are found in the *open* gorges or "caves," as they are incorrectly called, cutting through the walls at a height sometimes of 200 feet from the bottom.

The opinion is advanced that these caves and cañons were made when the ocean washed the foot of Pike's Peak; but that is hardly probable, in view of the fact that the geological formation is Silurian limestone, through which, as in the case of Mammoth and other caverns, the acidulated rain water could have eaten its way *since* the elevation of the region above the sea level. The swirling of a subterranean stream could round the fragments of granite into pebbles as readily as the wash of the waves.

In some instances we know that what now are open cañons were once caves; a striking example of which is furnished by the famous natural bridge of Virginia, the arch being merely the remnant of an ancient cave roof; and the combination of a cave, chasm, and natural bridge, on Hudson's Brook, Mass., as pictured in "Hitchcock's Report," vol. i., page 288, is even a better example of the same thing.

We cannot draw the conclusion that *all* cañons were once caves; but the subject is worthy of more careful investigation, and we commend the problem to the consideration of the "Boys' Exploring Association."

Among mineralogical peculiarities noted in Pickett's cave is the occurrence of oulopholites, or curled crystals of gypsum, often mimicking floral forms: likewise acicular crystals, probably of Epsom salts; both of which abound in Wyandot and Mammoth caves.

No inhabitants have yet been observed except bats and rats. And it is the opinion of the discoverers that no human beings ever penetrated to these subterranean rooms before. But it is so uniformly true, in respect to other caves, that careful examination has brought to light vestiges of aboriginal occupancy, that I am inclined to think it may prove so here.

Experiments should also be instituted forthwith to determine the rate of stalactitic growth, which is apparently very rapid in Pickett's cave. And the subject of stalactitic distortion by currents of air, fungoidal growths, and other causes, demands some attention for the sake of comparison with similar inquiries made in other localities.

Rock-boring Ephemera.

At the meeting of the New York Academy of Sciences, April 11, Dr. Trimble, of New Jersey, exhibited specimens of marine shells and marble which were deeply perforated by larva of certain ephemera. The marble had been bored in every direction to the depth of from two to three inches, and thus honey-combed with slender passages plugged at the entrance with a closely cemented deposit. In their flying state the ephemera (commonly called May flies or day flies) live but a few hours. The larvæ live in water for a year or more, and, according to Dr. Trimble, secrete an acid which enables them to bore into limstone, passing through their first transformation in the closed burrows.

STANDARD TIME IN THE UNITED STATES.

The American Metrological Society have issued a circular in relation to the introduction of uniform standard time into daily use for both popular and scientific matters; a question which, through the extension of rapid electric and railway communication, has become of considerable practical importance.

The society find at least a hundred local times or meridians in ordinary use, many of them differing but a few minutes from each other. More than seventy such standards are used by railway and other companies in the United States and Canada, making no little unnecessary confusion and complexity in their time tables. It is, accordingly, proposed that the community unite upon a division of the continent into a few (time) sections, throughout each of which the time by the clock shall be kept in agreement with the standard meridian.

In anticipation of the ultimate adoption of a system of standard times throughout the world, the society recommends for the United States the adoption of a central meridian in the Mississippi valley exactly 90° or six hours west of Greenwich, and proceed to east and west by steps of exactly one hour each. On this plan the sectional times would be about as in the following:

PROPOSED SCHEDULE OF STANDARD TIMES.

Geographical Section.	Standard Meridian west of Greenwich	Standard Times slower than Greenwich.	Standard time slower or faster than true "local times."	Designation of proposed Standard Time.
		H. M. S.	Min.	
Newfoundland	60°	4 0 0	29 slower than St. John's, N. F.	Eastern Time.
New Brunswick			24 faster than St. John, N. B.	
Nova Scotia			14 faster than Halifax, N. S.	
Canada	75°	5 0 0	15 slower than Quebec	Atlantic Time.
			18 faster than Toronto	
			16 slower than Boston	
			3 slower than New York	
Maine to Florida, Ohio to Alabama, Lower Lakes			8 faster than Washington	
			19 faster than Charleston	
			45 faster than Montgomery	
			14 faster than Buffalo	
			30 faster than Detroit	
			38 faster than Cincinnati	
Mississippi Valley	90°	6 0 0	0 faster than New Orleans	Valley Time.
Missouri Valley			1 faster than St. Louis	
Upper Lakes			12 faster than St. Paul	
Texas			18 faster than Kansas City	
			19 faster than Galveston	
			10 slower than Chicago	
Rocky Mountain Region	105°	7 0 0	0 faster than Denver	Mountain Time.
			28 faster than Salt Lake City	
Pacific States	120°	8 0 0	12 slower than San Diego	Pacific Time.
British Columbia			10 faster than San Francisco	
			11 faster than Olympia	
			12 faster than Victoria	

What the Gulnare Expedition Failed to Do.

It will be remembered that the expedition in the Gulnare to plant the first Howgate Arctic colony came to naught through the unfitness of the vessel for any sort of sea-going service. The disappointed commander was naturally in no amiable frame of mind during his brief Arctic experience, and traces of his displeasure appear in the irony of his official report, a summary of which has got into unofficial print. Probably no one will enjoy his little scold any more than those explorers who did not fail so conspicuously.

"The cruise of the Gulnare," says Lieutenant Doane, "is the first acknowledged failure in Arctic annals. We did but little, but left a great many things undone requiring some moral courage to refrain from doing. We did not change the names of all the localities visited, as is customary, nor give them new latitudes, to the bewilderment of the general reader. We do not dispute any one's attained distance, nor declare it impossible that he should have been where he was. We did not hunt up nameless islands and promontories to tag them with the surnames of plethoric merchants and wildly enthusiastic females who had given us plug tobacco and button-hole bouquets. We did not even erect cenotaphs. A cenotaph is a monument erected to one who is buried elsewhere or not buried at all. The artistic style for such a structure is a pile of rocks, on the flattest of which is daubed in letters of tar the following stereotyped inscription: 'Sacred to the memory of the heroic ——.' Why a cenotaph should be erected where no one will see it, and what use there is in erecting one at all, are questions. We received no flags, converted no natives, killed no one. We discovered no new evidences regarding the Mosaic account of the Creation, nor the Deluge, nor the unity of races, nor the location of ancient Troy, nor the Garden of Eden. We found nothing in Greenland to put our naturalists to the blush by comparison, nothing superior to railroads and modern civilization. We did not see anything half so grand, half so sublime, nor half so beautiful there as can be seen in the Yellowstone National Park and a dozen other localities at home. We did not even see what others have seen in the same regions.

"The primary geographical iceberg, which in perspective towers above first-class ships in the foreground, and has a contemplative bear gazing seaward from the loftiest pinnacle, oblivious of the herd of fat seals on its beach, is not produced any more. Neither is the iceberg of shop windows. The present ones are not so high by several hundred feet, and instead of being in a freezing condition were rapidly thawing whenever afloat. Polar bears do not put their paws on men's shoulders and smilingly offer their stomachs to be ripped open in the Norwegian regions, as formerly. The rocks and bluffs of the Arctic are not at all clouded with water fowl, as pictured, nor is it dangerous to run a whaleboat lest it should ground on a sleeping whale, be pierced through by the horn of a narwahl, or captured by an angry herd of walrus. Arctic scenery is grand, but with little variety. The glacial phenomena alone in summer-time are magnificent; in winter the auroras are added. At the pole during the summer there is, of course, constant daylight, yet nobody seems to have thought it worth while to call attention to the fact that solar observations could be taken astronomically during that season. No one has proposed wintering at the pole. The proposition would probably not be carried into effect if outlined. The object of this report is to expose a few of the specious pleas, fallacious reasonings, and ill-grounded conjectures which are called scientific, and to place the subject of circumpolar exploration on a basis of facts and reasonable probabilities. One cannot explore the earth's surface from an observatory, nor by mathematics, nor by the power of logic. It must be done physically."

Another Florida Project.

Mention was made not long since of a plan to drain Lake Okeechobee and the adjoining Everglades of Florida, the aim being to reclaim some 12,000,000 acres of land suitable for the cultivation of sugar, cotton, and tropical fruits.

A charter has been granted by the State of Florida to another company—composed, however, of the same Philadelphia capitalists—having for its purpose the construction of a ship canal across the State by way of the Caloosahatchie River (the outlet of Lake Okeechobee), the lake, and eastward across the low country to the Atlantic, ending at or near the mouth of the St. Lucie River. The capital stock of the ship canal company is $30,000,000. It is said that operations will begin at once, surveyors having already been sent into the field.

A proper ship canal across the Florida peninsula is something to be desired; and, if the canal required for the Everglades drainage scheme can be utilized for commerce, its double usefulness might atone in part for its otherwise unfavorable position.

The Great Corliss Engine.

The great Corliss engine of the Centennial Exhibition seems to have the power of multiplying itself as remarkably as the bones of mediæval saints, or the furniture of the Mayflower. A little while ago, according to local reports, it was doing duty in San Francisco, and also in several other places this side the Rocky Mountains. Its latest appearance is in the new town of Pullman, near Chicago, where it gave impressiveness to the ceremony of inaugurating the Pullman Palace Car Works, just started there.

A Valuable Patent Right.

It is announced that the right to use in this country the basic process for dephosphorizing iron has been purchased by the Bessemer Steel Association. The Philadelphia *Bulletin* says that the figures involved in this important transaction (by which all of the patents covering the basic process, comprising those issued in the names of Messrs. Thomas, Riley and Snelus, become the property of the Bessemer Association) are placed all the way from $275,000 to $400,000, but parties who have facilities for knowing something of the matter say that the lesser figure is the correct one.

Instantaneous Silvering Mixture.

To coat copper or brass objects with silver, without difficulty or loss of time, the following process is given in the *Gewerb.-Bl. f. Ost- u. Westpreussen:* Mix 3 parts of chloride of silver with 20 parts of powdered cream of tartar and 15 parts of powdered common salt. Moisten a suitable quantity of the mixture with water, and rub it with a piece of blotting paper upon the metallic object, which must be thoroughly clean. The latter is afterward rubbed with a piece of cotton upon which precipitated chalk is dusted, then washed with water, and polished with a dry cloth.

Nitrate of Silver for Worms.

Dr. M. P. Greensword (*Medical Summary*) was accidentally led to regard nitrate of silver as a remedy for worms. Further use of this drug has convinced him that it is one of the most potent agents we have for the destruction and expulsion of worms. He gives a teaspoonful three times a day, of a solution of five grains of nitrate silver in six ounces of rain water.

Ladies, Beware!

A singular case is reported from the University of Michigan, service of Dr. A. B. Palmer. A young married woman of twenty-one years was brought to the hospital, suffering much pain, partly paralyzed, subject to convulsions, helpless. Various forms of treatment were used, particularly for uterine difficulties, which was the supposed trouble, but without improvement. Finally it was diagnosed that it was a case of lead poisoning, and under proper treatment for that disorder she soon improved and recovered. But how the lead ever found its way into her system could not at first be ascertained, though the most careful inquiry was made. It came out at last, however, that she had for several years been in the habit of beautifying her complexion by the use of a white powder sold as "flake white," which she applied to her cheeks after first wetting them with water. This "flake white" proved on analysis to be nothing more nor less than carbonate of lead, a deadly poison to the human system.

IMPROVED WATER METER.

There is no question of more vital importance to a city than that of its water supply. What at first seemed like a plentiful supply in many of our large cities has proved inadequate when the increasing waste has remained unchecked, but when this waste is checked by registering the amount of water used by means of efficient meters, the original estimates were found ample. This proved to be the case in this city, for according to the report of the Commissioner of Public Works in 1880, the supply which ten years ago was required for a population of 842,000, by the introduction of water meters is made to suffice for a population of 1,280,000.

The city of Brooklyn, which, during the last season, almost suffered a water panic, would have been enabled to distribute a plentiful supply of water and to arrest waste if a good water meter had been adopted. In fact, the universal adoption of an efficient meter, to be used as a part of the water supply system, is the only means of insuring economy in the use of water.

We give herewith an engraving of a meter, which, according to the reports of the New York and Chicago Water Commissioners, has proved very satisfactory. The following tabulated statement of the test at Chicago indicates very accurate registration:

Duration in Minutes.	No. of C. feet by Meter Register.	Actual quantity delivered.	Pressure upon Main.	Remarks.
2½	10	10·3	29·5	Discharging through 1 inch nozzle.
2½	10	10·4	30·5	" " " "
2½	10	10·5	29·5	" " " "
3½	10	10·3	30·5	" " " "
9½	10	10·3	29·5	" " " "

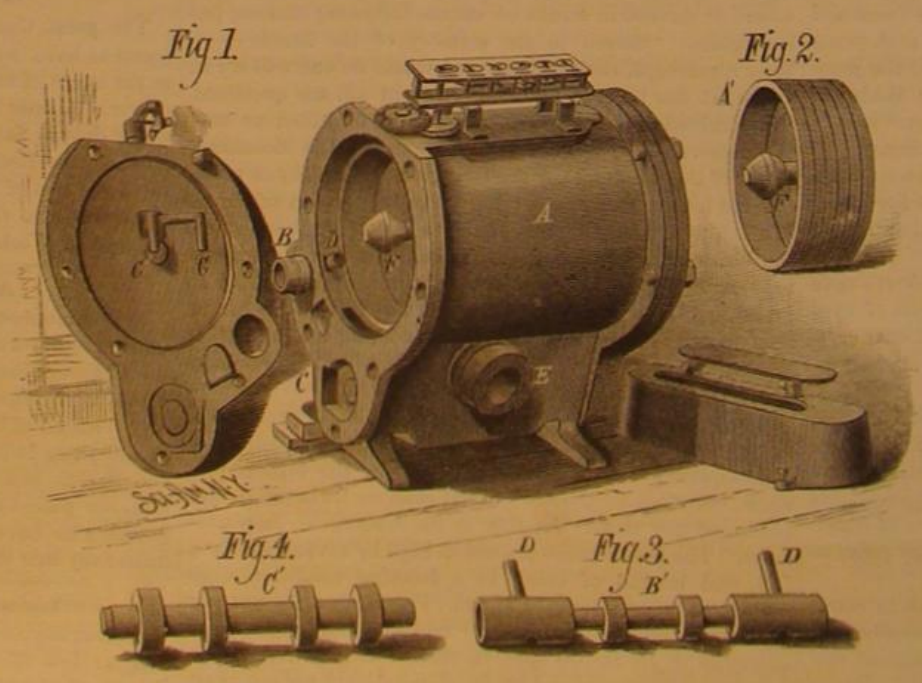
The meter is shown in Fig. 1 with one of its heads and the cover of the recording mechanism removed, showing the inside of the cylinder and valve chamber with the piston and valves in position. Fig. 2 is a detail view of the piston, and Figs. 3 and 4 are, respectively, auxiliary and main valves.

Water is admitted to the meter through the inlet, E, to the main valve chamber, C, passing between the two middle heads of the main valve, C', through ports into the cylinder, A, forcing the piston to one end of the cylinder. When near the end of its stroke it strikes one of the pins, D, projecting from the valve, B, and moves the valve in the same direction, thereby directing the flow of water into the valve chamber, C, between one of the outside heads of the main valve, C', and the head of the meter. The main valve is then forced to the opposite end of the valve chamber, when the flow of water into the cylinder, A, is reversed, and the piston is moved back into its original position, forcing the water on the eduction side of the piston, downward and out through the exit opening, which is exactly opposite the inlet opening.

The recording mechanism is operated by a double cam, F, projecting from the center of the piston, A', as seen in Fig. 2. This cam engages a forked lever having two projecting lugs, G G, projecting into the cylinder. This forked lever is attached to the lower end of a vertical shaft which extends upward through a stuffing box, and carries a double lever at the top, having two pawls which engage a ratchet wheel actuating the recording mechanism on the top of the meter, the wheel being moved forward one tooth for each stroke of the piston.

This meter is inexpensive in its construction and registers accurately.

Further information may be obtained by addressing Mr. Augustus Sequeira, 1447 Broad street, Hartford, Conn.

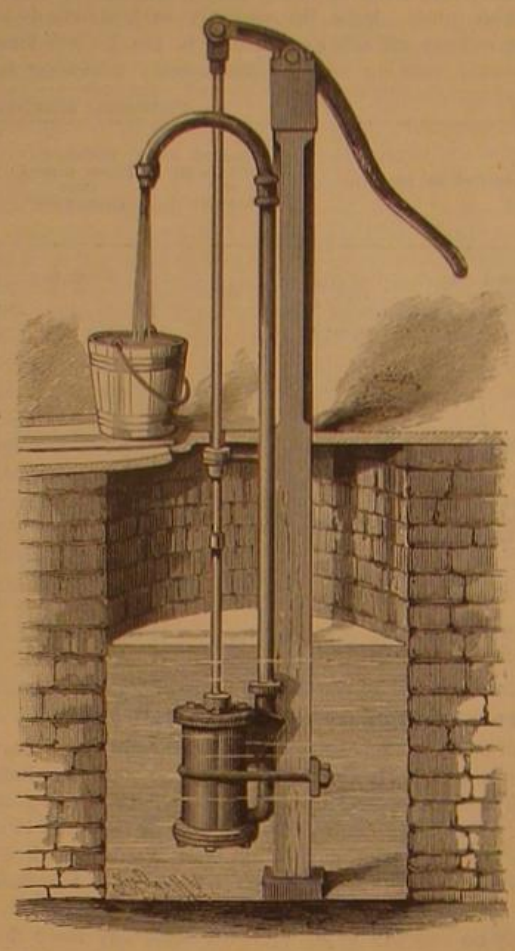


SEQUEIRA'S WATER METER.

DANIEL F. BEATTY, the celebrated organ manufacturer, of Washington, New Jersey, was re elected Mayor of that city this week. This is the third successive term of Mayor Beatty.

IMPROVED FORCE PUMP

The annexed engraving represents an improved force pump recently patented by Mr. A. J. Hopkins, of Hamilton, Ontario, Canada. The cylinder of the pump is mounted on a standard which rests on the bottom of the well, and reaches above the well covering a sufficient distance to receive the handle and support the upper end of the discharge pipe.



IMPROVED FORCE PUMP.

The pump is double-acting and works very freely, taking the water from the bottom of the well where it is coolest and purest. It can never freeze, for as soon as the movement of the piston is stopped the water retreats from the discharge pipe into the well. The pump is well made and calculated to remain in order in all seasons and under all conditions.

A New Photographic Process.

The phosphorescent properties of sulphide of calcium have been applied to many purposes more or less useful both in and outside the bounds of photography; but so far as the latter is concerned the applications have been hitherto of little real practical utility.

At a meeting of the London Photographic Club, however, Mr. A. L. Henderson announced an entirely new and, if it should prove to be practically workable, a most valuable application of the sulphide of calcium. This is, as yet, only in the experimental stage, and is given to the public that others may join in working it out to a practical issue. It consists in a method of producing instantaneous pictures by any light, however feeble—as Mr. Henderson himself described it, even by gaslight—with a pinhole stop. This result is attained by incorporating finely divided sulphide of calcium with the emulsion itself. With such an emulsion Mr. Henderson has himself obtained startling results, though as yet not perhaps photographically perfect. The luminosity set up by the momentary exposure of the phosphorescent film to light, feeble though it may be to the eye, is sufficiently powerful to gradually impress the particles of silver bromide, which, after a short time, become amenable to alkaline or other development in the same manner as if impressed in the ordinary way, the length of time between exposure and development ruling the degree of impression effect; in other words, the longer the plate is kept the better or more fully "exposed" it will be. We have not yet had the opportunity of trying this novel application of phosphorescent light to photographic purposes, as while we write but a few hours have elapsed since it was made public; nor is it possible yet to prognosticate what degree of success will attend its practice; but we give it at once to our readers on Mr. Henderson's behalf, feeling certain that many will be ready to enter the field of research in this direction.—*British Journal of Photography.*

Alcoholism a Predisposing Cause of Crime and Epilepsy.

In a recent number of the journal with the awkward title *Brain*, Dr. Clarke has published some tables of statistics, which lead him to the conclusion that "alcoholism of parents is a predisposing cause of crime and epilepsy in their children." Forty-four per cent of the epileptic criminals were the children of drunken parents. The proportion of epileptic and insane relatives is found to be very much greater with criminals than with ordinary epileptics. The convictions for bastardy are three times as numerous among epileptics as among non-epileptics. The statistics show that the amount of crime, as indicated by the number of convictions, is greater among epileptics than among ordinary criminals.

MECHANICAL INVENTIONS.

A safe and simple stationary fire escape, suitable for buildings of all kinds, has been patented by Mr. Charles Barlow, of Cookshire, Quebec, Canada. The invention consists of two cylinders fixed on different radii, each cylinder being filled with liquid, air, or gas, and containing two pistons provided with orifices that may be opened or closed by the relative adjustment of the pistons, to prevent or permit the passage of the liquid or air from one end to the other of the said cylinders, and thereby retard or hasten the operation of the lowering mechanism.

Mr. William H. Grubb, of Hannibal, Mo., has patented an improved device for bending metal tubes, consisting of a steel plate having several holes of different sizes which are perpendicular to the faces of the plate, and the holes are of the exact size required for standard sizes of pipe. The device is first firmly secured in vertical position in a vise clamp, the portion in which the hole is formed being uppermost. One end of the pipe is then inserted in the hole and the pipe drawn gently toward or pushed from the workman at right angles to the axis of the hole. The pipe is then pushed through the hole half an inch, or thereabout, and the operation of drawing and bending repeated, thus producing the curve.

Messrs. George M. Fay and Nahum Fay, of Eureka, Cal., has patented a combined sawing, grooving, and planing machine, more particularly intended for the sawing, planing, and grooving of boards to be used for roofing.

A mandrel that may readily be inserted in and withdrawn from the hole in the piece of work to be turned, that furnishes a parallel bearing the full length of the hole or any part thereof, has been patented by Mr. John A. Wilde, of Hudson, N. Y. The invention consists of a mandrel having an enlargement or boss in the middle of its length, or at either end, that is cut away so as to form two raised parallel longitudinal bearings and a corresponding groove, which are at equal distances apart, the groove being deeper at one end than at the other, and being designed to receive the third bearing, which consists of a corresponding key that is to be forced into the groove to secure the mandrel in place in any piece of work.

A simple saw-filing machine that is readily adjustable for any desired rake, bevel, and depth of tooth, and for any length of file, has been patented by Mr. Eugene P. Ellis, of Emporia, Kan.

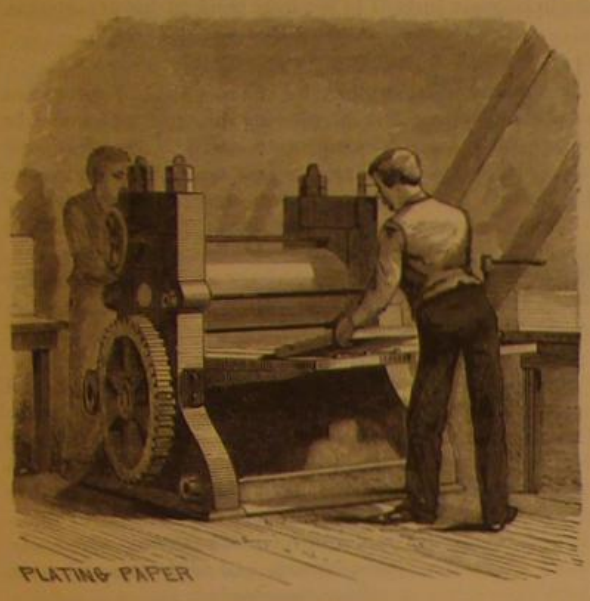
A magnetic support for scale beams has been patented by Mr. Solomon H. Brackett, of St. Johnsbury, Vt. This invention relates to beam or even balance scales, or other scales depending on pivoted levers. The main feature of this invention consists in the combination, with the pivotal beam or lever, of a magnet arranged to attract the central or pivotal part of the beam, and suspend or partly suspend the same against the action of gravity.

An improved tiling for roofs, etc., has been patented by Mr. John J. Williams, of Fair Haven, Vt. The object of this invention is to apply tiling to roofs, floors, and other places in such a manner that water cannot pass in through the joints between the tiles, and that the expansion, contraction, springing, and sagging of the tiling or its support will not open the joints and cause leakage.

AMERICAN INDUSTRIES.—No. 72.

THE MANUFACTURE OF WRITING PAPERS.

While it is pretty generally known that the American people use more paper in proportion to their number than any other people in the world, there are few who realize how large is the amount of capital or the number of hands employed in the manufacture of paper, to say nothing of the more extended industries involved in book and newspaper making and general printing. It is acknowledged that more than one-third of the paper now made in the world is manufactured in the United States, and it is estimated that over $100,000,000 of capital and 40,000 persons are engaged in its manufacture. The business has shown a wonderful growth in the past ten years, and American skill, inventive genius, and business capacity have each found admirable illustration in the prosperity of this trade. In 1869 we had no export business in paper worth mentioning, while our imports amounted to more than half a million dollars, and in 1873 the imports had increased to $1,326,460. For the last fiscal year, however, our exports amounted to $1,183,140, while our imports had fallen to $235,051, the most of this being in fancy wall papers, writing paper representing only $28,167 of the total. In the finer kinds of paper the progress made by our manufacturers has been particularly marked, and the productions of American mills now find a steadily growing demand in nearly every foreign market.



PLATING PAPER

In the first page illustrations of this number we represent the manufacture of fine and staple writing papers of all kinds, as conducted by a firm the commencement of whose business dates back more than half a century—the Owen Paper Company, of Housatonic, Mass. When their business was established, in 1822, paper making in this country was in its infancy, and very little paper was made anywhere except by hand, the Fourdrinier machine, which was destined to work a revolution in the business, having then been but little used in England and France. The first employment of one in this country was in 1833, but the machine has been greatly improved since its first introduction, and is now used in making the finest papers, the improvements made in it having been quite as much in the direction of perfecting the goods as in lessening labor and cheapening the product. There is little or no paper now made by hand in this country, the Fourdrinier machine having been so adapted to the necessities of the business that it works with a nicety of adjustment and an exactness of detail which gives a more uniform and perfect quality than can be found in handmade-papers, while another invention, known as the cylinder-machine, has been carried to great perfection in this country in the manufacture of book, news and cheap papers for various uses.

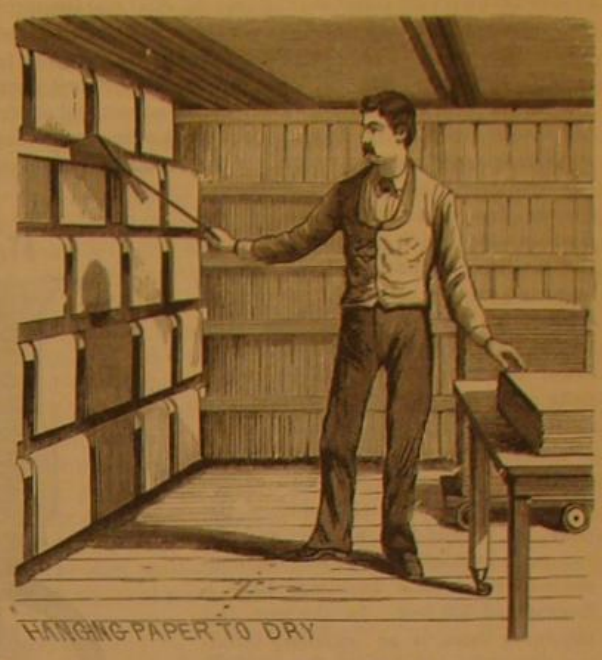
The first detail in paper making is the sorting of the rags, or the stock from which the paper is made. These are classified by the dealers, according to color and fiber, so that the manufacturer is able to select and purchase his raw material with close regard to the exact kind of goods he proposes to make. In this establishment nothing but the best linen and cotton fiber is used. If the rags are dirty when they come to the mill they are first passed through a duster, where they are thoroughly thrashed and beaten by a machine, of which there are several varieties, but in all provision is made for the dust dropping out or being blown out through a wire screen. The rags then go to the sorters and cutters, who stand at a table covered with wire cloth, and provided with knives inclined a little from the perpendicular, as seen at the left in one of the small views, entitled "Cutting Rags." Against these knives the rags are drawn and torn, to open seams and dislodge dirt, remove buttons, buckles, etc., and, while a close assortment is being made, the rags are cut to a suitable size for the engines and the dirt falls through the wire cloth to a receptacle below. Only the rags for the finer grades of paper are cut by hand, those of the coarser kind, for lower qualities of manufacture, being cut by machines.

The next process is boiling with alkalies to loosen dirt, remove grease, coloring and glutinous matters, etc., before washing. For this purpose lime, soda ash, or caustic soda is used, in water. Sometimes the lime solution only is used, while in other cases lime and soda ash are used. The boiling is effected now generally in rotary boilers, of a capacity to hold 3,000 to 6,000 pounds of rags, the solution being poured in upon the rags, and the heat supplied by steam at a pressure of 30 to 50 pounds, which is admitted at a point below the top of the liquid.

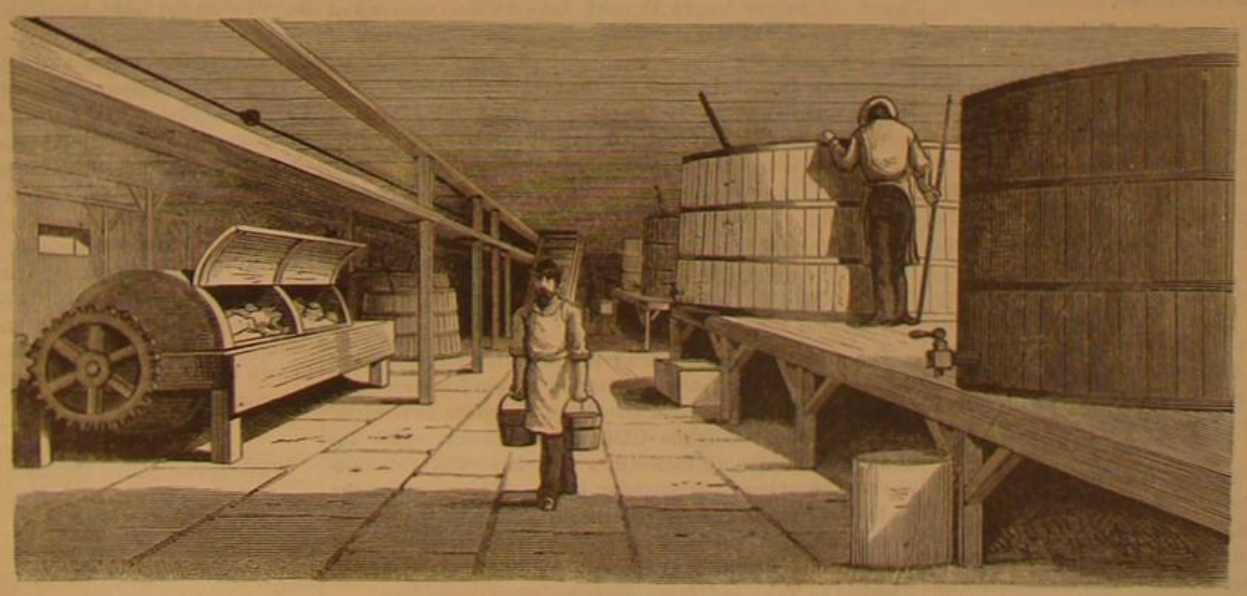
The rags, after being boiled a longer or shorter time, according to their condition, are then ready for treatment in the washing engine, shown at the bottom of the page. This machine is an oblong kind of vat, with rounded ends, divided lengthwise in its center by a midfeather. There is a constant flow of fresh water, only the purest water that can be obtained being used in this, as in all other processes of paper making. On one side of the midfeather is an inclined plane on the bottom of the vat, leading up to the bottom of the dip of a revolving roll, whose circumference carries steel faced blades; the bottom of the vat then so conforms to the space in which the roll revolves that the rags, passing in with the water, are carried partly around the roll against other knives in the bottom, and dropped on the other side of the roll, to be then carried around the end and through the other side of the vat until they come again to the roll, the action of which washes, rubs, and disintegrates the fiber. In the other side of the vat, is an eight-sided cylindrical frame, covered with fine wire cloth, through which the wash water strains to the interior, where it is gathered by buckets and discharged over the side of the vat. After the rags have been submitted to the process for a time, the roll is so lowered that its blades reduce the stock to finer fibers than would be effected in its first position, different kinds of stock requiring different treatment, but it being indispensable, in all first-class papers, that the pulp should be fine and even. The bleaching agent, usually a solution of the ordinary bleaching powder of commerce, is applied when the stock is in the condition of half stuff in the washing engine, and, after the pulp has again been thoroughly drained in the drainers below, it is subjected to the action of the beating engine which operates on the same principle as the washer, but runs faster and has knives which are not so blunt. There is great difference in the treatment of the pulp in the engine, according to the quality of the stock and the paper that is to be made, coarse paper requiring but 4 or 5 hours, while fine writing paper takes 15 to 24 hours, strong bond and bank note papers, where the fibers must be long, requiring sometimes as much as three days and nights.

The sizing and the coloring are the last operations in the preparation of the pulp, except in the case of super-sizing, which consists in putting on a coat of size after the paper has been made. A certain amount of size in the body of the paper is necessary, however, to increase its strength, to prevent ink spreading on its surface, and to give it a body which will admit of a high finish. Quite a number of different substances enter into the manufacture of size for various qualities of paper, a vegetable size being made of resin dissolved in a solution of water in soda ash or soda crystals. Alum is also used to some extent, and has the effect of brightening many colors. In the preparation of the size in this establishment where the best animal sizing is used, a large stock must always be kept on hand and forms an important department of the business, the general features of which will be readily understood from the view given in one of the illustrations.

The Fourdrinier machine, which forms the central view on the first page, is a most elaborate piece of mechanism, in which the paper is made in a continuous web, but with devices by which it may be slit and cut into sheets as desired. The pulp is fed into a regulating box, where any excess of what is required is taken by an overflow; the pulp is kept constantly agitated, and flows upon an endless wire cloth, upon which the paper is formed, the water straining through and leaving the pulp as a thin sheet upon its surface. Guide bands at the side, called deckles, determine the width, and, after traveling about forty feet, what are called couch rolls, remove the paper from the wire cloth, the pulp being previously subjected to a shaking motion laterally to interweave or felt the fibers, the motion being greatest where the pulp is most fluid, and diminishing as the web becomes free from water. Letters, figures, etc., are impressed upon the paper in the soft web by a wire cylinder, called a dandy roll. When the dandy roll is covered with plain woven wire cloth, what is called "wove" paper is made. When the roll is covered or laid over with wires running parallel and at some little distance apart, it impresses lines in the soft web, producing what is known as "laid" paper. All the water draining off, with its coloring matter, sizing, particles of fiber, etc., is taken back to the mixing box to be again incorporated with the pulp, so that absolutely nothing is wasted. The web, after leaving the couch rolls, is delivered to an endless felt apron, and passes between rolls to press out the water, and, when its moisture is largely diminished, it passes between and around a number of steam-heated drying cylinders. The paper may now be passed through calendering cylinders, if desired; these are accurately ground, and have polished surfaces, the paper in passing through them being subjected to great pressure, which compacts the fiber and gives a hard, smooth surface. This operation also charges the paper with electricity, which is drawn off by a simple device; in case this is not done the sheets are very likely to stick together.



HANGING PAPER TO DRY



In cutting the paper for the many different sizes of fancy goods in which the finer qualities are sought, the operation is conducted as shown in one of the views, the paper having first been cut from the web in sizes approximating those to which it is finally to be trimmed, or so that it will divide with but a minimum of remnants to be reworked. This, and also the ruling, folding, and stamping, shown in separate views, are very particular details in the making of the finer grades of paper, an important specialty with the Owen Paper Company. On many of their styles and machines they have patents, the goods having attracted wide attention and having commanded a large sale.

For bank-note, bond, and other fine writing papers, the drying is not completed on the Fourdrinier machine, but in steam drying lofts, as shown in one of the views. After drying, the sheets are subjected to a powerful pressure, which gives them a dead finish, without disturbing the grain of the surface. Subsequently the finishing is continued by different methods and different machines, according to the use for which the paper is designed, or the caprices of the users, who demand sometimes an excessively smooth surface (which is obtained by rolling between polished metal plates, as shown in one of the views); sometimes a surface of medium smoothness, and sometimes a rough "antique" finish—the finishing process being necessarily different for each.

In all the papers of the Owen Paper Company, the stock consists of the most carefully selected white linen and cotton rags, and especial care is taken that nothing shall be

used in the washing or bleaching to impair the strength of the fiber.

The Owen Paper Company was incorporated in 1862. The business was commenced at Lee, Mass., in 1822, by a firm of which Charles M. Owen was the senior partner. In 1849, Edward H. Owen, a son, became a partner, and soon succeeded to the practical management of the business. The firm built, in 1857–8, the mill at Housatonic, shown in our sketch as the "Old Mill," which, with various enlargements, is now 320 feet in length, its internal arrangements being admirably adapted for saving labor, the bales of rags being taken from the cars at one end of the mill, and reloaded as finished stock ready for transportation from the other end. The company formed in 1862 included Edward H. Owen, Henry D. Cone, and Charles M. Owen, the former of whom died in 1864, and the latter in 1873, leaving Mr. Cone treasurer and manager of the business, of which he is now, also, the sole proprietor. He has continuously made it a specialty to manufacture only first class paper, made from the best linen and cotton fiber, without any of the adulterations and make-weights in the shape of clay, china clay, kaolin, and other substances used in cheap papers. As a result, the business has developed with great rapidity, the foreign demand for the goods of the company being felt in most if not all the civilized countries of the globe, large orders being received from abroad, frequently without solicitation. The new mill just erected, about half a mile lower down the river, will be, when fully equipped, one of the largest and most complete paper manufacturing establishments in the world. Mr. Cone owns all the houses, with two exceptions, with the land both sides of the river, for a mile and a half; and the two main buildings of his factory, connected by a central building, have a frontage of 500 feet. In the rear, and adjoining them, is an auxiliary building 400x30 feet, and an ell 200x40 feet; also boiler and engine house, store houses for stock, and the like. A good idea of the plan and elevation may be obtained from our illustration. A considerable village has arisen in the neighborhood, the result of this industry, in which most of the workmen live in houses occupied by only one family each, and educational and social advantages have been generously supplied by the liberality of Mr. Cone. There is an admirable library of several thousand volumes, free to all, with salary of librarian and all expenses of library and a well-furnished reading room paid by Mr. Cone. The place is, of itself, one of great natural attractions, and to see it so occupied by a flourishing industry, making happy homes and intelligent, well-to-do workmen, is no less a matter of personal pride to Mr. Cone than is the business success he has achieved in a department of manufacture where we formerly depended so much upon foreign labor and capital.

The Cattle Car Prize.

During a recent visit to Chicago we saw the collection of models of cars and plans of cars which have been sent to Mr. Brown as chairman of the judges. There are 480 of the former and 243 of the latter.

A careful description of each is being prepared for the use of the judges. It will be apparent, at a glance, that this must be done in justice to each competitor, and also that careful work and much time are required for it. This explains the delay; a delay which must be protracted for some time longer.

Then in several manuscript volumes are copies of every patent issued so far by our Patent Office for an improved cattle car, numbering now 116; the first, in time, bearing date in West Virginia, May 29, 1860. It will require much careful consideration to determine how many of the new plans were already protected by one or other of these numerous patents.

We were curious to know whence the competitors came. Nearly every State is represented, and also England, Switzerland, and, of course, Canada.

Illinois has 51 models and 18 plans, being the highest numbers from any one State; Pennsylvania is second, with 47 models and 27 plans; New York is third, with 43 models and 15 plans; Ohio is fourth, with 37 models and 18 plans; Indiana is fifth, with 21 models and 13 plans; Massachusetts is sixth, with 19 models and 26 plans; Michigan is seventh, Iowa eighth, Missouri is ninth, and Minnesota is tenth. Among the competitors are eight women, from the same number of States.

Some competitors have more than one model, and others more than one plan.

The collection represents a great amount of thought and labor and ingenuity, as well as skilled workmanship. That a better car will be the result no one doubts who has full information on the subject. There are cars which came into existence in consequence of the offer of the prize, which are not there, because their inventors think them too valuable to part with for the prize; but their points will be known to the judges, and they are, of course, a part of the valuable results already secured by the offer.

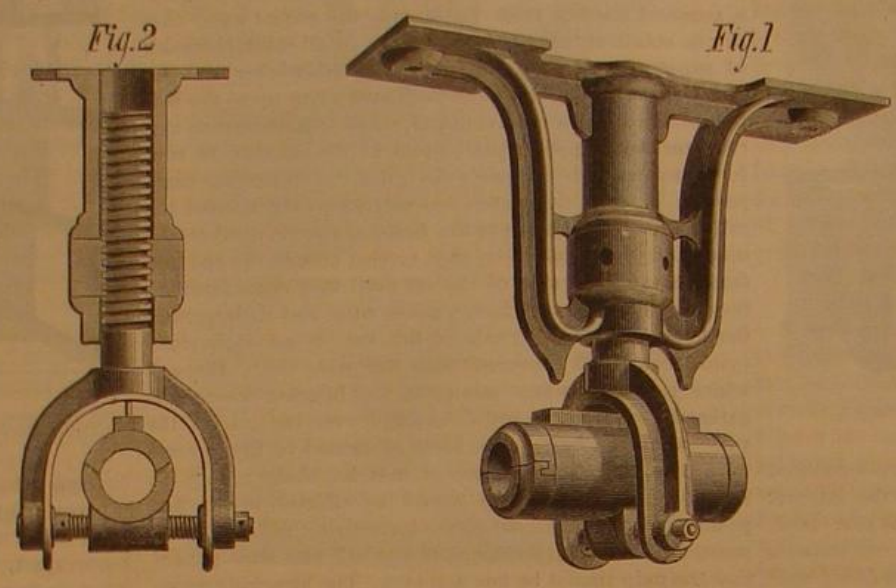
It is, also, beyond question that the judges will have before them a more complete exhibition of all that ingenuity has done so far in this direction, than has ever before met the eyes of any man or any body of men.—*Our Dumb Animals.*

HANGER FOR SHAFTING.

Next in importance to the shaft itself are the supports which sustain it, and in putting up a shaft of any length the duration of its usefulness depends on the manner in which it is supported, and on the truthfulness of its alignment. It is useless to provide large and perfect journal bearings for a shaft without providing means that will permit of its automatic adaptation to any flexure of the shaft without binding or heating, and it is also essential that the bearing be capable of adjustment in all directions in the plane of the shaft's rotation.

The hanger shown in the annexed engraving meets these various requirements, and presents a shaft support as nearly perfect as human ingenuity can make it.

Fig. 1 shows the hanger complete, and Fig. 2 is a perspective view showing the various adjustments.



IMPROVED HANGER.

The journal box proper is made in two parts, held together by means of rings or nuts screwed on at the ends, and forming a chamber to receive hempen or other packing, and when properly screwed up effectually prevents all dripping of oil or other lubricants from the ends of the journal box. These rings or nuts may, if desired, be divided and interlocked so that they can be readily taken off the shaft after they are unscrewed from the box.

The box is provided with an automatic oiler at the top, and is supported by a steel pin or pivot passing through the two arms of a fork formed on the lower end of a screw extending upward through a sleeve forming the central portion of the fixed part of the hanger, and a threaded sleeve (of proper length to work between the two arms of holding fork) which is screwed through the lower section of the box; and the proper alignment of shaft is made by turning the threaded sleeve on the pivot and thereby driving the box to one side or the other of the holding fork of hanger, as may be required. A cylindrical nut fitted to the bisected portion of the sleeve receives the screw of the forked support. This invention will be understood without further description. It was lately patented in the United States, Canada, and Great Britain, by Mr. Henry D. Cone, of Housatonic, Mass., to whom inquiry in relation to the same may be addressed.

The Telephone in China.

The Chinese language is so peculiar that there is great difficulty in devising any practicable system for conveying telegraphic messages. The telephone, therefore, is received with peculiar favor by the Chinese Government, which has at length decided to establish a complete system of telephones throughout the country, commencing north of the Yang Tse Kiang. The work will be conducted under the charge of J. A. Betts, the American telegraphist, under whose superintendence the telegraphic line was built from Tientsin to Taku.—*L'Ingén. Universal.*

Mechanics to the Front.

There has been no time since the exactions of the war from 1861 to 1865, says the Boston *Journal of Commerce*, when good workmen were in such demand as the present. It would be well for interested readers to notice the adjective "good," the writer adds, for pretenders and half-learned apprentices will get the cold shoulder at every shop where good workmen are obtainable. One of the great hindrances to the pushing forward of mechanical enterprise just now is the need of competent workmen. Only a short time ago the country was swarming with good workmen, excellent mechanics, some of whom were strongly tempted to take to the road as tramps because of their trouble of procuring employment. All this is changed, and if there is any mechanic who believes himself to be a workman and can prove his faith by his works, now is his opportunity.

It is a matter of frequent, almost daily, surprise to hear the inquiry from manufacturers: "Do you know of any good workmen?" But now as always, it is of little use for a fly-away apprentice or a slouchy workman to apply for work; the demand is for first-class *workmen*, not for shop hands or pretenders. In machine shops the requirement is for good tool makers, good planer men, lathe men, filers and fitters, floor men; and there is less room for fill-gaps, and mere operatives and would-be-apprentices have a poor show. But if one of this latter class can get a position, he has now a much more encouraging show for advancement than for many years past.

Our tool manufacturers and machine builders are at their wits' ends to meet their orders in time; not so much for lack of material and need of room as for want of good, sensible, steady, competent workmen. This is one of the periods when the earnest and honest mechanic can go a peg higher, and the industrious apprentice can have unusual opportunities to improve himself in the finer work of his department.

RECENT INVENTIONS

In canning fruit, etc., much difficulty and inconvenience are often experienced in introducing the cans or jars into the vessel of water and withdrawing them, and great care must be exercised to prevent the contact of the jars, if they be of glass, with the bottom of the vessel or boiler, lest the jar be broken. A simple, inexpensive, and convenient device for overcoming these difficulties has been patented by Sarah W. Brown, of Hudson, N. Y.

An improved adjustable spring bed bottom has been patented by Mr. Henry A. Scott, of Athol, Mass. The object of this invention is to furnish invalid bed bottoms having head and foot sections capable of easy adjustment in horizontal or inclined positions, which may be used with and easily removed from ordinary bedsteads.

An improved fountain for soda and mineral waters has been patented by Mr. Charles Jackson, of New Bedford, Mass. The objects of this invention are to permit connection of the two parts of the fountain by a brazed joint, whereby strength and security against leakage are obtained; to permit inspection of the interior of the fountain; to permit of their being readily washed out and retinned without separating the joints.

First Gold in California.

General Sherman has given this account of the first discovery of gold in California: "I remember one day that two men, Americans, came into the office and inquired for the Governor. I asked their business, and one answered that they had just come down from Captain Sutter on special business, and they wanted to see Governor Mason in person. I took them into the Colonel and left them together. After some time the Colonel came to his door and called me. I went in, and my attention was directed to a series of papers unfolded on the table, in which lay about half an ounce of placer gold. Mason said to me, 'What is that?' I touched it, and examined one or two of the larger pieces, and asked, 'Is it gold?' Mason asked me if I had ever seen native gold. I answered that in 1844 I was in Upper Georgia, and there saw some native gold, but it was much finer than this, and that it was in phials or in transparent quills; but I said that if this were gold it could easily be tested—first, by its malleability and next by acids. I took a piece in my teeth and the metallic luster was perfect. I then called to the clerk (Baden) to bring an ax and hatchet from the backyard. When they were brought I took the largest piece and beat it out flat, and beyond doubt it was metal, and a pure metal. Still, we attached little importance to the fact, for gold was known to exist at San Fernando, at the south, and yet was not considered of much value."

Tea Two Hundred Years Ago.

While investigating the history of tea an English writer came across a rare manuscript in the British Museum, giving as below a quaint summary of the virtues of "the herb called tea or chee." It bore the date of October 26, 1686, and purported to be a translation from the Chinese.

1. It purifies the Bloud that which is grosse and heavy.
2. It vanquiseth heavy Dreames.
3. It easeth the brain of heavy Damps.
4. Easeth and cureth giddiness and Paines in the Heade.
5. Prevents the Dropsie.
6. Drieth moist humors in the Heade.
7. Consumes Rawnesse.
8. Opens Obstructions.
9. Clears the Sight.
10. Cleanseth and Purifieth Adust (*sic*) humous and hot liver.
11. Purifieth defects of the bladder and kidneys.
12. Vanquisheth superfluous sleep.
13. Drives away dissines, makes one nimble and valient.
14. Encourages the heart and drives away feare.
15. Drives away all paines of the Collick which proceed from wind.
16. Strengthens the inward parts and prevents consumptions.
17. Strengthens the memory.
18. Sharpens the will and quickens the Understanding.
19. Purgeth safely the gaul.
20. Strengthens the use of due benevolence.

RECENT DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

TILGHMAN *vs.* PROCTOR *et al.*—SEPARATING FATS, OILS, GLYCERINE, ETC.

Mr. Justice Bradley delivered the opinion of the Court.

This case involves a consideration of the same patent which was the subject of litigation in the case of *Mitchell vs. Tilghman*, reported in 19 Wallace, 287. The evidence in the present case, which is quite an unwieldly mass, is much the same as in that, being supplemented, however, by the testimony of the patentee respecting the nature of his original experiments and the practicability of using profitably the coil apparatus described in the patent, together with certain exhibits relating to the novelty of the alleged invention. Upon the renewed consideration which has been given to the subject the court is unanimously of opinion, contrary to the decision in the Mitchell case, that the patent of Tilghman must be sustained as a patent for a process, and not merely for the particular mode of applying and using the process pointed out in the specification, and that the defendants have infringed it by the processes used by them.

The patent in question relates to the treatment of fats and oils, and is for a process of separating their component parts so as to render them better adapted to the uses of the arts. It was discovered by Chevreul, an eminent French chemist, as early as 1813, that ordinary fat, tallow, and oil are regular chemical compounds, consisting of a base which has been termed "glycerine," and of different acids, termed generally "fat acids," but specifically "stearic," "margaric," and "oleic" acids. These acids, in combination severally with glycerine, form stearine, margarine, and oleine. They are found in different proportions in the various neutral fats and oils, stearine predominating in some, margarine in others, and oleine in others. When separated from their base (glycerine) they take up an equivalent of water and are called "free fat acids." In this state they are in a condition for being utilized in the arts. The stearic and margaric acids form a whitish semi-transparent hard substance, resembling spermaceti, which is manufactured into candles. They are separated from the oleic acid, which is a thin oily fluid, by hydrostatic or other powerful pressure, the oleine being used for manufacturing soap and other purposes. The base (glycerine) when purified has come to be quite a desirable article for many uses.

The complainant's patent is dated the 3d day of October, 1854, and relates back to the 9th day of January of that year, being the date of an English patent granted to the patentee for the same invention. It has but a single claim, the words of which are as follows:

"Having now described the nature of my said invention and the manner of performing the same, I hereby declare that I claim as of my invention:

"The manufacturing of fat acids and glycerine from fatty bodies by the action of water at a high temperature and pressure."

In the case of Mitchell the majority of the Court was of opinion that in the application of the process thus claimed the patentee was confined to the method of using the process particularly pointed out in the specification, and as by that it was proposed to produce a very rapid separation of the fatty elements by the use of a high degree of heat—the operation being effected in the space of ten minutes by forcing the fat mixed with water through a long coil of strong iron tube passing through an oven or furnace, where it was subjected to a temperature equal to that of melting lead, or 612° Fah.—it was concluded by the Court that the producing of the same result in a boiler subjected to only 400° Fah., and requiring a period of several hours to effect the desired separation, was not an infringement of the patent, although the process by which the effect was produced—namely, the action of water in intimate mixture with the fat at a high temperature and under a sufficient pressure to prevent the formation of steam—was undoubtedly the same. On further reflection we are of opinion that in the case referred to sufficient consideration was not given to the fact that the patent is for a process, and not for any specific mechanism for carrying such process into effect.

Decree of the Circuit Court reversed and the patent sustained.

Our space only permits the presentation of a small portion of the decision, which is very interesting. The report *in extenso* will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 278.

The Manufacture of Artificial Hydraulic Lime.

A few years ago an English writer on limes and cements suggested in our columns the advisability of preparing an artificial mixture of chalk and clay, rather than continue to employ the fat chalk limes which at one time were so much in favor with London builders. It was at once urged that, possessing, as we do, such vast deposits of gray chalk lime, or lime rich in silica and aluminum, and with a broad belt of liassic limestone running across England from Somersetshire to Yorkshire, it was quite unnecessary to think of preparing an artificial hydraulic lime, or to go to the expense of improving the limes made from pure chalk. It is impossible to deny that we have in this country many very excellent building limes; still, such limes do not exist in all parts of the country, and in the North of England the limes chiefly burnt from the carboniferous and mountain limestones are notoriously bad for structural purposes. Such being the case, a description of the great manufactories of artificial lime near Paris, which for some reason or other are rarely visited by English travelers, may not be without interest.

The rocky escarpment crowned by the fortress of Issy, which overlooks the plain of Meudon, is a chalk ridge, and the hill of Issy is an outcrop of the upper or flint-bearing chalk, which here is from 1,200 to 1,500 feet in thickness. The belts of flint run through it in perfectly horizontal lines or strata, showing its undisturbed geological position. The quarries of Issy are extremely interesting, as the workings are all in parallel galleries or tunnels having arched roofs, each gallery being three meters wide and seven meters high. These galleries are very numerous and intricate, and extend for great distances under the hill, as the quarrying has been practiced since 1829. The French Government engineers have the entire control of the quarrying operations, and decide upon the positions of the galleries and tunnels. The chalk is got by piecework; the men being paid 1·20 franc per cubic meter loaded on to the carts; this is about equivalent to 9*d*. per cubic yard. Considering that the men have to keep the galleries neatly trimmed, and the roofs a true arch, the price seems small, though we were given to understand that a good workman easily earns 5*s*. per diem at this work. The chalk, when brought to the works, is mixed with 20 per cent, by measure, of clay brought from Argenteuil. This is a gray plastic clay with veins of yellow and red, indicating the presence of iron. It is an excellent brick earth, and is largely employed at the potteries in the neighborhood for the manufacture of tiles, pans, drain pipes, etc.

The mixture of the chalk and clay is effected in two different ways: the one the summer plan, the other chiefly practiced in winter. As the drying of the compound is accomplished without artificial heat, it is necessary during the winter to effect the mixture of the chalk and clay with the least possible quantity of water; and to do this it is usual to employ during the cold months an ordinary vertical pug mill similar to that in use in brickworks. The chalk and clay are thrown in by shovelfuls at a time, five of chalk to one of clay (the chalk naturally contains about 4 per cent of clay). This compound is pugged twice, and then spread in small lumps on the floor of large sheds to dry. It becomes dry enough to put in the kilns in about twenty-four hours, or that spread one day can be burned the next. The calcination is effected in small running or continuous kilns with interstratified fuel; the fuel consists of small coal and gas coke. The burnt lime is drawn out twice a day, and placed in sheds, where it is slaked with a minimum of water. The slaked lime remains for five or six days in layers of considerable depth, after which it is ground and sifted. The grinding appears to be necessary, chiefly owing to a considerable proportion of "core" or underburnt material. From the sieves the lime passes into small sacks, in which it is sent out for use. Nearly all the hydraulic lime used in Paris is thus sent out by the burner as *slaked* lime. The sacks are supplied gratis to the customer—that is, no charge is made for them if they are returned in fair condition when the next load is delivered.

This hydraulic lime, which makes excellent mortar, is usually mixed with three parts, by measure, of sand, though it is a common practice to specify two measures of sand to one of lime. Comparatively very little lime, however, is used in Paris, owing to the practice of employing plaster of Paris, which still prevails almost universally. The plaster seems to stand fairly well even in exposed situations, in consequence of a considerable admixture of lime, which protects it, to a great extent, from the action of the weather. The mixture of lime and clay obtained from the pug mill is very imperfect, and on crushing up the lumps from the kiln they are found to be full of particles of quicklime, many of them as large as peas. The manufacturers admit the incompleteness of the compound made in the pug mill, but content their customers with the assurance that they must have this or nothing, as they cannot prepare a slip in the winter time.

The summer mode of manufacture is precisely similar to that practiced by some of our English Portland cement makers: the chalk and clay are washed together in a mill, which consists of a large wheel rotating in a circular trench. The tire of this wheel is armed with iron spikes, and a considerable quantity of water is used. The chalk and clay are ground under this wheel for from one and a half to two hours; at the end of which time the contents of the mill are reduced to a creamy slip, which is run off into settling ponds or becks to dry. The water gradually evaporates or soaks into the ground, and the creamy mixture when sufficiently consolidated to be dug out, which may take several months, is removed in small cakes to the drying floor, whence in twenty-four hours it is ready to be burnt.

The hydraulic lime thus prepared is far more perfectly mixed than it could be by simple dry-pugging, and the quality is much superior to that prepared in the manner we first described. During the winter-time a large quantity of clay is carted into caverns or excavations in the galleries of the quarries, and is there mixed by washing with chalk, in order to dry and become ready for summer use. The advantage of making this mixture in the quarry is that the chalk is so absorbent that the water is very freely sucked away from the slip, and the compound becomes sufficiently dry for use with little or no trouble.

The works at Meudon are those originally founded by M. St. Leger, who was the first maker of hydraulic lime in France under the process described by Vicat. M. St. Leger seems to have patented his process in England, but it does not appear that he ever put his plan in operation here.

Near Paris there are now three manufactories of artificial hydraulic lime on this plan. That of M. Deschamps-Hévin, of the Route des Moulineaux, at Issy, is the most important. The price of the ground hydraulic lime is about 24 francs per cubic meter—say, roughly, 15*s*. per cubic yard.—*Building News.*

Engineers' Club, Philadelphia.

At a recent meeting, Dr. H. M. Chance described an attempt to extinguish the Kehley Run Colliery fire at Shenandoah City, by carbonic acid gas and nitrogen. The gas was generated in an open brick furnace with reversed draught, and forced into the mine through four 3-inch pipes by injectors supplied with steam at 60 lb. pressure. Each pipe was supposed to supply 1,500 cubic feet per minute, or a total of 6,000 cubic feet per minute. The attempt was entirely unsuccessful, and Dr. Chance attributes its failure principally to *the impossibility of making the mine airtight*, but also considers that the gas was delivered at too high a temperature, and that it was possibly mixed with carbonic oxide. The method seems to be worthy of further trial at mines that can be made thoroughly airtight.

Mr. P. H. Baermann described briefly the construction of the Cooperstown, N. Y., waterworks, and particularly the method of laying the supply pipe extending from the pumphouse up the Susquehanna River into Otsego Lake, a distance of 4,500 feet. The pipe was laid from a staging carried on 120 barrels, and lowered in 108 foot sections. Up to 9 feet in depth the joints were made with dry pine wedges, and above this with lead. The end of the pipe is provided with a copper strainer, which is in 38 feet of water and 10 feet above the bottom.

A paper was also read by Dr. Chance on "Wear in Wire Ropes," showing that the cause of rapid wear is often due to the use of drums, sheaves, and pulleys of insufficient size, and that a great saving might be effected by increasing their diameters; especially that of the small deflection and knuckle pulleys and sheaves. The actual wear averages 0·138 cent in slopes, and 0·053 cent in shafts, per ton, for each hundred feet of lift.

A Barber on Baldness.

Speaking of the credulity of many people touching the efficacy of hair tonics, an intelligent French hairdresser says:

Very often the hair falls out after sickness. In such cases it generally grows again without the aid of any hair tonic whatever; but when it falls out from natural causes it never grows again. The celebrated Dr. Bazin, who was formerly physician in chief of the St. Louis Hospital at Paris, and who is known throughout the world as the most learned specialist for affections of the skin, told me one day that there was nothing that could make the hair grow after the baldness had come on gradually. This I believe firmly, for, if there was anything of the kind, we would not see so many New York doctors with heads as completely destitute of hair as the backs of turtles. I am even persuaded that these gentlemen would follow the example of those Greek heroes who, under the leadership of Jason, made a voyage to Colchis to bring back the Golden Fleece. Modern Argonauts, the doctors, would consider themselves happy if they could bring back from such a voyage the secret of restoring the human fleece.

I don't think I am far from the truth when I say that during the past twenty-five years that I have practiced the profession of hairdresser, I have made the trial upon different bald heads of more than five hundred different hair tonics, and I am bound to admit that I never saw a single head the hair of which was restored after baldness. At the end of so many failures, I am completely undeceived as to the value of all the preparations, and I would not now recommend any one of them, because I would be afraid to commit the crime that is designated by the words, "obtaining money under false pretenses." In my pathological studies upon the hair, I have found that people who perspire a great deal from the head are apt to get bald. The bad habit of wearing hats indoors is also very hurtful to the hair. In 1806, after the famous battle of Jena, in which the Prussians were completely defeated by Napoleon I., Baron Larrey, the celebrated military surgeon, perceived that many of the German prisoners were completely bald. Surprised, he made inquiries as to the cause of this, and he found that they owed their baldness to the shape—as homely as unhealthy—of their caps. The foul air of their head gear, having no issue, destroyed the vitality of the hair.

Disinfectants.

Professor Beilstein, who has recently studied the various substances used for disinfection, arrives, in a communication made to the St. Petersburg Technical Society, at the following conclusions: Sulphuric acid would be the best disinfectant if it did not destroy the sides of the tanks; the use of lime and of salts of lime ought to be completely renounced, as they but temporarily destroy bacteria, and under some circumstances may contribute to their development; nor does sulphate of iron, even in a solution of 15 per cent, ultimately destroy bacteria, as they revive when put into a convenient medium. Therefore, Professor Beilstein recommends sulphate of aluminum, which is used in paper and printed cotton manufactures. The best means for providing it is to make a mixture of red clay with 4 per cent of sulphuric acid, and to add to this mixture some carbolic acid for destroying the smell of the matter which is to be disinfected.

HULLING COTTON SEED.

Cotton seeds contain elements which are invaluable to the farmer as food for animals and as a fertilizer. The following table shows the relative value of different kinds of food, and, as will be seen, cotton seed stands highest on the list:

Kinds of Food.	Flesh Producing.	Fat Producing.
Turnips	1	5
Straw	3	16
Potatoes	3	17
Hay	8	50
Rye	11	72
Oats	12	63
Corn	12	68
Beans	22	60
Linseed cake	28	56
Bran and coarse mill stuff	31	51
Decorticated cotton seed meal	41	77

The importance of cotton seed as a food for animals is thoroughly recognized by Southern farmers, and its value as a fertilizer is unquestioned; but to utilize this article to the fullest extent it requires hulling, as the hulls are injurious to animals, and retard the decomposition of the seeds when used as a fertilizer. In view of these facts the importance of an efficient cotton-seed hulling machine will be at once recognized.

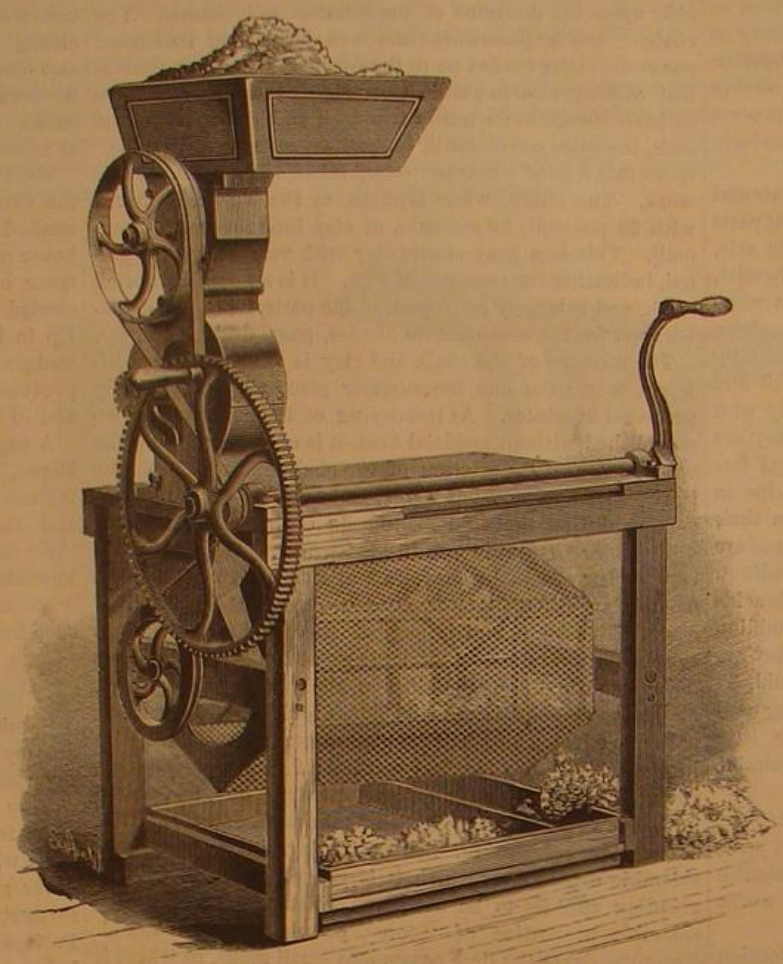
We give engravings of two forms of huller—a hand machine and a power machine—manufactured by Mr. David Kahnweiler, of 120 Center street, New York city. These machines have been largely introduced, and are favorably known all over the South. In addition to the sizes represented, Mr. Kahnweiler makes larger machines, having a capacity of 20 to 25 tons and upward per day. These machines are extensively used in oil mills. The smaller machines are used on plantations, the smallest ones being operated by hand, the larger by steam or horse power.

The judges at the Centennial Exhibition, in their report recommending the machine to the Commission for Awards, gave a very concise statement of the advantages of this huller, which we copy. It was recommended "for being well made and thoroughly efficient, supplying an increasing want on cotton plantations, namely, a means of preparing the cotton seed, by the removal of the shell and the cotton left by the gin, to be made into a highly valuable food. The mechanism is simple and the result satisfactory. The feed roller insures regular supply and prevents passage of nails, sticks, and other foreign matter which would injure the mill. The under roller or cutter head has a smooth surface, carrying eight knife sections; they are easily regulated to compensate for wear. The concave has three or four knives." The shell and kernel fall into a hexagonal revolving screen which permits the seeds to fall through, while the hulls are carried through the revolving screen and are delivered at the end. The hand machine has a capacity of 3 to 4 bushels per hour, and the power hullers for plantations will hull from 10 to 25 bushels per hour, according to the size. The steel knives on the cutter cylinder are made adjustable. The machine may be used to advantage in grinding and cracking corn, peas, etc.

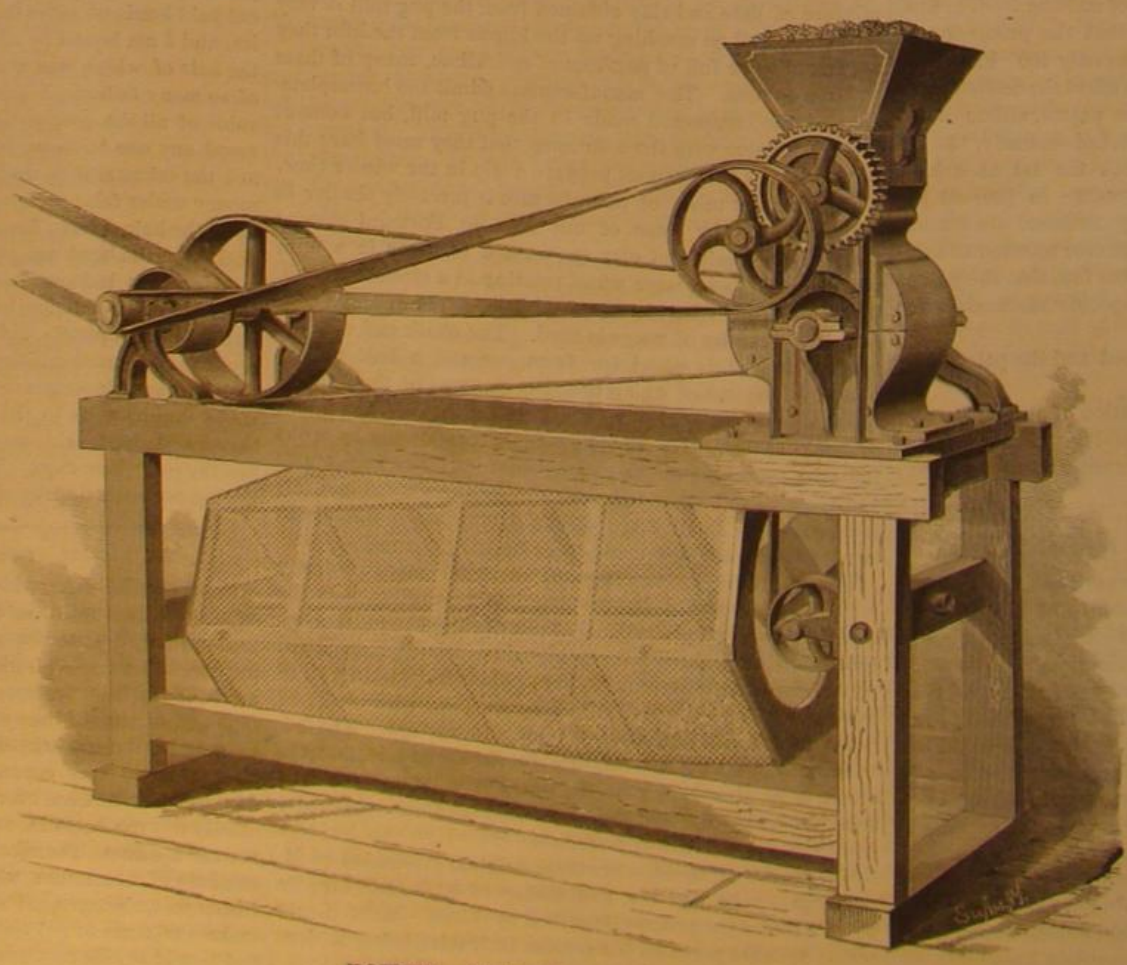
It is believed that these machines will save the planter hundreds of dollars every year, enabling him to prepare his own feed and fertilizer. The old process of preparing cotton seeds as a fertilizer by exposing them in heaps to the action of the elements for months is wasteful of the most important fertilizing elements, and besides this many of the seeds are not killed, and will sprout. By employing a cotton-seed huller the seeds are at once deprived of power to germinate and are ready for immediate use as a fertilizer, and all of their nutritious elements are retained.

If desired, the meal and hulls may be permitted to mix as they are discharged from the machine by simply removing the hexagonal screen.

One of the recent improvements made in this machine is the adding of a countershaft, rendering the entire apparatus self-contained.



HAND COTTON-SEED HULLER.



POWER COTTON SEED HULLER.

Progress in Japan.

Reviewing the industrial operations of the Japanese during the year 1880, the *Japan Mail* mentions the building of the Sapporo Railway; the two smelting furnaces at Kamaisi, delivering an output of some 700 or 800 tons of iron per mensem; the works of the harbor of Nobiru, almost completed; the weary tunnel at Kariyasu in Uzen, at last carried through; the great aqueduct from the Inawashiro Lake achieved, and an immense area of country irrigated; the building of ships on western lines at the two dockyards of Kawasaki and Tokiyo carried on with increased industry; silk-reeling establishments erected in the three prefectures of Hiroshima, Aichi, and Shidzoka; the port of Mikuni opened to shipping; the works on the Tsuruga Railway progressing vigorously; the outcome of the coal mines in Kiushiu augmented; the docks of Nagasaki unceasingly occupied; and mining industries exceptionally active.

An Old Battlefield Uncovered.

During the spring rains in Georgia the Coosa River overflowed its banks, and in one place washed the soil from a considerable area. After the water subsided the washed land was found to be an ancient battlefield and burying ground. Part of the territory consisted of mounds, evidently fortifications. These were strewn with implements of aboriginal warfare, beads, and earthen vessels.

The remainder of the ground was covered thickly with skeletons, all perfectly exposed, and all in good preservation.

A press dispatch from Rome, Ga., dated April 2, says: "The place is attracting crowds from all directions, and it is almost impossible to prevent vandalism from seriously impairing what will undoubtedly prove to science one of the richest 'finds' ever made on the American continent. Among the countless number of Indian pipes found is one of great size and exceedingly fine workmanship, the bowl of which is carved with great skill into the form of a human head."

MISCELLANEOUS INVENTIONS.

Dr. Christian Heinzerling, of Biedenkopf, Germany, has patented an improved method of converting hides into leather, consisting in subjecting them to the action of a compound containing chromic acid and then treating the hides by a solution of stearine or similar fats.

Mr. Joseph H. Clyde, of Atlantic, Iowa, has patented an improvement in pantaloons, the object being to prevent the protrusion in front and wrinkling in rear in the knee portions of the legs of pantaloons, and also the uneven wearing of the seat portion.

In the manufacture of scrap-books and other books of a similar character it is necessary to provide guards or spacings between the sections of the book, and this is usually done by inserting the sections between folded strips of paper, and the sections and strips being afterward secured together, the strips form the guard between the sections. Mr. Frank Bowman, of Brooklyn, N. Y., has patented a device which obviates these difficulties of manufacture, and reduces the expense, and produces a stronger and better appearing scrap-book.

A cheap, simple, and effective trap, to be placed over mole or gopher "runs," for the purpose of destroying the animals, has been patented by Henry W. Hales, of Ridgewood, N. J.

An improved chalk holder for billiard tables has been patented by Mr. John Jefferson, of Columbus, O. The invention consists of cords, weights, and pulleys attached to and moving in suitable casing and tubes attached to the gas fixture, chandelier, or other object over the billiard table, the chalk being suspended above the table by the cord. It may be drawn down to a convenient position for use, and when released will be automatically returned to place.

An improvement in cryptography has been patented by Mr. Charles G. Burke, of New York city. The invention consists in the use of four characters, differing in form or color, which, when used in combination with a scale consisting of three horizontal parallel equidistant lines and spaces, represent intelligible sounds, which are convertible into words and sentences, and may be substituted for and made the equivalent of the English language.

Messrs. Green E. Hood and Charles W. Tift, of Albany, Ga., have patented a cotton-seed planter and guano distributer so constructed that it can be readily adjusted to plant more or less seed, or distribute more or less guano, and to cover the seed to a greater or less depth, as may be required.

An improvement in wool carding machines has been patented by Messrs. William E. Bosworth and H. Wallace Bosworth, of Lexington, Ky. The object of this invention is to obviate the trouble experienced in carding machines from the wool getting under the creel spools and thereby becoming tangled, stretched, and broken; also, to prevent accumulation of wool on the guides of the carding machine where the rolls enter, so that free passage of the rolls shall not be hindered.

An improved watch-case spring has been patented by Mr. Joseph Canne, of Newport, Ky. The object of this invention is to provide a more durable watch-case spring, the spring part of which can be replaced, when broken, without renewing the body. This invention consists in forming the spring of sheet steel, having the thinner part toward the head instead of toward or near the body, as in other watch-case springs, so as to have the head on the most elastic part of the spring, and in lapping over the head instead of forging it, and in cutting away the lower edge of the spring portion for the purpose of increasing the elasticity of the spring and diminishing its stiffness. By using sheet steel for the spring no forging is required, and the strength of the spring is not

impaired, and by having the thinnest or most elastic part near the head the spring is not so liable to "stay back" after usage, as is commonly the case with springs of even thickness and with those that are thickest near the head.

THE STAG BEETLE AND CHAMPION BEETLE.

The common stag beetle (*Lucanus servus*) must have been known to the ancients, for Pliny says in one of his books on natural history: "Beetles (he calls them scarabei) have a hard covering over their feeble wings, but none of them have a sting. There is, however, a large family, which have horns, on whose points are two-pronged forks, which can be closed at will and are capable of pinching. They are hung on the necks of children as a charm." Rigidius calls them Lucanus. Moufet, who, in his "Insectorum sive Minimorum Animalium Theatrum," has collected with great industry all that was known about insects up to his time, describes the stag beetle, but believes that the same description will apply to the female; while Aristotle asserts that in insects the males are always smaller than the females. Now every boy who is acquainted with beetles and lives in a region abounding in oaks, where the stag beetles make their appearance, knows that those having horns are males, while the females have simply short curved mandibles in no way conspicuous. The most recent observations on other kinds of stag beetles have taught us that according to the scanty or abundant nourishment of the larvæ, the beetles turn out small or large, and this is especially true of the males. The horn-like mandibles of the smaller beetles through small development confers upon the whole beetle a changed appearance, in comparison with a fully developed one. We may, therefore, see in a single family medium and smaller forms, without bestowing on them special names, as in earlier times.

The stag beetle is the largest of the European beetles. The male has enormous horn-like jaws or mandibles, the tips being armed with antler-like projections, slender antennæ, the upper lip is bent downward, and the tongue is deeply slit. The color is a dull black, the wing covers and horns are a glistening chestnut brown.

In June these beetles are found in the oak forests, where on beautiful evenings the males fly with a loud humming noise about the tops of the trees, while the females keep themselves concealed. In the daytime they run among the dry leaves on the ground and betray their presence by their rustling, or they sit on the bleeding trunks of the oaks and lap up the sap. Chop gives an interesting account in his "Garten-laube" of their behavior at these feasts.

In June, 1863, while lying under the cooling shade of an old oak tree on a very warm afternoon, a peculiar rustling sound attracted his attention. A soft snapping or grating was heard at short intervals, as if small dry twigs were being broken. Shortly a blackish object fell from the tree to the ground; it proved to be a stag beetle, which he found after a long search in the act of creeping up the rough bark again. The rustling did not cease, and when the observer looked upward he saw, seven or eight feet up the trunk, a peculiar brown mass. In the course of half an hour eleven stag beetles, of both sexes, had fallen down one after another, and because the crackling sound was still heard Chop procured a ladder in order to examine this remarkable appearance. A curious sight met his view. Upon a small surface the sap was flowing down from the old bark. To this dainty meal a very mixed company of insects had invited themselves as guests.

Large ants climbed busily up and down, dainty flies of all kinds sat together in crowded heaps, and hornets swarmed fiercely humming around the trunk. But the most conspicuous guests were undoubtedly the stag beetles. There were twenty-four individuals of them counted, those already captured not being reckoned. They played apparently the most important character at this banquet, and in spite of the sweet food did not seem to be in very good humor. Even the bold hornets avoided coming too near the powerful nippers of their clumsy companions, and held themselves at a respectful distance. The beetles fought a furious battle with one another, and certainly two-thirds of them contended together. The females, with their short, strong teeth, angrily bit each other in their struggle for the food. The contest between the males was especially interesting. Their horns were interlocked and projected over the neck shields of their antagonists, and they fought furiously together until one of the combatants dropped to the ground from sheer exhaustion. Sometimes a skillful fighter would succeed in seizing his opponent about the body, and with his head erected let him struggle in the air for a little while, and finally drop him. The observer, although near, was unnoticed, the fighters struggling and the victors licking the sap greedily. They seemed disturbed when the breath touched them, and the slightest noise, as the breaking of a twig, immediately affected the whole company. They would all raise themselves quickly and appear to listen. A similar thing would happen if one of the beetles that had fallen to the ground ascended the tree again and approached the others. In this case the males would move toward them with wide open mandibles eager to engage in a combat with them. Toward evening the greater part of the beetles buzzed away, and the crackling sound was much diminished when the observer left the garden at eight o'clock. The struggles of a male over a female are of a more serious and determined nature, as the deep impressions and perforations in the wing covers show.

At the end of June or the first days of July the short swarming time is past. The pairing takes place in the night, the females lay their eggs in the decayed wood of an old oak tree, and the hard remains of the dead bodies of the males lie strewed around. It may even occur, and has frequently been observed, that after the pairing the feeble males, while still alive, are eaten by the rapacious ants, the hard front of the body being robbed of the soft back part, and they drag themselves painfully along on their long legs, a singular habitation for solitary ants. The bodies of the females are seldom found, because few of them come forth from their brooding places, and because the females are much more seldom met with than the males, who are about six times as numerous.

THE STAG BEETLE AND CHAMPION BEETLE.

The larvæ grow very slowly, and are nourished by the decayed wood of the oak tree. It requires four or five years for them to attain their growth of about four and one quarter inches and the thickness of a finger.

Their appearance is similar to that of others of their family. They have four-jointed antennæ on the horn-like head; the last joint is very short. The anterior of the three rings around the body is imperfectly defined on account of the cross folds, and has six strong legs which are yellow like the body; the horny parts about the mouth are black.

These larvæ were without doubt known to the ancients, for Pliny says: "The large wood worms which are found in hollow oaks and called 'cossis' are regarded as a choice morsel, and are even fattened with meal." They must have long been in use as a means of nourishment, for Hieronymus says: "In Pontus and Phrygia large, fat, white worms with black heads, which are generated in decayed wood, afford a considerable source of revenue and are valued as very dainty food." The full grown larva prepares a firm case, as large as the fist, from the decayed splinters of wood, and smooths it out well inside. Three months sometimes pass before the larva assumes a chrysalis state and afterward becomes a beetle. From the hatching of the egg to the development of the perfect beetle requires about five years, some say six, and they enjoy for scarcely four weeks their winged existence. They may be kept in confinement by nourishing them with sweetened water or sweet beer.

Bültner mentions a swarm of stag beetles which were drowned in the Baltic and washed ashore. Cornelius gives an account of the great number of beetles which appeared in a limited locality at Elberfeld, in 1867, and thinks that every five years they will return again, and that the supposed developing time must be five instead of six years. Haaber mentions this and thinks this supposition is confirmed, as he observed a large number of beetles in 1862 and again in 1867 in the region of Prague.

Here, as at Elberfeld, they flourished in old oak stumps, which appear especially favorable to their propagation. It would be of interest for other regions to note the flying year of the stag beetles. These beetles extend over the whole of middle and northern Europe, and are only wanting in regions where there are no oaks.

The champion beetle (*Cerambyx heros*) may be seen on an oak stem with the stag beetle in our engraving. It is a magnificent insect, of a glittering black. The head is long, the eleven-jointed antennæ swell out in the third to fifth joint into a club-shape, and end in a long slender joint, which appears to be separated, and in the male is considerably longer than the body. The neck shield is grooved or wrinkled, and has in the middle a thorny point at the broadest place. The wing covers have a blunt three-cornered shield in front. The under part of the body is covered with silky hairs, and is silvery white.

The larva has a granulated horny shield on the back of most of the joints, and lives three or four years in the inside of decayed oak trees. The broad flat passageways in the decayed wood which they bore out wind in various directions next to the bark. A trunk which is already perforated seems to possess a particular attraction for the female, and the work accomplished by these colossal larva is enormous. The beetle emerges from the chrysalis in July, and is not seen by day; it only projects the points of its antennæ out of its retreat and speedily draws them back again if it is not approached very cautiously. The antennæ must project a long distance to enable one to bring the sly fellows to light. In most cases they will allow the points to be torn off before they can be drawn out of their retreat. After the sun has set they come out voluntarily and fly swiftly around, but not very high, in search of others of their family. The pairing ensues during the night, and the swarming time is, as with the stag beetle, a limited one.—*Brehm's Animal Life.*

EIGHTY-THREE thousand buffalo hides were sold at Miles City, Montana, alone, during the past fall and winter. At this rate the buffaloes will become extinct before long.

Wasting Color.

In looking over the imports of aniline dyes, and comparing them with the amount of goods dyed in this country, we are astonished to see how much more color we require to produce a certain shade than in the old countries. Does our cotton and wool require more coloring than foreign goods? There is no reason why it should, but where is the cause of this large consumption? We have principally to attribute it to the indifference of our dyers. If we look in our dyehouses, especially those which are connected with large establishments, we notice an almost constant stream of colored water of all shades running into our rivers, thus actually throwing away large amounts of money, which might be saved by very little care and attention. It might be the easiest way for the dyers in large dyeworks, after they have acquired the desired strength of their color, to let the liquor which remains in the dyebath simply run away, especially if a color of the same shade should not be immediately wanted again. But could not this color be saved and worked over again and be used afterwards? We have noticed in large dyeworks a constant stream of blue water running into the river, which would surely carry with it at least one pound of dry blue every hour. This is worth saving, even if some care and trouble is needed. If these dyeworks would arrange cisterns large enough to hold the remainder of one certain color, and give it time to settle or precipitate the coloring matter with some chemical agent, a large amount of money could be saved. It might look at the first glance on this matter that this idea might not be very well carried out in large dyeworks, where so many shades are produced every day. It might need too many cisterns and too much extra work to make it pay; but *a trial* would not cost too much, and practical experience would bring the matter into a very easy state of working.

This might be a practical idea: After every dyeing process, when the liquor of a certain color is no more needed, collect it in a barrel, and add to it the same color every time during that day. Let stand for at least two or three days or longer, if the capacity of the establishment allow of it. Then draw off the liquor through holes in the barrel into a second one, and a large amount of color, in paste form, will be found at the sides and on the bottom of the barrel. This collect carefully, and dry. The barrel is, without washing out again, used for the same color and the whole commenced in the same manner again. The dry color, although sometimes not as good and bright as in its original state, will do very well for dark shades. Many dyeworks will be able to save in this manner up to one third of the color, which is certainly inducement enough to give the matter a thorough trial.—*Textile Colorist.*

A New Thermograph.

Dr. A. Wellington Adams, of Colorado Springs, has invented a new form of thermograph, which is designed for measuring and recording automatically the heat of the human body for a given or indefinite length of time. It is said to be a very ingenious contrivance, and is based upon the principles advocated by Breschet. There has long been need of an apparatus which would register accurately the rise and fall of temperature during sickness, the system in use being sadly limited by many imperfections and the very narrow range of its applications.

The thermometer proper in Dr. Adams' instrument consists of a spiral spring made of two lamellæ of brass and steel respectively, soldered together, the brass occupying the outer side. As this spring expands uniformly with equal increments of heat, the brass, the more expansible of the two metals, will, upon a rise of temperature, give a platinum knob attached to the free end of the spring a concentric twist. In this way there is produced a varying pressure upon the contents of a vulcanite tube against which the knob impinges. The vulcanite tube is filled with a powder made of finely divided plumbago, gas carbon, and silver, and these contents, at the other extremity of the tube, abut against a platinum knob attached to a hard rubber bracket. The whole is inclosed in a circular, perforated German silver case, with rounded edges. The two platinum knobs are placed in electrical communication by means of binding posts. When the apparatus is introduced into an electrical current the latter enters through one of the binding posts and emerges at the other, passing in its course through the substance in the vulcanite tube. Two handles are provided at the sides of the thermometer for securing it in proper position in the axilla. The salient feature of the apparatus is the changing of its electrical resistance with pressure, and the ratio of these changes, moreover, corresponding exactly with the pressure, the latter, in turn, being dependent upon and in unison with the rise and fall of temperature.

By subjecting this instrument to varying degrees of temperature the resistance of the powder varies in precise accordance with the pressure exerted by the uniform expansion of the spiral spring under equal increments of heat, and consequently a proportionate variation will be produced in the strength of the current. The latter possesses, therefore, all the character of heat waves, and, by its reaction through the medium of an ingenious electro-magnetic piece of mechanism devised by Dr. Adams, these are transferred to a movable surface, in the form of a sinuous line whose rising and falling inflections give a graphic representation of them. Not only is it possible with this instrument to procure a continuous curve denoting the constant febrile condition of a subject, but, with the addition of certain accessories, now in process of construction, there may be procured on the same strip of paper, at the same time and under similar conditions, a sphygmographic and a respiratory curve, thus enabling pathologists, therapeutists, physiologists, and, in fact, general practitioners to study the inter-relationship of these three cardinal symptoms under various modifying circumstances. The inventor feels confident that he shall be able to make additions that may also furnish a moisture curve.

Correspondence.

History of the New Mineral "Hiddenite" So-called.

To the Editor of the Scientific American:

I have seen the various articles in your paper touching the discovery of the new mineral as above. I discovered this mineral at White Plains, Alexander County, N. C., in 1876, and collected it as a beautiful variety of diopside, associated with beryl and other minerals. Shortly after its discovery I sent a number of specimens to different mineralogists, among these Prof. N. Spang, of Etna; and some time after that, or in 1879, Prof. W. E. Hidden came to Statesville with a letter of introduction and recommendation to me. I showed him my collection, and showed him some of this mineral, *which was the first he had ever seen.* I then took him to White Plains, and showed him the locality where I had been collecting this green mineral. Prof. Hidden went away, and some time after that returned with another gentleman. They called to see me, and Mr. H. remarked that they were going to take a ride. He, accompanied by his companion, then went, without my knowledge or consent, to the locality which I had shown him, and leased the land.

Up to this time the mineral had been pronounced diopside, but when Prof. Hidden commenced work upon the lease he sent some specimens to Prof. J. Lawrence Smith, who examined it and found it to be a new mineral, and wrote to Prof. Hidden, proposing to call it "Hiddenite." I at once, upon learning of this letter, wrote to Prof. Smith, informing him that I had discovered the mineral about three years before Prof. Hidden came to North Carolina, and asked if I, as the discoverer, did not have the right to say what it should be named (intending to call it "Mitchellite," in honor of the late Rev. Prof. Elisha Mitchell, D.D., of this State, an able and devoted scientist). Prof. Smith's reply of November, 1880, led me to believe that the mineral would have no distinctive name, but would only be called spodumene, so I let the matter rest until I saw his article in the *American Journal of Science* for February, describing the mineral and conferring the honor of the name upon Prof. Hidden, and so wording the article as to deprive me of the credit of the discovery. I. A. D. STEPHENSON.

Statesville, N. C., April 2, 1881.

The Fusing Disk.

To the Editor of the Scientific American:

In your paper of the 16th inst. I find a reprint (with cuts) of an article from *Engineering* (London), relating to the fusing disk. I have written *Engineering* that the statements made in the article are so astonishing, and the work exhibited is so radically different from any that I have ever seen produced by the fusing disk, that I think the gentlemen who furnished the article and cuts and made the statements contained in the article have made a mistake, and I asked for their address that I might give them attention first.

In answer to Mr. Emerson, permit me to say that I do not feel called upon to specifically answer in detail every article published relating to the fusing disk, or the theory which I, at the urgent request of many eminent scientists, have advanced, explaining the phenomena exhibited in its operation, as the machine and theory are now being considered in all civilized countries, as my receipts of letters and scientific journals show. But I will from time to time explain my theory, and will cheerfully accept the result of its discussion, whatever that may be.

I call the machine a fusing disk because I conceive that the material operated on is changed instantly from the solid state to the fluid state. I conceive that the change of state occurs because the material disengaged from the solid bar operated on flows downward and welds into a solid mass (nine inches below the point of fusion). I consider fusion simply as a phenomenal indication of the degree of intermolecular velocity, as temperature, luminosity, and incandescence are phenomenal measures of molecular velocity; therefore, whatever increases molecular velocity tends to bring the metal nearer to the *velocity of fusion.*

Not a single atom composing a molecule, nor a molecule composing a physical structure in the universe, is at any time in an absolute state of rest.

Matter *per se* is inert; its energy is derived from the physical forces. The force of attraction is inherent in the atoms, *and can neither be increased nor diminished.* It tends to draw the atoms together and hold them in a state of rest. The force of caloric accompanies the atoms. *It may be increased or diminished;* and tends to push the atoms apart into a state of activity. By virtue of the resultant force so exerted, the atoms composing a molecule, and the molecules composing a physical structure, are held at a certain distance from each other and kept in a continuous state of activity.

The force of attraction being inherent, its energy is exerted in an inverse ratio with the distance of its object, hence its greatest power is exerted when the atoms and the molecules are nearest to each other, and least when they are furthest apart. The change of distance is the result of the activity of the atoms and the molecules. An increased motion separates them, and a decreased motion brings them nearer together.

When the molecular velocity of a body is of that low degree that the *molecular resultant force exceeds the force of gravity,* the molecules remain in a relative local position to each other, and are said to be in the solid state. Now, when the molecular velocity is increased to that degree so as to separate the molecules to such a distance from each other that the molecular resultant force which holds them together is reduced to a less measure than the force of gravity, the molecules are no longer held in a correlative position; they become mobile, and gravitate into the fluid state. And this is what I call fusion.

The essential requisite of fusion, therefore, is *the molecular velocity of fusion,* and I conceive that this is attained in the fusing disk as follows: A *round bar* of steel is placed in front of the disk and caused to revolve at the rate of 200 revolutions per minute. The disk is revolved at a rate equal to a peripheral velocity of 25,000 feet per minute. The atmosphere, pressing against the sides of the disk at nearly 15 pounds to the square inch, is thrown outward. The increased velocity of the air separates its molecules to a greater distance, and they abstract additional caloric from the surrounding atmosphere. This column of air, surcharged with caloric in proportion to its velocity, is carried around the periphery of the disk at the rate of five miles per minute. Now, when the revolving bar is brought into close proximity to the disk, the passage of the air is retarded, its velocity reduced, and the molecules approach nearer to each other. This unlocks the surcharged caloric, and it becomes sensible heat, which enters the bar and increases its intermolecular activity to the velocity of fusion. The fused metal flows away and a fresh point of the bar is continually presented to the disk. In addition to the caloric unlocked from the air, a portion of the metal oxidizes, which furnishes additional caloric, which, with the impact of the air traveling at a velocity of five miles per minute, keeps up the velocity of fusion in front of the disk until the bar is severed in two.

Now, gentlemen, please remember this is only a theory based on my limited knowledge of molecular physics, and in your criticisms don't be personal, but let us endeavor to increase our knowledge of the physical forces which energize the universe. JACOB REESE.

Pittsburg, Pa., April, 1881.

Medical Properties of Sulphocyanide of Mercury.

To the Editor of the Scientific American:

Inasmuch as many inquiries have been elicited by your publication of item regarding the medical properties of sulphocyanide of mercury in certain affections of air passages of the human body, as more fully specified in your issue of April 9, 1881, and inasmuch as your generous impulse led to a more pretentious heading to the article in question than was intended by the insertion of the word "catarrh," it is hoped you may not be indisposed to add these few lines in explanation.

The prevalent idea attached to the term "catarrh" lies in an entirely different direction from the line and scope of experience indicated in the article in question. It is doubtless safe to say that nothing whatever is known as to the action of the compound under consideration in connection with "catarrh" in the popular sense of that term.

Judging from letters of inquiry from different parts of this country, it seems probable that some may endeavor to make the substance in their own way. Let not any unskilled manipulator undertake the production and preparation of this compound for his own use or that of his friends; the chances are altogether in favor of his finding something decidedly more "snaky" and poisonous than the veritable "eggs of Pharaoh's serpents." The substance for use, as suggested by experience, must be pure sulphocyanide of mercury; from the *per*-nitrate, not *proto*-nitrate, and washed until there be no acid reaction. The use of this in the manner and quantity and for the purpose indicated in your issue of April 9, 1881, will be attended with prompt and effectual relief, and without the slightest injurious results.

J. DE WALDEN CHURCHILL.

Richmond, Va., April 10, 1881.

Ammonia for Preventing Petroleum Fires.

M. Schlumberger has communicated a note to the Société Française d' Hygiène on the "Automatic Extinction of Petroleum Fires." Many accidents are caused, he says, chiefly by the igniting of this substance through imprudence. The druggist, for instance, in going into the cellar where the oil is kept does not always take proper precaution, and the result is that a disastrous explosion often takes place. He proposes a method of extinction in this and similar cases which he recommends shall be made compulsory under police regulations. His plan is to place on each barrel of petroleum a large bottle of liquid ammonia, so that, at the least explosion or on contact with the flames, the glass will be broken and the vapor of the liberated ammonia will form an automatic mode of extinction. The author states that he speaks from practical experience, and that he has frequently been indebted to ammonia for safety while conducting distillations of a dangerous character. He suggests that the plan should be extended to mining operations, and that easily broken vessels filled with ammonia should be stored wherever there may be a risk of accident from fire-damp explosions. Carbonic oxide cannot burn in an ammoniacal atmosphere.

THE COLORS OF THE STARS.

The constellated regions of the heavens, says the astronomer Niesten, in *Ciel et Terre*, offer an exceedingly vast field for the investigation of all those who desire to see progress made in astronomical science; and the most varied and interesting questions crowd themselves upon observers for examination. Among these the study of the coloration of the stars holds one of the most important places, not only for the attraction that it offers because of its novelty, but for the facility with which it may by pursued, and for the importance, especially, of the scientific questions connected with it.

If, on a fine evening, we raise our eyes toward the starry vault, we are immediately struck with the diversity of size, or rather with the brilliancy, which the stars exhibit. If we bestow a little attention on the subject we shall be readily convinced that these worlds or unknown suns, which are commonly said to shine with a whitish light, emit rays of the most varied colors. If the observer compares with each other the most brilliant stars—those of the first magnitude—*Procyon* and *Altair* will appear to him of a dazzling white; *Sirius*, *Vega*, *Castor*, and *Regulus*, of a white slightly tinged with blue; *Aldebaran*, *Betelgeuse*, and *Arcturus* will be orange; *Pollux* and *Alpha* of Cetus will appear yellow; and *Antares* and *Alpha* of Hercules will be orange red. Among the stars of the second magnitude *Epsilon*, *Zeta*, and *Eta* of Ursa Major will appear white, while *Alpha* will be distinguished by its yellowish color. In Ursa Minor, *Alpha* or the Polar Star will be seen to be yellow, and *Beta* yet more so. Castor will be found to emit greenish-white rays, while those of *Eta* are of a pronounced blue. Finally, if the observer makes use of a telescope, there will be seen thousands of stars exhibiting to him the same diversity of color.

According to Sir John Herschel, there is, near *Kappa* of the Southern Cross, a remarkable group formed of one hundred and ten stars, the principal ones of which, scarcely of the eighth magnitude, exhibit the greatest diversity of colors: one is of a bluish-white, two are red, two are green, and the three others are of a pale blue. It is an extremely brilliant and beautiful object, says Sir John, and the stars which compose it, when viewed through a telescope of sufficient power to distinguish their colors, have the aspect of most exquisite jewels.

These different colorings are not limited to certain particular stars, but we may observe in certain constellations nearly all the stars having the same tint. Libra and Eriadnus contain a large number of stars which are yellow. The principal stars of the beautiful constellation of Orion exhibit a color of a decided green, while the majority of the smaller ones are of a blood-red. Dunlop, in his catalogue of southern stars, refers to an extensive group, all of whose stars are blue.

By using a sufficiently powerful telescope, the observer will be enabled to separate certain stars which to the naked eye appear single, and he will then be struck with the richness of the coloring, and especially with the notable difference of color which in most cases exists between them. Some, and indeed the majority of them, will show him the principal star colored either yellow or white, while its companion is one of the shades of white, yellow, or red, or else is tinged with purple, as in *Eta* of Cassiope, or with sapphire-blue, as in *Beta* of Cygnus. In others the two components are orange, or else one is orange and the other blue, as in *Theta* of Centaurus, or green, as in *Epsilon* of Bootes and *Gamma* of Andromeda.

In some stellar systems we find white contrasted either with purple, as in *Delta* of Orion; or with green, as in *Zeta* of Corona Borealis; or with blue, as in *Pi* of Andromeda, *Lambda* of Ophiucus, *Psi* of Cygnus, and *Delta* of Bootes; or with yellow, as in *Gamma* of Delphinus; or with red, as in Twelve of Coma Berenices. In other systems of double stars a white color is met with in both components, as in *Alpha* of Gemini and *Gamma* of Virgo. Red is associated with blue in *Antares*, *Eta* of Perseus, *Omikron* of Draco, etc., and garnet with blue in *Omega* of Auriga, and with green in *Alpha* of Hercules. Finally, Fifty-three of Ophiucus, *Mu* of Draco, *Delta* of Ophiucus, and Fifty-five of Coma Berenices, are formed of two bluish stars, while *Alpha* of Pisces and *Sigma* of Cassiope each consists of one blue and one green star.

Upon the whole, in the light of the stars—those distant suns which probably illumine other worlds that are as yet unknown to us—the observer will possibly meet with all possible combinations of the principal colors along with their extended scale of tints. He will then ask himself whether these colorings are indeed real; whether all these tints, so harmonious in juxtaposition, are not the effect of contrast; and whether all these sparkling fires of ruby, topaz, and sapphire are not perhaps optical illusions merely. Having assured himself on this point, he will endeavor to learn whether these stars do not exhibit in their coloration a short period of variation or a secular one, as has been ascertained already with regard to the intensity of their light. The effect being known, he will strive to learn the cause, and perhaps will succeed in finding, in these differences in the intensity of luster and coloring, some indices that shall aid him in extending the knowledge which we possess in regard to the stellar world.

Remarkable Nugget of Platinum.

Mr. P. Collier states, in the *American Journal of Science and Arts*, that he has in his possession a nugget of platinum said to have been found near the village of Plattsburg, N. Y., and the weight of which is 104·4 grammes (about 3¾ ounces). Its composition by weight is 46 per cent native platinum and 54 per cent chromite. The occurrence of the platinum metals in the St. Lawrence valley has long been known, and the presence of extensive deposits of chromite and its mineral associate, serpentine, in the same general locality is well established; but so far as known the nugget under consideration appears to be remarkable not only for its size, but also as an indication of the probable presence of this metal in a locality hitherto unsuspected. On visiting the locality where this and several other specimens were found, Mr. Collier found it to be a drift deposit of considerable extent.

RICHLY DECORATED VASE.

The accompanying engraving represents a porcelain vase of French manufacture highly ornamented. The central

FRENCH PORCELAIN VASE IN ALTO-RILIEVO.

object is composed of game and a huntsman's paraphernalia in high relief.

The vase, in addition to the richness of its decoration, which unfortunately cannot be shown here in its many colors, is, as the reader will observe, symmetrical in form and artistic in design.

Constipation.

Dr. S. H. Price (*Medical Brief*, March, 1881) says the following combination has never failed to relieve constipation, in his experience, when the person is otherwise healthy: ℞. Ext. cascara sagrada, fl., f. ʒ j.; tr. nuc. vom., f. ʒ ij.; ext. belladon., fl., f. ʒ ss.; glycerine, f. ʒ j. M. Sig.—Teaspoonful night and morning, as necessary. He has used this in all ages, from the three weeks' infant to the octogenarian, changing dose to suit age.

A New Liquid Hydrocarbon.

The announcements multiply respecting the extraordinary properties of the inflammable hydrocarbon liquid introduced by M. Friedel. The *Journal de l' Eclairage au Gaz* states that at a recent meeting of the Société d'Encouragement des Arts, etc., some remarkable experiments were made with this liquid, which boils at about 100° Fah., and is said to burn with a brilliant white flame of a comparatively feeble temperature. On the occasion in question, a large can containing a supply of the liquid was set on fire by applying a light to its mouth, the spirit was then poured while flaming into lamps. The flame, spreading on all sides, simulated the beginning of a great conflagration, but was eventually extinguished by the lightest puff of wind. Any one in need of a light, but without a lamp for properly burning this liquid, may do so by dipping the corner of a pocket-handkerchief or the finger of a glove into it; and thus may be made a temporary torch, which when blown out will be found to leave the improvised wick without the slightest injury. Lamps intended to burn this spirit are constructed in such a manner that they are extinguished if thrown down. It is said to be extremely difficult to form an explosive mixture with the vapor of the new spirit and air, and that in any case the explosion cannot be made violent. The liquid has a slight and not disagreeable odor, and is not dear. It is sold at present at 1 franc per kilogramme (8 cents per pound), and its production is said to be unlimited. It has on other occasions been said to be a product of the Galician mineral hydrocarbons.

Mariette Bey.

Mariette Bey, the celebrated Egyptologist, who died this winter at Cairo, was born at Boulogne-sur-Mer in 1821. In the year 1847 he began to undertake, in his native town, the study of Egyptian hieroglyphics; and, although he possessed very few books to guide him in his researches, made himself master of the principal difficulties to be encountered in the science which Champollion was chiefly instrumental in creating.

In 1850, upon the recommendation of the Institute of France, Mariette Bey, who was attached to the Egyptian Museum of the Louvre, where his knowledge was much valued, was charged with a scientific mission to Egypt with the object of searching out and examining the Coptic manuscripts preserved in the convents; but scarcely had he arrived at Cairo than his attention was drawn to ancient Memphis, whose monuments lie covered by the sand near to the pyramids. Assisted by the guidance obtained from the authors of antiquity, he began excavations and discovered the Serapeum, the sanctuary of the god Serapis, the tombs of the Bull Gods, as well as other archæological remains of the greatest interest.

Spending four years in the midst of the desert he continued his excavations at Memphis, at Abydos, and at different places in Upper Egypt and Nubia. He unearthed the famous colossus of the Sphinx, which is cut, as is known, in a natural rock at the foot of the pyramids of Ghizeh, and brought to light a number of bass-reliefs, inscriptions, and gold and silver ornaments.

On his return to France, Mariette Bey was made conservator of the Egyptian Museum at Paris. In 1858 he undertook the direction of the excavations in the valley of the Nile, and made fresh discoveries.

We owe to him the unearthing of the Temples of Edfou, Karnak, Medinet Abou, and also the foundation of the Museum of Boulag, at Cairo, where he has been engaged during the last few years in arranging all the valuable objects which have been brought together by his energy and skill. In 1873 the Institute of France awarded him its biennial prize of 20,000 francs.

For some years the health of Mariette Bey had been much affected, and it may be said that he died in harness—a victim of his devotion to archæology. —*The Architect.*

Mines in Maine.—Cinnabar.

It has at last been generally admitted that we have *mines* in Maine. We have not, to be sure, been able to show deposits of fabulous richness—ores assaying thousands of dollars to the ton or "chunks of native silver as large as a man's head"—but it has been abundantly proven that Maine contains bodies of silver and copper ores which, with skilled labor, suitable machinery, and honest management, may be mined and sold at a large profit. What more could be asked? It is also a fact that more than two-thirds of our territory has never yet been prospected, although, from time to time, specimens of native gold and rich ores of silver and copper have been brought to us from the almost unknown regions of the State. We have recently seen a piece of pure cinnabar weighing nearly a pound which was taken from the surface with a pick less than 100 miles distant from Bangor.—*Maine Mining Journal.*

Tomato Canning.

The Baltimore correspondent of the *Grocer* estimates the total pack of tomatoes last year in this country at 38,400,000 cans, costing the packers $3,200,000. The business was distributed as follows:

	Cases.
In Baltimore and Hartford County, Md., and other parts of the State and Virginia	330,000
New Jersey	320,000
Delaware	180,000
New York	165,000
Massachusetts, Connecticut, Rhode Island	155,000
California	50,000
Ohio	80,000
Pennsylvania, Michigan, Iowa, Indiana, and other Western States	120,000
Total number cases	1,600,000

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. A. M. asks: Is there any instrument made for determining the moisture of soils? A. We know of no special instrument for this purpose. The moisture is usually determined by weighing accurately a small average sample of the soil and then drying it at 212° Fah., until it ceases to lose weight. The difference between the first and last weights corresponds to the weight of moisture.

(2) H. K. T. asks for a formula for a paste which will cause labels to adhere to tin without first brushing the surface of the metal with hydrochloric acid. A. Try the following: Water, 1 pint; borax, 1 oz.; shellac, 5 oz.; boil until the latter is dissolved. Thin with boiling water if desired. It works most satisfactorily while hot.

(3) E. P. M. asks: Can you give the formula for preparing good common logwood chrome ink? A. Distilled water 1,000 parts (by weight); logwood extract, 15 parts; carbonate of soda (cryst.) 4 parts, chromate of potassium, 1 part. Dissolve the logwood extract in 900 parts of the water by aid of heat, and let it stand to settle; draw off the clear liquid, heat to boiling, and add the carbonate of soda; lastly add, drop by drop, with constant stirring, the chromate (yellow chromate) previously dissolved in 100 parts of water. The color is not fully developed at once, but on standing for a few hours gradually deepens to a full bluish-black. The ink thus prepared flows well and dries quickly. The addition of a trace of clover oil will prevent mouldiness.

(4) S. R. J. asks (1) for a receipt for silver wash. A. The following bath for silvering by cold dipping gives excellent results: Dissolve in a small quantity of cold water an ounce of fused nitrate of silver, and gradually add, with constant stirring, a strong aqueous solution of good bisulphite of soda until the precipitate at first formed is just redissolved. A momentary immersion of the thoroughly cleansed articles (copper, brass, or bronze) is all that is necessary. 2. Electro silver plating. A. See article on Electro-metallurgy, page 81, current volume.

(5) J. K. asks (1) if there is any such thing as waterproof powder. A. We know of no waterproof gunpowder. Dynamite, dualin, gun cotton, and other blasting substances are not affected by water, but they are unsuitable for use in fire arms. 2. How long will powder last in an air-tight cartridge? A. If put up in a dry airtight cartridge ordinary powder will remain unchanged for an indefinite period. 3. Give the name of the best powder to use. A. Common war powder—*a*. Saltpeter, 75 parts; sulphur, 10 parts; charcoal, 15 parts. *b*. Saltpeter, 75 parts; sulphur and charcoal, each 12½ parts. Sporting powder—Saltpeter, 76·9; sulphur, 9·6; charcoal, 13·5. Blasting powder—Saltpeter, 62; sulphur, 20; charcoal, 18. See column of Business and Personal and Hints to Correspondents.

(6) E. K. B. writes: 1. Referring to SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, what are the long terminal points of the induction coil made of? A. Brass. On a large coil they might be tipped with platinum with advantage. 2. How are carbons made as for Bunsen battery? Will you please give the degrees of heat, etc.? A. Powdered coke or gas carbon is mixed into a uniform paste with thin coal tar, moulded by pressure, dried slowly in an oven, and then gradually heated to whiteness in muffles which exclude air. Repeated soaking in thin tar and reheating makes the surface hard and dense.

(7) C. F. M. asks: 1. Can dry plates be worked by Newton's process in a room lighted through yellow panes of glass? A. Yes. 2. In any photographic process, what is the exact color and shade of the glass which should be put in the window of the dark room? A. A clear dark yellow approaching orange. 3. Will not colored sheets of gelatine do as well as glass? A. Yes.

(8) E. F. C. writes: Some time ago you published a formula for a concentrated fertilizer to be used on potted plants, etc. Among the ingredients was biphosphate of ammonium. As no drug store or chemist's shop here has this chemical in stock, and no work on chemistry that I have consulted makes mention of it, I would be obliged to you if you would give the formula for making it. A. Macerate, for twenty-four hours or more, 81 lb. fine bone ash with 147 lb. strong sulphuric acid: dissolve 24 lb. carbonate of ammonia (or a quantity of ammonia water containing 18 lb. real ammonia) in 15 gallons of soft water, and gradually stir in the paste. After standing several hours draw off the liquid portion, agitate the remainder with a little fresh water; let settle, draw off the clear liquid, add it to the first liquid drawn off. If desired boil down this solution of acid ammonium phosphate until it will solidify on cooling. The portion insoluble in water is chiefly lime sulphate.

(9) J. M. H. asks: 1. Is there any difference in a troy ounce and an avoidupois ounce? A. The troy pound contains 5,760 grains, the avoirdupois pound 7,000 grains; the troy pound contains 12 ounces of 480 grains each, the avoirdupois pound 16 ounces of 437½ grains. 2. What is the lifting capacity of one cubic yard of hydrogen gas? A. A cubic yard of air at 60° Fah., weighs about 11 ounces (avoirdupois), a cubic yard of hydrogen about ¾ ounce; the difference or "lifting power" is therefore about 10¼ ounces per cubic yard of gas. 3. Will hydrogen penetrate common tin, or waste if confined in such a vessel? A. Hydrogen will not penetrate tin or tinned iron.

(10) E. E. T. asks: 1. How can I take a gallon of silver solution and find out how much silver and cyanide it contains? A. Draw off two half-ounce samples, and to one add gradually (in the open air to avoid inhaling the fumes) about two ounces of pure hydrochloric acid, shake together, heat to boiling, and let settle. Decant the liquid, throw the precipitate on a small filter, wash with hot water, cover and set aside in a warm, dark place to dry; when dry weigh on an accurate balance, and multiply the weight by 153·6—the result is the weight of metallic silver (approximate) per gallon of solution examined. Evaporate the other half ounce to dryness, weigh, multiply by 192, and deduct the weight of silver found. The result (if the bath was plain silver potassium cyanide solution) will indicate the weight (approximately) of cyanide of potassium per gallon of solution. 2. Will the same rule work on a copper and gold solution? A. No. 3. What can I dip brass into to turn it black without destroying the surface of the metal? How do they get the deep yellow color so much worn on jewelry? A. Dip the article bright in nitric acid, rinse, and place it in the following solution until it turns black: one ounce each white arsenic and iron sulphate and twelve ounces of hydrochloric acid; rinse, dry in sawdust, and polish with black-lead or lacquer. See article on Electro-metallurgy, page 116 current volume.

(11) A. F. writes: My table gives size of drive pipe for No. 5 hydraulic ram, 2 inches; discharge pipe, ¾ inch. My friend claims I cannot use a larger discharge pipe. I claim it makes no difference what size is used after leaving nozzle of ram, whether ¾ inch or 36 inch, save that there would be less friction in using the larger pipe. Which is right? A. You are right. Strictly, the proper proportions depend upon the relative height from which the water is received and that at which it is delivered, but makers have satisfied themselves that for general use, the delivery pipe should be about half the diameter of the receiving pipe, and so make them.

(12) R. Q. T. writes: 1. We desire to supply our town with water; have a reservoir about 120 feet above the town, 4¼ miles distant—area 100 acres, depth 30 feet. What size of pipe will we need to supply, say, six hydrants in case of fire? A. 10 inches. 2. To what elevation can water be thrown? A. About 70 feet, depending upon length of hose. 3. What should be the size of the mains to furnish water to a population of 10,000? What would be the probable consumption for three months in the winter? A. Allow 35 gallons per day for each inhabitant. The above are only approximate. If you wish accurate information you should employ a hydraulic engineer to survey, examine, and estimate.

(13) W. M. A. wants information in regard to preparing brimstone in a paste form. I am engaged in working what they call locust timber into wagon hubs, and I want something to fill up the cracks or checks in the timber. Brimstone is cheap and it is the same color and it becomes hard. A. Heat the sulphur in an iron pan over a moderate fire until it melts to a thin liquid; too much heat thickens it. On cooling the sulphur regains its former appearance and qualities. It can be used advantageously in the liquid form as a filler.

(14) J. C. A. asks: How may I increase the cold of an ice box? My experiments teach me if I apply salt to ice in open air the ice will melt. Now, if I should make an ice box, and confine the ice crushed with salt, mixed in tubes, would the salt have the same effect on the ice, or would it have the opposite tendency and save the ice? A. Other conditions being equal, salt will liquefy ice in a closed tube as quickly as in the open air. The volume of salt ice water resulting will not absorb a greater total quantity of heat than the ice from which it was produced, though the salt liquid will be sensibly much colder than ice at first. Ice liquefied by salt in tubes will freeze water surrounding them, but the ice thus produced will be considerably less in quantity than the ice melted by salt to produce it. There is no way by which ice may be melted by chemical means without making the ice water unfit for potable purposes. See Tyndall's "Heat as a Mode of Motion."

(15) A. A. D. writes: In the SCIENTIFIC AMERICAN, of February 5, 1881, page 87, in article entitled "Filtration and Decolorization," by C. G. Pfander, London, occur the following sentences: "Three parts dried clay to four of blood, sometimes vegetable charcoal is added. The mixture is moulded into lumps, dried, mixed with equal bulk of granulated clay, and then carbonized in a retort." If blood is carbonized are not its peculiar cleansing qualities destroyed? I supposed the albumen of blood, coagulated by heat, formed a drag net or screen, which swept impurities to the surface of the liquid. Would not clay mixed with molasses and then carbonized answer as well as clay mixed with blood and then carbonized? It would obviate objections and difficulties. A. The product is similar in its action to the animal charcoal used extensively in sugar refiners' filters. It does not depend upon the action of albumen, but upon the decolorizing action of animal charcoal in a finely divided state. Blood or albumen clarifies by removing suspended impurities; charcoal chemically deprives of coloring matter, etc. Clay and molasses would not answer as well.

(16) A. G. asks for a recipe for a preparation known as Allen's crystals for the bichromate battery. A. To 3½ oz. of finely powdered bichromate of potassium (or ammonium) gradually stir in 1 oz. cold sulphuric acid, and rub thoroughly together.

(17) J. C. asks for a deodorizer for benzine and the proportions. A. Agitate it violently and repeatedly with about three per cent of sulphuric acid, let stand a few hours, draw off the clear portion, and slowly redistill, the vessel receiving the distillate being replaced by another from time to time. Select the contents of those receivers containing the portions freest from odor and discard the other portions.

(18) H. F. B. asks: 1. How are the leather packings for hydraulic jacks pressed or formed to prevent fulling at the edges? A. The leather is well softened in water, and then pressed in cast iron formers and dried. 2. How can I straighten a long two-inch brass tube which is slightly bent? A. Draw the tube carefully on the hollow side.

(19) M. B. asks (1) how to braze steel wires without a blowpipe. A. This is sometimes done by placing the wires, properly charged with flux and silver solder, between two white hot blocks of cast iron. 2. Is there a composition of some kind of a hard solder which, if kept in a molten state in a crucible, we could put on, and in which we could dip the ends of such wires for a moment for the purpose of brazing them? The blow pipe takes out temper. A. Brazing cannot be done in the manner proposed, and it cannot be done in any way without destroying the temper. The blowpipe method of brazing or soldering small articles is the best.

(20) J. K. writes: 1. I have sunk a tube well to the depth of about forty feet through blue clay, on to what is termed hard pan, which seems very hard and unyielding, so that I can drive deeper only with great difficulty. Now, how shall I proceed to drive clear through that hard pan, under which I expect to find plenty of water that will not be affected by drought? A. We think you should use a drill (inside the tube) to drill through the hard pan, before driving the tube. 2. How can I take the first muddy and sandy water from the tube? My pump will not work on account of mud and sand, which stop up the openings in the screen at the bottom, thus preventing the water from entering the tube, also works up into pump cylinder and locks the pump. A. Use a rough sand pump that will not clog. 3. How can I tell when deep enough down and when to stop driving, so as to leave the screen or bottom of tube in the best bed or supply of water, and thus obtain the best well? There is water in the well now, but I cannot pump it on account of mud that accumulates on the point which adheres and sucks into the openings of the screen so close that the water cannot enter the tube, but is shut out so perfectly and complete that the suction of the pump is not sufficient to suck it through into the screen and pump. This is the main difficulty: is there no remedy? A. We know of no way except by trial. You had better consult some one of experience in putting down drive wells.

(21) T. R. asks (1) how phosphorus is made from white burnt bone. A. The ground bone ash is mixed into a cream with twice its weight of water and a quantity of sulphuric acid (bone ash, 100; water, 200; acid, 78 lb). In twenty-four hours more water is added, and the mixture is heated in a leaden pan until it has lost its granular character. It is then diluted largely

with water and transferred to tall casks to settle, after which the clear liquid is drawn off, the residue washed with water, the clear washings added to the liquid, and the whole evaporated down in copper or leaden pans. The clear liquid is then drawn off from the calcareous deposit, the sediment drained on a filter, and the liquid evaporated to the consistence of honey and mixed with charcoal powder (9 lb. for 100 lb. bone ash). The mixture is then dried in iron pots and heated to incipient redness, cooled, and put into earthen retorts well luted and dried. Heat is applied around the sides of the retort in an air furnace. The beak of the retorts are connected with copper tubes which dip a quarter inch beneath the surface of lukewarm water, at the bottom of the vessel containing which the phosphorus which distills over collects. It is purified by squeezing it through chamois leather under water. While melted (under water) it is drawn up into glass tubes and transferred to cold water, where it solidifies and drops out of the tubes. These sticks must be kept under water. 2. What per cent of phosphorus do they contain? A. About 20 per cent.

(22) E. M. asks: Can you give me a good receipt for making manifold paper? A. Saturate fine unglazed paper with the following preparation. When dry it is ready for use: Tallow, 2 oz.; graphite (blacklead) in finest powder, ½ oz.; linseed oil, ¼ pint; lampblack, q. s. to make it of the consistence of cream; melt and rub well together in a mortar.

(23) H. S. W. asks for the best method of cutting a double, triple, and quadruple thread. A. There is no difficulty in doing it on a screw-cutting lathe; you determine the pitch of the thread, and you can then divide the thread into two, three, or four parts by changing the position of the cutting tool.

(24) N. B. P. asks: What will remove grape stains from a carpet? A. Wash out with warm soapsuds and a little ammonia water.

(25) S. R. B. writes: A wart has been growing on the right side of my nose for several years, and is now about the size of a large shot. Can you inform me how to remove it without leaving a scar, and whether there would be any bad result afterward? Several friends have suggested means for its removal, but I prefer to hear from you. A. By the system of Dr. Barnes—the use of an ordinary burning glass—the excrescence could be removed, leaving as little of a scar probably as by any method.

(26) H. D. P. writes: I have a piece of machinery which is almost constantly covered with a light rust: what can I apply to keep it off? A. Camphor, ½ oz.; dissolve in melted lard, 1 lb.; take off the scum, and mix in as much fine blacklead (graphite) as will give it an iron color. Clean the machinery and smear with this mixture; after twenty-four hours rub clean with a soft linen cloth. It will keep clean for months under ordinary circumstances.

(27) A. C. S. writes: I have a compound engine, small cylinder, 3 inches diameter by 6 inches stroke; large cylinder, 7 inches diameter. I wish to build a boat suitable for the engine. Please give me dimensions, also diameter and pitch of screw. A. About 16 feet long, and 3 feet 8 inches to 4 feet beam; screw about 18 inches diameter and 2 feet 9 inches pitch. 2. What should be the stroke of treadle for foot lathe, driving wheel, or large cone, 26 inches diameter? A. From 6 to 8 inches. The stroke should be adjustable to the ease of the person using it. What would be right for one would be too long or too short for another.

(28) J. S. asks: 1. Which is the best gasoline gas machine in use? A. For this information see our advertising columns and Hints to Correspondents. 2. What is the best absorbent for gasoline? A. Infusorial silica is about the best thing. Sisal hemp is often used.

(29) H. S. H. asks: 1. What pressure will a copper boiler, ¼ thick, 2 feet long, 18 inches diameter; with 40 one-inch copper flues, depth of fire box from grate to crown 8 inches, space between fire box and outside shell ¾ inch, copper flanged head and flue sheet the same, copper rivets ¾ inch diameter and double riveted both ways, or every seam and head to be double riveted. A. 35 lb., if all parts are equal in strength to the shell. 2. I would like to know what horse power it would be, burning coke or hard coal? It is to be a vertical boiler. A. About 2 horse power. 3. What would be the power of two cylinders, 2 inches bore and 3 inches stroke, connected at right angles, running 300 revolutions per minute? A. With 80 lb. steam, 2 horse power. 4. What would be most durable, brass or iron cylinders? A. Cast iron.

(30) R. B. F. writes: We are in search of a handy and rapid means of retaining a copy of short notes, telegrams, etc., without the aid of the copying press. The stylographic process seems to be about the thing, but the manner of using the carbon sheet in the several ways we have been able to secure are unhandy and not adopted to our wants. I want to try and improve the methods employed, and would like to know how to prepare the carbon sheets. The sample inclosed is good, durable, and furnishes a clear line free from smut, more like ink than the usual smutty sheets used produce. Can you explain the process in your paper of making the sheets? A. Try the following: Tannic acid, 10 parts (weight); pure sulphate of iron, 15; glycerine, 35; indigo sulphate paste (nearly neutral), 1; warm the glycerine, add the tannic acid, and rub together in a mortar to dissolve; powder the iron salt, divide into two portions, and calcine one by stirring it about on an iron plate over a fire until it becomes brown. Mix with the other portion, and gradually triturate into the glycerine; add in a similar manner the indigo, and rub all well together. Saturate thin unsized paper with this (adding more glycerine if too thick), hot, pass between a pair of smooth iron rolls under strong pressure, and hang up in the air for half an hour before packing for use. See answer to E. M., this page.

(31) M. A. H. writes: I wish to put in a new boiler to run a 12x24 engine, to be run at 60 revolutions per minute. Am divided in opinion between these boilers, namely: *a*. A two flue (flues 15 inches diameter), 42 inches diameter, 24 feet long. *b*. A Norton flue (flues 6 inches in diameter), 48 inches diameter, 16 feet long. *c*. A twenty-four flue (tubes 4 inches diameter), 46 inches diameter, 14 feet long (tubular). I am aware that these are not the same horse power, but either will answer, and I want your opinion on the following points: 1. Is there any difference in the durability under the same treatment in the boilers? A. The two-flue boiler will wear longest and is easiest cleaned. 2. Which will use the least fuel to produce the steam necessary for engine? A. Boiler with 4 inch tubes. 3. Which is the most likely to leak first, the tubular at end of tubes, or the flued to crack at end of flues? A. The tubular at the tube heads. 4. Which do you consider the best for economy of fuel, safety from explosion, and general use for the engine named? A. Either is safe from explosion under proper care, but the two-flued boiler is easiest managed.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. C. D.—The sulphur colored substance is pine pollen—carried by the wind.—F. M. D.—Silica similar to your sample is used in the preparation of cements, glass, enamels, silicate of soda, and artificial stones. It is also used for polishing and scouring purposes, and also filtering. See Hints to Correspondents.

COMMUNICATIONS RECEIVED.

On the Cheops Pyramid. By G. V.
On the Propulsion of Ships. By J. G.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

March 29, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressor, W. R. Boerner 239,310
Altitude instrument, S. C. Chandler, Jr. 239,315
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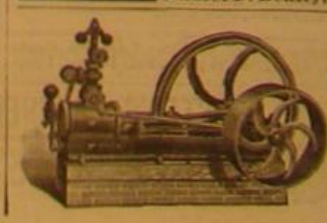

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THE CHICAGO WATERWORKS.

The city of Chicago is justly noted for its business activity, its bold enterprises, its live way of doing things generally; and the history of the city water supply system, from its comparatively small beginning to its latest development, is characteristic of the progressive spirit that pervades the great Northwest. Lying, as the city does, on a flat prairie, with no natural elevation upon which to place a reservoir to insure a proper distribution of the water, and with no desirable near source of supply, the engineers encountered exceptional difficulties in planning and executing the work.

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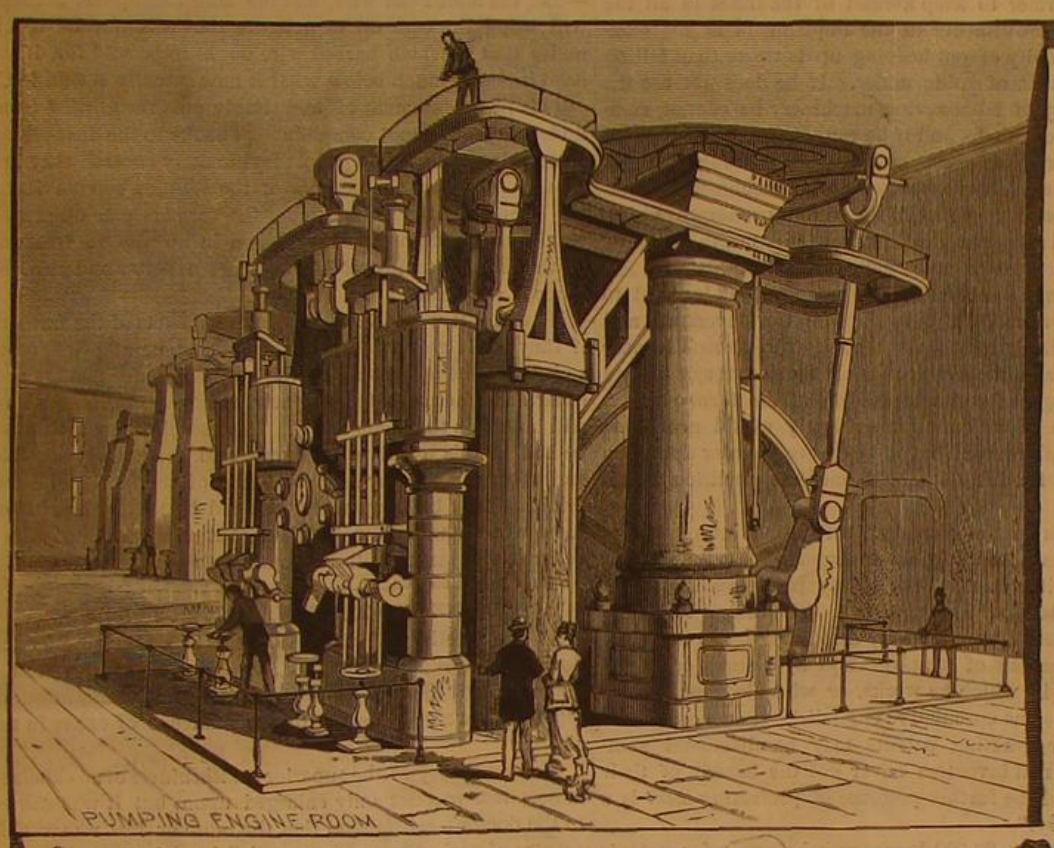

NORTH SIDE WATERWORKS, CHICAGO.

Scientific American.

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NEW YORK, SATURDAY, MAY 7, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 279,

For the Week ending May 7, 1881.

Price 10 cents. For sale by all newsdealers.

"PATENT PERFIDY."

Under this heading the *Prairie Farmer* devotes a long column to a denunciation of the patent system, exhibiting in its worst phase the spirit of unreason which just now pervades so large a portion of the agricultural world with respect to patent rights.

The grounds for complaint against the patent system appear to be in substance two: First, under its fostering influence inventors are continually introducing new machines, and improvements on old ones, which farmers cannot afford to do without; Second, the manufacturers of the improved machines actually charge money for them, and often get rich by making and selling them in large numbers. Incidentally the manufacturers are given to the wholesale purchase of patent rights from inventors, and erecting upon them greater "monopolies," to "the vexation of the public." In this way the beneficent purpose of the Patent Office, they tell us, has been and is constantly perverted, and the institution turned into an "engine of fraud and oppression."

This perversion of patent rights, our contemporary goes on to say, "presses harder on the farmers than upon any other class of the community. The necessities of existence compel the farmer to keep abreast of the times in all the mechanical improvements in the implements of his business. The penalty of not keeping up is worse than falling behind: it is that of going under. If he does not use the average quality of labor-saving machinery he cannot compete with those who do, and if he cannot compete he cannot live in a country where labor and the cost of living are high. Even his manual labor, separated from machinery, is comparatively valueless, so that, if he cannot use improved implements of his own, he must perforce hire out to use those of his more fortunate or more enterprising neighbors."

It is terrible to contemplate the pressure thus brought to bear upon farmers by this fertility of our inventors, and somewhat amazing to see how tenderly the *Prairie Farmer* regards them and their interests. If the patent system had become an engine for the oppression of the farmers only, the perversion of its function evidently would not be so grievous or unbearable; but it bears even harder upon the inventor, and for his sake its immediate abolition is demanded.

In the words of the *Farmer*, "the patent laws were designed to reward the original inventor of a valuable contrivance; but it is a rare, not to say phenomenal, case in which such intention is carried out. The design is almost invariably stolen by some tricky associate of the inventor, or boldly taken out of his possession by a superior in the establishment in which he works, or wheedled out of him for a song by some speculative capitalist. The sentimental arguments for granting patents may be dismissed summarily. The real inventors never get the benefit of their inventions, and the further pretense of protecting *them* is a hollow mockery."

Strange that the 20,000 inventors who apply for patents every year, and keep on inventing and taking out patents year after year, sometimes scores of them in the course of a lifetime, do not discover the extent to which they are swindled, and strike hands with the Grangers in securing the overthrow of this terrible "engine of fraud and oppression!"

Forgetting syntax and all save the enormity of the crime which the Patent Office commits in giving the deluded inventor his letters patent, the *Farmer* says: "The government takes the applicant's money, the agents takes all he can beg and borrow, and his return is a document seldom worth the paper its matter is printed on."

To put a stop to this official injustice, what remedy can be more summary and logical than the one the *Farmer* proposes when it says, "An act of Congress should declare all existing patents forfeited to the people!" and what proposition could more fitly fall under the heading "Patent Perfidy"?

The immediate occasion of this outburst against the patent system is the recent decision of the Supreme Court sustaining the barbed wire fence patents owned by Washburn, Moen & Company.

"The sweeping character of that decision," says our excited contemporary, "is almost beyond comprehension. The use of barbed wire will be practically unlimited for some years, and the profits of this one firm will distance the tales of the Arabian Nights, the treasures of Monte Christo, or the fortunes of the Bonanza kings. Allowing one firm to bleed hundreds of thousands is all the more doubtful policy from the fact that the firm produces nothing, but simply preys on the work and needs of others, under the protection of government, like the highwaymen and freebooters of the Romantic period."

That the company which own the barbed wire fence patents have a most desirable property is beyond question. That they may make a good deal of money out of their property, if their business is wisely conducted, is altogether probable. But where the bleeding and robbery of hundreds of thousands come in is not so apparent.

The company offer the Western farmers an excellent fencing material, and the farmers will buy it when they cannot do better. If the barbed wire fencing is so much cheaper and more efficient than any other to be had that the prairie farmers cannot do without it, the company are to be congratulated, and the farmers have no obvious reason for complaining. There are a great many species of property that are desirable, and that men would like to get without paying therefor the market price—land and cattle and corn, as well as fence material—but the intensity of that desire is no just ground for the legal or illegal seizure of such property; and any arguments which go to justify the confiscation of intellectual property justify with infinitely greater force the abolition of property in land. The champions of the farmers will do well, in this connection, to keep in mind the proverbial advice to those who live in glass houses.

In any case the objection to the barbed wire patents is largely sentimental and grossly exaggerated. The *Western Rural* cries out against the "barbed wire fence outrage" as loudly as the *Prairie Farmer*, and demands as shriekily the overturning of the patent system; yet, at the close of a long editorial on the "barbed wire fence monopoly," as an illustration of this "reckless disregard of justice and the interests of our farmers in the management of the patent shop at Washington," it says:

"Some of our subscribers in Iowa inform us that they intend to resort to the use of plain telegraph wire for fence purposes, setting the posts closer together, and using five wires, which they claim will answer the purpose just as well as barbed wire. It will be found, however—we think—that the additional wire, and the additional posts needed, will bring the cost up to a figure that will not be much under that at which barbed wire ought to be sold for, if indeed it comes much below what it now actually is sold for."

This plain statement of fact simply cuts the ground from under the anti-patent complaint. Thanks to the inventions which the barbed wire people legitimately control, they are able to set before the farmers of the West as good a fence as, if not a better fence than, the farmers can otherwise obtain, and in doing this they lessen in no way the freedom of the farmers to invent or construct a better and cheaper fence if they can.

No doubt it would be money in the pockets of the farmers if they could get their fences for nothing, or at prime cost; so it would be apparently to the profit of fence makers and other manufacturers to get their wheat and corn and beef and butter on the same terms. But useful things are not to be had in this world in that way, and fortunately sensible and sober-minded farmers are aware of the fact. The unthinking may be temporarily deluded by the sophistries of those who assume to guide them, but their common sense and sense of justice will dominate in the end.

OZONE AND THE SANITOLOGY OF ODORS.

At the meeting of the (Homeopathic) County Medical Society in this city, April 13, Dr. John S. Linsley read a paper on the "Sanitology of Odors," in which some astounding results were attributed to the influence of ozone in the air.

The old theory of the superior healthfulness of an ozonized atmosphere was not only enlarged upon, but it was shown to the doctor's satisfaction that the more or less remarkable careers of such men as Moses and John Adams and Daniel Webster and Horace Greeley and some of our popular poets, might be traced to the energizing property of an ozonic atmosphere. The atmosphere which "energized" Moses, we presume, must be accepted as specially ozonized, only by inference from its inferred effects, which is a somewhat unsatisfactory basis for an argument; but the doctor was able to point to the fact of more recent observation that the celebrated New Englanders he mentioned were all natives of what he called the ozonic region.

A considerable source of the ozone which is supposed to exert so beneficial an effect upon the atmosphere by disinfecting and "vitalizing" it, was attributed to plants whose foliage, fruit, or efflorescence emits fragrant volatile oils or resinous matters which yield ozone by oxidation. Among our native trees worthy of cultivation for the production of atmospheric ozone, the doctor mentioned Oregon maple, magnolia, pine, basswood, locust, and sassafras; and among the beneficent shrubs and plants, the golden currant, spice bush, azalea, wisteria, clematis, thyme, celery, sweet vernal grass, and clover.

The natural inference is that intending parents who wish to be progenitors of great men—national leaders, statesmen, poets, or what not—will do well to set their homes in ozonic regions, and surround them with as large a variety as possible of ozone-making trees and flowering plants.

It would be cruel to needlessly discourage any enterprise in this direction, for the world needs great men badly, and the suggested method of getting them is not an expensive or unpleasant one. Still it is but fair to say that it is not quite so certain, as the doctor appears to think, that there is ever any large ozone in the air, or that its effects would be as intimated.

A great many pretty hypotheses have been based upon supposed evidences of the occurrence of ozone under certain atmospheric conditions, and the supposed oxidizing and other effects due to its presence; but the whole subject has been thrown into confusion by the discovery that the trusted ozone tests are unreliable, and that the oxidizing principle of the atmosphere may be and probably is in large part, if not wholly, hydrogen superoxide. It appears that most of the reactions formerly relied upon for the detection of ozone are also produced by the hydrogen compound whose existence in the air has been demonstrated; and also that the remaining reactions may be due to other compounds known to occur in the air, as carbonate of ammonium and certain sulphides. The odor sometimes observed and ascribed to ozone is not a trustworthy evidence of its presence, since

most observers, according to Schoene, are liable to confound the odors of ozone and hyponitric acid. It is alleged further that ozone is not produced by the electric spark in a mixture of oxygen and nitrogen, but only oxide of nitrogen, and it is probably to the latter substance and not to ozone that we must attribute the odor sometimes observed after lightning discharges and sparks from an electric machine. Ozone, however, would appear to be produced by the silent discharge of electricity; but it has been justly observed that we know too little of this form of electrical action as an atmospheric phenomenon to justify our regarding it as a probable source of supply of ozone.

In view of all these uncertainties touching the occurrence and action of ozone in the air, it may be prudent to wait a while before admitting ozone to be quite so powerful a factor of individual or national genius, health, or social development as Dr. Linsley and others would have us believe.

PUBLIC WORKS IN NEW YORK CITY.

The report of the New York Commissioner of Public Works for the last quarter of 1880 contains many facts of more than local interest.

New York now has, south of Harlem River, 334½ miles of paved streets, classed as follows: Stone-block pavements, 229½ miles; cobble stone, 80 miles; macadam, 24½ miles; concrete, ½ mile. There were laid last year 244,807 square yards of pavement, covering twelve miles of streets. During the past four years $1,100,000 have been spent upon new pavements and in restoring old ones, 641,957 square yards of worn out and rotten pavements having been replaced by stone blocks.

An appropriation of $400,000 will be devoted this year to the substitution of stone-block pavement for the old cobble stones, which are all to be removed as fast as they can be. More than nine-tenths of the streets of New York will be paved with stone-blocks when the plan is carried out. All plans for concrete and wooden pavements have been dismissed as unadapted to the city, and the macadam roadbed is used to only a very limited extent.

The sewerage system of the island embraces 376½ miles of sewers, with 4,573 receiving basins. Over 5 miles of sewers and culverts, with 62 receiving basins, were added last year. In the older and more densely populated parts of the city the sewers are in anything but a suitable or desirable condition.

A large amount of work in the way of grading, curbing, guttering, and flagging new streets was done during the year, and a large area of new ground was made available for building.

Over 402 miles of streets are lighted, besides 2½ miles of piers and 61 acres of parks. The number of public lamps was 23,511, an increase of 374. Nearly 14 miles of new gas mains were laid, the entire length of gas mains now exceeding 874 miles. The cost of the public lamps was a little short of half a million dollars. The gas consumed was 321,583,860 cubic feet. One mile of Broadway has been lighted by electric lamps on the Brush system, and many private electric lamps help to illuminate the streets.

THE NATIONAL ACADEMY OF SCIENCES.

The annual meeting of the National Academy of Sciences began in Washington, April 19, the venerable President of the Academy, Professor W. B. Rogers, of Boston, in the chair. The list of papers read included: "The Domain of Physiology," T. Sterry Hunt; "The Compass Plant of the Western Prairie," B. Alvord; "The Solar Constant," S. P. Langley; "The Color of the Sun," S. P. Langley; "On Mountain Observations," S. P. Langley; "On the Relation of Soils to Health," R. Pumpelly; "Reduction to Sea Level of Barometric Observations made at Elevated Stations," Professor Abbey; "Electric Light Photometry" George F. Barker; "On the Relations between Strain and Impact," and "On the Structure of the Feet of Mammals," E. D. Cope; "On the Progress of Pendulum Work," C. S. Peirce; "The Production of Sound by Radiant Energy," A. G. Bell; "On the Carbon Lamp Fiber in the Thermo Balance," G. F. Barker; "Memoir of Count S. F. de Pourtales," Alexander Agassiz; "On the Utilization of the Sun's Rays in Heating and Ventilating," E. S. Morse; "On the Later Tertiary of the Gulf of Mexico," E. W. Hilgard; "An Account of the Land Ice of Kotzebue Sound," W. H. Dall.

At the Executive Session of Thursday, Professor A. W. Wright, of Yale College, and Professor H. A. Rowland, of Johns Hopkins University, were elected members, and the following were elected members of the council; Professor S. F. Baird, Professor Wolcott Gibbs, Cambridge; Professor A. Hall, United States Navy; Professor J. E. Hilgard, Coast Survey; Professor Clarence King, Professor Fairman Rogers, Philadelphia. Professor Simon Newcomb was elected Home Secretary, and Professor J. H. C. Coffin, United States Navy, Treasurer.

THE DATE OF THE GLACIAL ERA IN EASTERN NORTH AMERICA.

Mr. G. F. Wright, in a paper read before the American Association for the Advancement of Science, and published in the February number of the *American Journal of Science and Arts*, has made an attempt to calculate approximately the date of the glacial era in Eastern North America, by studying the depth of one of the bowl-shaped depressions which abound in the moraines and kames of New England. These depressions are of all shapes and sizes, from symmetrical "kettle holes" to ponds and lakes of no mean dimensions. It is evident that they cannot always exist, for they are wearing down at the top and filling up at the bottom. For the same reason we know that they cannot always have been in existence.

The basin chosen by Mr. Wright for his investigations was one located near Pomp's Pond, in Andover, Mass., with a diameter of 380 feet, and having an accumulation of peat 96 feet in diameter at the bottom. It is evident that since the first formation of the crater-like depression no material can have reached the bottom except from three sources: (1) The wash from the sides; (2) the decay of the vegetation growing within the rim; and (3) the dust brought by the winds. The problem is to determine the time it would require these three agencies to fill the bottom of this bowl to a depth of 24 feet, which would be equal to a depth of only 8 feet over its present surface—the present depth (17 feet) being estimated from the angle of declivity. Mr. J. Geikie, following the lead of Mr. Croll and others, who look to astronomical data alone, supposes that the so-called glacial period, whose marks we now study in these low latitudes, synchronized with the last period of high eccentricity of the earth's orbit, which closed about 80,000 years ago, and whose maximum influence must have been exerted about 200,000 or 210,000 years since. But once in 21,000 years the astronomical conditions dependent upon the precession of the equinoxes for a glaciation of the northern latitudes occur, though owing to the present low eccentricity of the earth's orbit this influence is now at its minimum.

The question with the crater-like depression above-mentioned is: Could this have stood with so little change for 80,000 years? or even for 40,000 years, as supposed by Prof. Hitchcock? If the close of the great glacial period be so far back as Mr. Croll and Mr. Geikie estimate, we must believe that detritus could accumulate, in the situation above described, over a surface of the area of the present peat bog, only at the rate of one inch in 1,000 years; while, if we put the close of this period back 10,000, the rate of accumulation would seem as slow as the imagination can well comprehend—one inch in 100 years. These considerations have led Mr. Wright to look with increasing distrust upon the astronomical calculations which are made concerning the glacial period, unless the moraines mark the limit reached at the last semi-revolution of the earth's equinoxes about 10,000 years ago. He believes it evident that the glacial phenomena of New England are comparatively recent in their origin.

PHOTOPHONIC AND SPECTROPHONIC DISCOVERIES.

At the meeting of the National Academy of Sciences, April 21, Prof. A. Graham Bell read an important paper describing at great length the recent investigations made by Mr. Tainter and himself in the field so brilliantly opened by them a year ago. After referring to their earlier observations on the production of sound by radiant energy, Prof. Bell said that at his suggestion and during his absence in Europe, Mr. Tainter had pursued the investigation of the sonorousness of matter under the influence of radiant energy, employing a vast number of substances inclosed in test tubes in a simple empirical search for loud effects. He was thus led gradually to the discovery that cotton-wool, worsted, silk, and fibrous materials generally, produced much louder sounds than hard rigid bodies like crystals or diaphragms, such as had hitherto been used.

Mr. Tainter next collected silks and worsteds of different colors, and speedily found that the darkest shades produced the best effects. Black worsted especially gave an extremely loud sound. As white cotton wool had proved itself equal, if not superior, to any other white fibrous material before tried, he was anxious to obtain colored specimens for comparison. Not having any at hand, however, he tried the effect of darkening some cotton wool with lampblack. Such a marked re-enforcement resulted that he was induced to try lampblack alone. About a teaspoonful of lampblack was placed in a test tube and exposed to an intermittent beam of sunlight. The sound produced was much louder than any heard before. Upon smoking a piece of plate glass and holding it in the intermittent beam, with the lampblack surface toward the sun, the sound produced was loud enough to be heard, with attention, in any part of the room. With the lampblack surface turned from the sun the sound was much feebler.

The experiments were repeated when Prof. Bell returned, and were continued by the two gentlemen together. It was found that when the beam was thrown into a resonator, the interior of which had been smoked over a lamp, very curious alternations of sound and silence were observed. The interrupting disk was set rotating at a high rate of speed, and was then allowed to come gradually to rest. An extremely feeble musical tone was at first heard, which gradually fell in pitch as the rate of interruption grew less. The loudness of the sound produced varied in an interesting manner. Minor re-enforcements were constantly occurring, which became more and more marked as the true pitch of the resonator was neared. When at last the frequency of the interruption corresponded to the frequency of the fundamental of the resonator, the sound produced was so loud that it might have been heard by an audience of hundreds of people.

The extremely loud sounds produced from lampblack demonstrated the feasibility of using this substance in an articulating photophone in place of the electrical receiver formerly employed. In regard to the sensitive materials that can be employed, the experiment indicated that in the case of solids the physical condition and the color are two conditions that markedly influence the intensity of the sonorous effects. The loudest sounds were produced from substances in a loose, porous, spongy condition, and from those that had the darkest or moist absorbent colors. The materials from which the best effects have been produced are cotton-wool, worsted, fibrous materials generally, cork, sponge, platinum, and other metals in spongy condition, and lampblack.

The explanation suggested for the superior loudness of the sounds produced by a dark porous substance, for example, lampblack, was as follows. Said Professor Bell:—"I look upon a mass of this substance as a sort of sponge, with its pores filled with air instead of water. When a beam of sunlight falls upon this mass, the particles of lampblack are heated, and consequently expand, causing a contraction of the air spaces or pores among them. Under these circumstances a pulse of air should be expelled, just as we would squeeze out water from a sponge. The force with which the air is expelled must be greatly increased by the expansion of the air itself, due to contact with the heated particles of lampblack. When the light is cut off the converse process takes place; the lampblack particles cool and contract, thus enlarging the air spaces among them, and the inclosed air also becomes cool. Under these circumstances a partial vacuum should be formed among the particles, and the outside air would then be absorbed, as water is by a sponge when the pressure of the hand is removed. I imagine that in some such manner as this a wave of condensation is started in the atmosphere each time a beam of sunlight falls upon lampblack, and a wave of rarefaction is originated when the light is cut off. We can thus understand how it is that a substance like lampblack produces intense sonorous vibrations in the surrounding air, while at the same time it communicates a very feeble vibration to the diaphragm or solid bed upon which it rests."

As intimated above the lampblack proved to be an efficient as well as economical substitute for selenium and tellurium in the electrical receiver of the photophone.

The investigation of the influence of radiant energy upon various substances, solid, liquid, and gaseous, placed in different parts of the solar spectrum, resulted in the production of a new instrument of physical research which has been called the spectrophone. When different substances were used as receivers it was found that the loudness of the sound varied in point of position upon the spectrum in a remarkable manner. With the lampblack receiver a continuous increase in the loudness of the sound was observed upon moving the receiver gradually from the violet into the ultra red. The point of maximum sound lay very far out in the ultra red. Beyond this point the sound began to decrease, and then stopped so suddenly that a very slight motion of the receiver made all the difference between almost maximum sound and complete silence. With red worsted entirely different results were obtained. The maximum effect was produced in the green at that part where the red worsted appeared to be black. On either side of this point the sound gradually died away, becoming inaudible on the one side in the middle of the indigo, and on the other at a short distance outside the edge of the red. With green silk the maximum was found in the red, with the limits of audition in the blue on the one hand and the ulta red on the other. Hard rubber shavings gave a maximum in yellow. Vapor of sulphuric ether produced no audible effect, until a point far out in the ultra red was reached, when suddenly a musical tone became distinctly audible. Vapor of iodine disclosed its maximum in green. With peroxide of nitrogen distinct sounds were obtained in all parts of the visible spectrum, but no sounds were observed in the ultra red.

The repetition of these tests in connection with an undistorted spectrum, that is, one produced by a diffraction grating, will obviously be necessary before any positive conclusions can be arrived at touching the exact relations of color or wave-length to the sonorousness of different substances.

In its present form the spectrophone is a modification of the ordinary spectroscope, made by substituting for the eye-piece a sensitive substance placed at the focal point of the instrument behind an opaque diaphragm containing a slit, the sensitive substance being put in communication with the ear by means of a hearing tube. With reference to the probable utility of the spectrophone, Professor Bell said:

"Of course the ear cannot for one moment compete with the eye in the examination of the visible part of the spectrum, but in the invisible part beyond the red, where the eye is useless, the ear is invaluable. In working in this region of the spectrum, lampblack alone may be used in the spectrophonic receiver. Indeed, the sounds produced by this substance in the ultra red are so well marked as to constitute our instrument a most reliable and convenient substitute for the thermopile. . . . I recognize the fact that the spectrophone must ever remain a mere adjunct to the spectroscope, but I anticipate that it has a wide and independent field of usefulness in the investigation of absorption spectra in the ultra red."

HOT WATER COMPRESSES IN TETANUS AND TRISMUS.—Sporer has successfully treated cases of tetanus by merely applying to the nape of the neck and along the spine large pieces of flannel dipped in hot water, of a temperature just bearable to the hand (50-55° C.)—*Allg. med. cent. Zeit.*

THE CHICAGO WATERWORKS.

[*Continued from first page.*]

remote if not impossible. The first water works in Chicago were commenced in 1851, when the population of the city was about 35,000.

It was then thought that the small quantity of water discharged from the river would not affect the quality of the water in the lake at a point 1½ miles south. The works were put in operation in February, 1854, and consisted of one reservoir, containing about a half million of gallons, and eight and three-quarters miles of iron pipe, beside the pumping engine. The population at this time had increased to about seventy thousand, and the growth of the city, together with the introduction of sewerage and the establishment of packing houses, distilleries, etc., increased the quantity of filth flowing into the lake to such an extent that complaints of the impurity and offensiveness of the water were frequently made, and it was proposed to extend an iron pipe, five feet in diameter, one mile out into the lake, to obtain a supply beyond the effect of the sewage. Various other experiments were discussed, but it was finally decided to extend a tunnel two miles into the lake. The work was commenced May 26, 1864, and the tunnel with all of its appurtenances was completed in March, 1867. In this tunnel provision was made for extension either lakeward or landward without interrupting the supply through it, except for a very short time; but it was not supposed that an extension would be required for many years. The breakage of a siphon under Chicago Avenue Bridge, August 18, 1869, deprived the west division of the city of water for about sixty hours, greatly endangering a large portion of the city.

This circumstance led the City Council to direct the Board of Public Works to take immediate action with reference to the wants of the city in this respect.

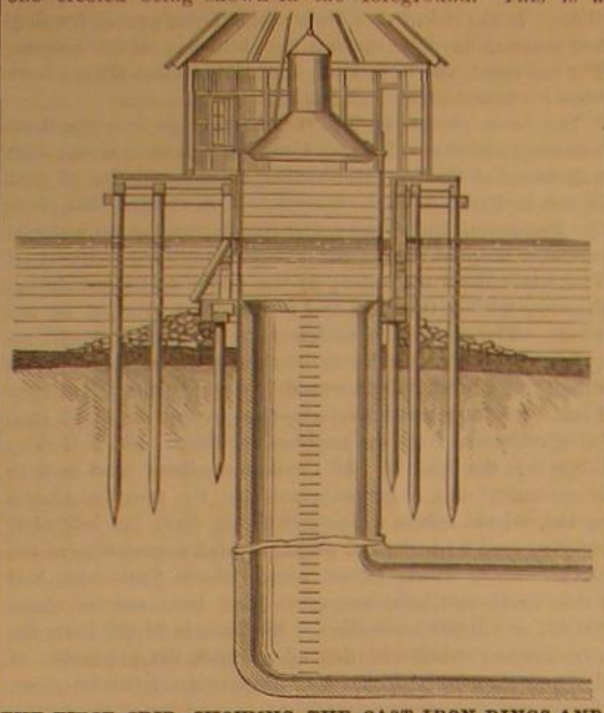
It was decided to build a new tunnel, seven feet in diameter, parallel with the old one, extending six miles into the lake. This great work was commenced July 12, 1872, and finished July 7, 1874. Great difficulty was experienced in sinking both shore and crib shafts, but the work was finally accomplished in the most satisfactory manner. In the construction of the new tunnel, as in the old, provision was made for extending it lakeward should sewage contaminations hereafter make it necessary or desirable.

The crib is a substantial structure of solid masonry, the three lower courses of which are built of granite, on account of its superior frost resisting qualities. The upper courses are of limestone, the arches are of brick, the filling of rubber, and the deck is composed of ordinary concrete, on the top of which is placed a layer of asphalt concrete. The light-house tower is of brick, with an iron stairway. Upon the deck is built a brick house, in which the family of the person in care of the crib resides. No more desolate and isolated place of residence could be imagined than this is in winter. One might as well be on a desert island as far as human companionship is concerned, although there is a telephone line to the shore. But there are many days when the storms blow and the waves beat in their fury, and the broken, floating ice dashes against its sides, that no one goes out from the shore. It is said that some of those who have lived at the crib have found the isolation so intolerable as to almost drive them insane. In the summer, however, boats constantly ply between the shore and the crib, carrying visitors, it being a favorite resort for boating and sailing parties.

Since the completion of the tunnel the immense growth of the city has so increased the sewerage flowing into the lake that it is believed that at times it extends as far as the crib and contaminates the water. Many plans have been suggested to remedy this, and on all hands it is confessed that the problem is a very grave one. It is probable that in ten years from now, with the present rate of increase, Chicago will have a million of inhabitants, and in that case no tunnel extending directly into the lake could insure pure water. The latest suggestion for procuring pure water for the city is that of Chicago's eminent architect, Mr. W. W. Boyington, who proposes that the city shall purchase 100 acres of land in Highlands, some 20 miles north of the city, where the ground is 130 feet higher than the city level. Here should be built an immense reservoir, into which water should be pumped from the lake, and thence conducted by a viaduct to the city.

The shore end of the tunnel is connected with the new North Side pumping works shown in our engraving, and extends to the West Side works. The building is a model of architectural beauty. Its style is castellated, and the tall water tower gives it a very imposing appearance.

The building contains four large pumping engines, two of which are in continual use, while the other two are held in reserve. The general appearance of these magnificent machines is seen in the upper view in the large engraving, the last one erected being shown in the foreground. This is a



THE FIRST CRIB—SHOWING THE CAST IRON RINGS AND GATE.

double engine, having a capacity of 36,000,000 gallons in twenty-four hours. The steam cylinder is 70 inches in diameter, stroke 10 feet. The water pumps are 57 inches in diameter, stroke 10 feet. The working beams are each 28 feet long and weigh 20 tons. The fly wheel is 26 feet in diameter and weighs 40 tons.

The first engine was erected at these works in 1853. It had a capacity 7,500,000 gallons in twenty-four hours. The second engine, erected in 1857, had a capacity of 13,000,000 gallons in twenty-four hours, and the third had a capacity of 18,000,000 gallons daily. The first and second engines were single, the third and fourth double. These engines are supplied with steam from five boilers 12 feet in diameter and 20 feet long.

In 1871 Chicago had 271 miles of pipe, now it has 500 miles, and it has over 3,000 fire hydrants. This extensive system of water supply has been perfected at an expense of about $8,000,000.

THE CRIB.

SECTION OF TUNNEL.

The Value of Authenticity.

The British Government has bought of Lord Suffolk, for $45,000, a picture by Leonardo da Vinci. Some twenty years ago the picture was stolen from Lord Suffolk's country seat, being cut from the frame. Afterward it was offered for sale in London. When shown to the President of the Royal Academy he pronounced it a copy of the well known "La Vièrge aux Rochers," and no one would buy it. Some one, remembering the robbery, subsequently took pains to inquire into the matter, and traced the picture to the possession of a messenger or door porter at the Foreign Office, Downing street, who produced it, rolled up, from one of the servant's closets there. The picture was taken to Lord Suffolk's, and fitted exactly the cut part, proving incontestably that it was the stolen *chef d'œuvre* of Leonardo da Vinci. That £9,000 is not too much for this picture is inferred from the fact that, at the time when it was restored to its owner, it was remarked that while not authenticated as an original work, £5 could not be got for it, but when it was authenticated it was well worth £10,000.

The Telephone.

The national gathering of telephone men at Chicago, on the 5th April, emphasizes better than anything else the rapid and prodigious growth of that very recent invention. At their previous meeting, held at Niagara Falls, September 7–10, 1880, there was represented $10,000,000 of stock, which, after an interval of only seven months, now represents something like $17,950,000 of stock, all being unpurchasable. Indeed, among all the wonders of the age, there is nothing more wonderful than the invention and progress of the telephone, made practicable only five years ago. Prof. Bell claims that the date of the invention of his method of articulate speech was Jan. 15, 1876. It is already found in use in all parts of the world, as popular and useful in Egypt, New Zealand, and Chinaas in America and Europe. This year alone the English post office authorities have given orders for 20,000 telephones, while its rapid spread in this country is almost beyond calculation. It is introduced with equal eagerness for commercial and domestic uses; it is fast driving out the old fire-alarm telegraphs, while for purely scientific purposes—such as detecting faults in ocean cables without resorting to the old and expensive process of cutting and splicing them—its availability seems beyond calculation.

Much of this is due to the restless energy and genius of its inventor and promoters, for the telephone has drawn to its assistance some of our most profound scientists and brightest business men. It has, in return, brought them in one short lustrum wider fame and ample fortune; the latter statement being best illustrated by an incident which recently occurred in England. At a meeting of the United Telephone Company, last autumn, the discussion developed the remarkable fact that two men who had paid $3,500 for their privilege of acting as the company's agents for the sale of telephones had refused $150,000 offered by the company to cancel that engagement. The number of exchanges in operation in this country has increased in one year from 138 to 408, and the number of instruments in use from 60,873 to 132,692, so that in the United States only one city having a population of over 15,000 is now without a telephone exchange. Other items in the same department show how the introduction of the telephone is being extended abroad as well as at home.

But the uses of the telephone must still be widely extended. Rapid strides are already being made in long-distance telephoning, speech having been recently transmitted from Tours to Brest, a distance of over 800 miles, with a single Leclanché element, the experiment being witnessed by Prime Minister Jules Ferry and other dignitaries. These experiments must be pushed further, for the application of the telephone to long distances has become a necessity, and its use must not stop with the shore. It must be applied to ocean cables, and made audible during the noise of military operations, and even above the roar of battle. Connecting the most remote corners of the earth, like the telegraph, it must rise superior to that invention, and bring them virtually within *speaking* distance.

We have taught ourselves to believe that there is no such word as fail, and with so many men of genius at work perfecting the details of this new agent of intercommunication, with so much capital eager to back their enterprise, and with so much organizing talent and executive ability as is displayed to day in the telephone business, the great invention of Alexander Graham Bell is

springing forward to success unparalleled in the history of scientific discovery.—*The Operator.*

IMPROVEMENT IN THE CONSTRUCTION OF FENCES AND POSTS.

The engravings illustrate several forms of iron fence and railings, together with constructive details of the fence fastenings, which have been patented by Mr. J. B. Wickersham, of 505 Cherry street, Philadelphia, Pa., who is manufacturing and has pretty thoroughly introduced the various forms, which have proved highly satisfactory wherever used.

Figs. 1 and 2 show different forms of railing and fencing. Fig. 5 shows a double fastening for holding the two rods forming the rail of an ornamental iron fence, the fastening being effected by nails, which are broken off and do not show after the fence is finished. The wrought iron bars project through the cast iron ornaments of the railing, as shown in detail in this figure, thereby strengthening the cast iron portions of the iron railing, preventing them from being broken off by mischievous persons. Fig. 3 shows a farm fence on a level, also on an incline, supported by Mr. Wickersham's improved iron post. The fastening of the fence rods is effected by driving nails through holes in the overlapping ends of the rods on opposite sides of the post, as shown in Fig. 4. The rods are grooved longitudinally, so that nails may be driven in at every post through which the rod passes.

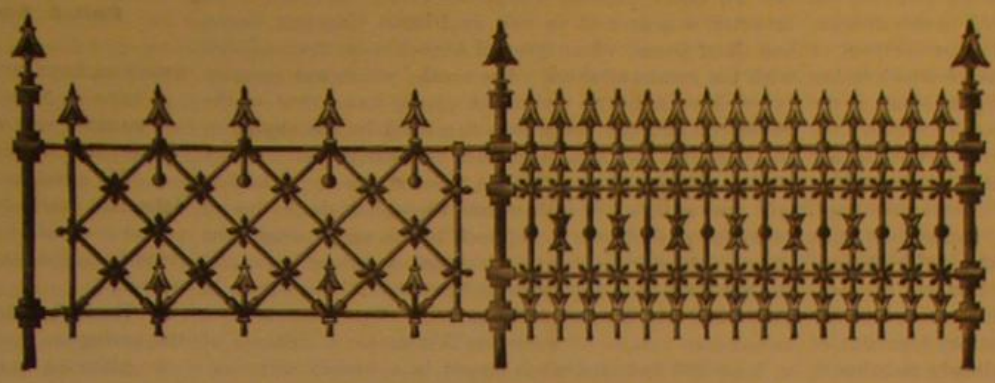


Fig. 1.—ORNAMENTAL IRON RAILING.

Fig. 6 shows the method of fastening flat bars in the posts, also fastening the pickets to the bars. The bars are grooved upon one side to receive the fastening nails.

This iron fence is suitable for farms, lawns, and country places, as a substitute for the barbed wire fences; at the same time it is a more visible fence than strands of wire produce, enabling horses and cattle to see it and avoid injury.

Fig. 9 shows in perspective and in section a fastener for securing a picket to an angle-iron rail by means of an eye, a washer, and a nail.

Fig. 2.—IRON FENCE.

Either wrought or cut nails are used for fastening the parts of the fence together, the portions being nailed together as readily and easily as pieces of hard wood. The process might properly be termed keying, but the inventor has appropriately named it "nailing iron to iron." Key-seats are formed in the iron to receive the nails; a hammer and nails are all that are required, with the several parts of the work, to form and erect handsome and durable iron railings and fences of either heavy or light patterns.

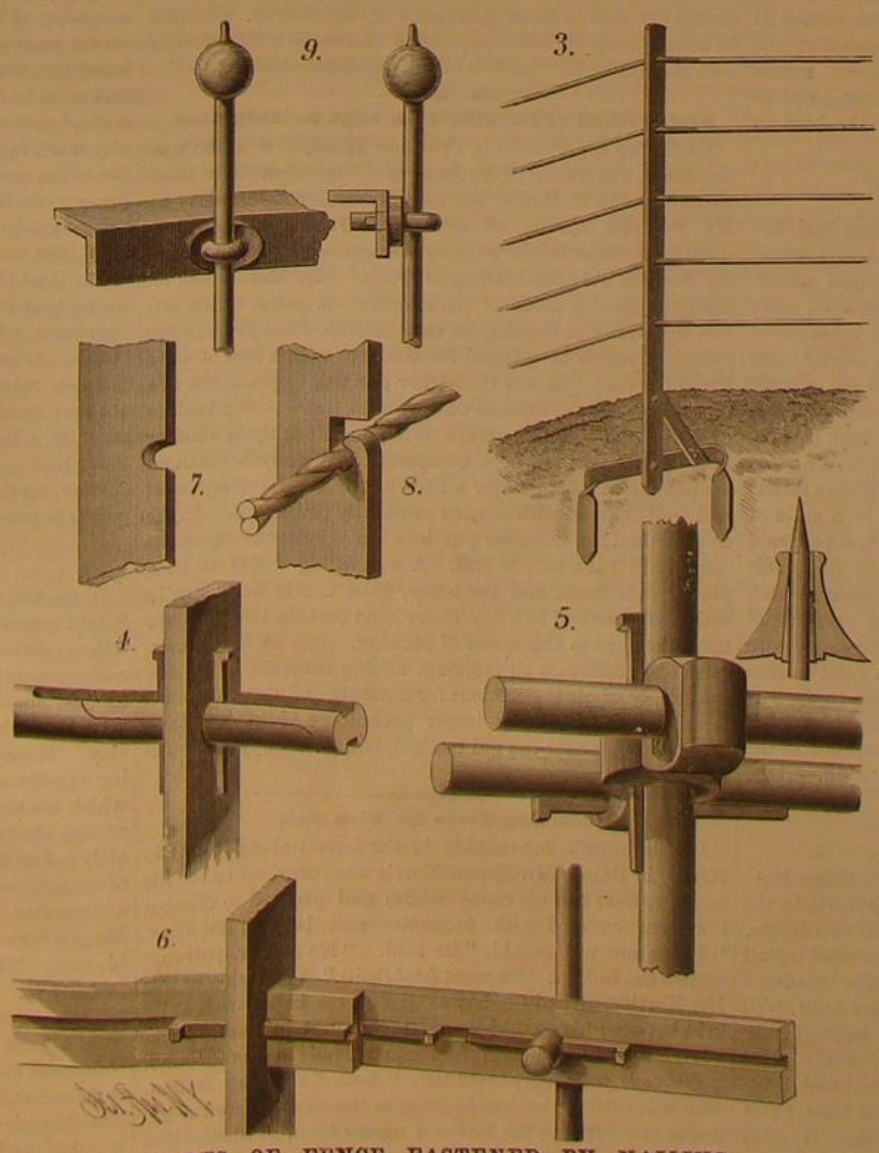
Fig. 7 shows a post with a semicircular notch for receiving barbed wire or wire cable, and a hole for receiving the fastening wire. In Fig. 8 is shown a post having a square notch for receiving a fence wire rod or cable.

The improved posts, shown in Fig 3, have been adapted for round, flat, or square iron, also for barbed and plain wire, to meet the requirements of cheapness, combined with strength and durability. By the method illustrated, the parts of the fence and posts can be quickly and strongly fastened together.

In the manufacture of plain fences composed of horizontal bars or rods for farm purposes, the joints of the rails at the intersections with the posts are secured by various ways in lapping of the rails and by nailing the parts securely together, at the same time allowing the rails and pickets to grade to any inclination of the ground or to expand and contract under changes of temperature. An important feature is the construction and planting of the improved iron post for farm purposes. The object has been to make an iron post which will resist the action of the frost, being so constructed that when planted the parts act in the same capacity as the roots of a tree in sustaining it in an upright position. The brace at the lower part of the post is buried under the ground, and assists in holding. It has been shown that where these posts have been in actual use for several years past they keep their vertical position.

We are informed that these iron posts cost no more than wooden posts. Being of iron they cannot burn in times of fire, or float away in a freshet, and will outlast any post made of wood; besides, there is always an intrinsic value in the old iron.

A large industry has been developed under these patents, and we are informed that this fence is largely coming into public use, supplanting fences of the English and other styles. Further information may be obtained by addressing the inventor and manufacturer as above.



PARTS OF FENCE FASTENED BY NAILING.

A New Hospital.

Mr. George I. Seney has given the handsome sum of $270,000 for another general hospital, to be located in the southern section of Brooklyn, N. Y. An entire block of ground has been secured. The plan of Mr. Seney contemplates the erection of a number of small buildings rather than a single large one, so that particular diseases may be located and treated apart. Possibly one of these buildings may be made a lying-in department, for which there is ample room; another may be devoted to contagious diseases, for which at present there is absolutely no provision within the city limits. The plans will be matured and work begun within a few months.

The Channel Tunnel.

Close to the western entrance in the Abbot's Cliff, near Folkestone, are the Channel Tunnel works, now progressing under Colonel Beaumont, R.E., by which it is hoped ultimately to realize railway communication between France and England—distance 22 miles. The project, both in design of plan and mode of execution, is practical and ingenious. The chalk strata of England and France are geologically continuous, and the dip of the beds is the same, namely, toward the east, on both sides of the English Channel. The lowermost portion, known as the "gray chalk," is of more clayey nature than the other portions of the chalk formation, and is sufficiently impervious to water to render perforation feasible. The plan proposed is to follow by a descending tunnel the natural dip of the gray chalk towards Dover, until a depth of 200 feet below the sea bed of the Channel is attained. The Channel Tunnel will then be driven horizontally right across from shore to shore. A similarly inclined tunnel on the French side, rising along the direction of the dip of the strata, will make communication again with the upper surface of the land. The gray chalk is thus entered and followed throughout along its natural position—from daylight on the one side, and in its subterranean and submarine depths, to daylight on the other side of the Channel. The works at Abbot's Cliff consist of a short drift-way from the sea front of the "Warren" to the commencement of the trial tunnel, which is circular, 7 feet in diameter, and runs parallel with the existing line of the South-Eastern Railway. It has already attained a length of 300 yards. The chalk is drilled by a circular disk of iron cutters, worked by a compressed air engine by means of a shaft with bevel wheel gearing, the shaft and engine extending for a length of 30 feet. The cutting disk makes two revolutions per minute, and is fed forward a quarter of an inch at each revolution. The total advance of the whole face of the boring is half an inch per minute. The *débris* cut out by the revolving disk is received in a sort of large iron tray, which is hauled back every now and then by a chain worked by an auxiliary air engine, and the water which percolates the chalk is easily kept under by a small donkey pump. The promise of success so far seems good, but the 7-foot tunnel has not yet been driven much, if anything, below low-water tidal level, and we have yet to learn whether any powerful jets of water may get in through fissures as the subterranean depth is increased. Trial shafts have been driven vertically down a considerable distance both on the English and French shores, and there have been no signs of extraordinary difficulty from such sources. Nevertheless, the question of a possible fissure or deep crack in the continuity of the gray chalk itself in mid channel, along a line passing between the "Varne" and the "Ridge," can only be actually settled when the Channel Tunnel itself solves it, and ends, once and for ever, all discussions upon the subject.—*Building News.*

Coal in Venezuela.

In a report by Mr. Plumacher, of the United States Consulate, at Maracaibo (Venezuela), some information is given concerning coal deposits in that country. It is stated that those parts of the country lying between Rio Zulia and Rio Gantatumbo and the Cordilleras, abound in asphalt mines and fountains of petroleum, and generally what is described as a large coal formation. Beyond the Rio Zulia, in the upper part of the department of Colon—that does however not extend to the foot of the Cordilleras—there are stated to be no coal mines, but Mr. Plumacher states that he has been informed by persons of truth and respectability, that the valleys of Cucuta, and the territories of the State of Tachira, abound in coal mines. Near San Antonio, in the ravine called "La Carbonera," exist some of considerable size, from which is frequently dug coal for the use of the smiths' forges in that place; and at the foot of the Cordilleras, on the northern side, there are a considerable number of coal mines, asphalt deposits, and also some fountains of petroleum. In the territory of the department Sucre, just opposite Gibraltar, at the foot of the mountain line, a large quantity of coal and asphalt is found. Mr. Plumacher states that among the samples of coal which he has examined during his

residence in the State of Zulia, he has only met with one true specimen of lignite. This specimen was found near the Cordilleras and in the direction of the Rio Torondoy, and its quality greatly interested those who examined it. It was ultimately sent to Caracas to be thoroughly examined and tested. The northern basis of the Cordilleras is not much known, and Mr. Plumacher reports that he is not aware whether it contains any coal; but between Escuque and Bettijoque, in the town of Columbia, petroleum wells of an inferior quality are abundant. Reporting generally on the coals which have been so far discovered in this district, Mr. Plumacher states that the driest and most compact of all is that of Tule, and after the many trials to which he has submitted it, he is able to place it among the coals of the best quality, serviceable for all those purposes for which the best lignites are advantageously employed. We further note that, however great the riches manifest on the surface of this region may appear to be in the innumerable fountains and deposits of petroleum, bitumen, and asphalt, such riches cannot be compared with those contained in the immense coal deposits from which those substances proceed. This conviction, which is derived from the nature and circumstances connected with the inexhaustible fountains of petroleum, asphalt, bitumen, and coal already mentioned, supports the opinion that few countries possess the mineral wealth that abounds in the regions around the lake of Maracaibo; and the opinion is expressed that if these coal deposits, which really form the greatest wealth of the State, have not yet been discovered, it is owing to the fact that by far the greater part of its territory is at present in the wild and desert condition in which it was found at the conquest. The government has never interested itself in an exploration of the district, neither have individuals done so, although many may have possessed the means and the knowledge adequate to such an undertaking.

A Big Load of Cotton.

On Saturday, April 2, there arrived in New Orleans the Mississippi River steamer Henry Frank, with the largest cargo of cotton ever brought into the Crescent City—9,223 bales. Other freight brought this cargo up to an equivalent of over 10,000 bales. The Frank is a stern-wheel steamer of not unusual size, but specially designed for the transportation of baled cotton. Of this tremendous cargo, only 2,500 bales were stored in her hold, the balance being built up over the entire steamer, so that her appearance was that of a floating fortress. Only her smokestacks, escape pipes, pilot house, and wheel were visible. Here and there port holes were located to admit air to the furnaces, or ingress and egress to and from the cabin. The bales were tightly packed, fourteen tiers high, the joints being broken as in brickwork. A force of twenty men were constantly on the alert with appliances for quenching any fire that might break out. The cargo was insured for $400,000, and the average weight of each bale was 450 lb. The Henry Frank's cargo was picked up between Memphis and New Orleans, and its arrival safely at the latter city evoked great interest. When it is remembered that 4,000 bales of non-compressed and 6,000 bales of compressed cotton is considered a large cargo for an ocean-going steamer, the size of the Frank's load of the non-compressed article becomes more apparent. The freight would average $1.25 per bale, and the money advanced shippers by the boat on account on this trip was over $20,000.

A Cracked Volcano.

Within the space of ten months Mount Etna had five abundant eruptions of smoke and sand, without any subsequent flow of lava. In one instance, after profound subterranean rumblings and numerous earthquake shocks, there appeared on the eastern side of the mountain a great cloud of vapors and ashes, which escaped by a crevice nearly three miles long. The snows melted suddenly around the summit of the mountain, jets of hot vapor escaped at many places, and the small muddy craters of the western declivity became very active, as is usually the case on the approach of a great eruption. But to the surprise of all observers, within thirty-six hours afterward the volcano had returned to a state of perfect calm. Such a phenomenon has never before occurred within the memory of man. Vicenzo Tedeschi di Ercole attributes it to the existence of an immense opening, which appeared upon the mountain at the time of the eruption of May 26, 1879. He concludes that a very strong pressure is required for the formation of lava, and that a great tension of gas is indispensable in order to raise the lava to the surface of a mountain. It appears probable, therefore, that there will be no reason to fear any further eruption in the cone of Etna as long as the present crevice is open.—*Ann. de Chim. et de Phys.*

Diphtheria.

Dr. Gauthier, of St. Paul, Minn., tells in the Chicago *Medical Review* of his success in an epidemic of diphtheria by the use of iodine. He has treated 200 cases with but two deaths, while before adopting this method he lost one third of all his cases. The treatment is as follows: The patient is ordered tincture iodine in ten to twelve drop doses every hour, well diluted with water, so long as the fever lasts, subsequently reducing to ten drops every two, and finally every three hours. Local applications are made use of at the same time. These latter should be made by the physician at least twice a day. For internal use the decolorized tincture is used. Bread and starchy articles of diet are used in abundance.

Trial of a Fire Nozzle.

A trial was lately had in Boston of the Monitor or Universal Nozzle, the patent of Andrew J. Morse. The nozzle is of the same pattern as that used upon the fire boat Flanders, and this exhibition was given to demonstrate its value for street service, whether operated by steam engines, or by a powerful pump in the basement of stores. The trial was given under the directions of District Engineer William H. Cunningham, of the third district, and a detail from Engine No. 25, under Captain George W. Frost. Mr. Morse, the inventor, was present, as well as District Engineer Regan and Chief Green, who expressed himself more than satisfied with the results attained. The nozzle, which was securely fastened to a heavy section of plank, was bolted to the pavement, and the power was furnished by the engine in the basement of the Mechanics' Exchange, on Hawley street. The pressure, each trial, was 160 pounds. The first trial was with a 1⅜ inch nozzle, through a single line of hose; the second with a 1⅛ inch nozzle and a single line of hose; the third with a 2 inch nozzle and three lines; and the last through a 1⅝ nozzle and two lines. The stream in each case was more than expected. Upon the level a tremendous volume of water was thrown for a distance of at least 250 feet, and when played in a vertical direction, the water was thrown completely over the five story buildings on Franklin street. The handling of the pipe was conducted by one man, who had not the slightest trouble in directing the torrents of water that came from the nozzle. It is the inventor's idea that for street service the nozzle should be mounted on a four-wheeled hose carriage, which could be separated at will, the rear wheels having the nozzle and the front wheels the hose.

Orchid Hunting along the Rio Negro.

In a recent letter to the *World*, written at the little settlement of Tauapassua, Rio Negro, Brazil, Mr. Ernest Morris corrects the statement made in a previous letter, that the prince of cattleyas, *C. El Dorado*, is a habitat of high forests. It is a native of the lowlands only, the error now corrected having arisen from his mistaking a schomburgkia for the cattleya. Cattleya El Dorado, he says, is found only on the Negro, but *C. superba* has an immense range, being found not only throughout the whole Rio Negro region, but up the Amazon as far as Teffe and at the mouth of the Japaru. There are several varieties of *C. El Dorado*. The most beautiful has sepals and petals of a clear rose, with lips of a most beautiful crimson and throat of deep orange. The flowers are large and delicately fragrant, and bloom in January or February. Among other orchids collected (and the first that I have seen) was a tall growing epidendrum (?) which produces its flowers from the *top* of the stem. Six specimens of this plant were found near Tauapassua, every one growing in an ants' nest.

Speaking of his collections, Mr. Morris says: "Besides the orchids I brought with me numerous twigs and branches which were covered with cauchy (a sediment deposited by the water, and very common in low forests), which has poisoned my hands and face. I propose to distribute among the orchid growers at home specimens of this cauchy. It should be found in every hothouse, and it would show the lover of orchids, did he but touch it, what a collector undergoes."

New Method of Packing Fish Eggs for Shipment.

Under the supervision of Professor Baird, U. S. Fish Commissioner, a shipment of 40,000 eggs of the whinnish, or landlocked salmon of Maine, was recently made to Germany, by Mr. Fredrick Mather, of this city. Half the eggs were consigned to the Berlin Fishery Association, and the rest to the Société d'Acclimatation, of Paris. Mr. Mather has recently adopted a mode of packing for shipment which differs materially in detail from that employed last year, in the course of which he shipped 700,000 eggs with a loss of only 7 to 8 per cent. It was the earlier practice to place the ova in shallow trays composed of a wooden frame with a bottom of canton flannel. The trays were placed one upon another in a vertical position in a compartment directly beneath an ice box, from which water a little above the freezing point and well charged with oxygen constantly percolated. In the new method the trays are put into tin boxes one upon the other until each box is full. A well fitting cover is then placed over them, and the boxes, thus nearly hermetically sealed, are packed in ice. There is no percolation of water upon the eggs in this mode of packing. But as the box detains and condenses all moisture arising from the trays, and the supply of air is sufficient for a number of days, it is believed that it will save a larger percentage of the eggs than was possible under the old method, besides occupying somewhat less space.

Climbing Trees for Fish Bait.

In his search for orchids in the forests along the Rio Negro, in Brazil, Mr. Ernest Morris was surprised to see his native rowers run his canoe ashore and proceed to climb a low tree covered with bromelias and large tillandsias. "Those are not orchids," he said. "No matter, patron," replied the Indian; "we want *iscal* (bait)." Wondering at this Mr. Morris watched the boy as, hand over hand, with knife held between his teeth, he passed from limb to limb. Soon a large tillandsia, several feet square, fell to the ground. "Where is your bait?" said he. "Look," said the Indian, who was cutting the leaves close at the base, where the explorer saw between the leaves a mass of worms resembling our common ground worm. How they got there puzzled him. The Indian said they climbed the tree, but this he doubted. At all events, there was bait. What a blessing it would be considered by the American small boy if, instead of digging up flower-beds or turning over old boards, thus losing much valuable time, he could fill his can of bait by climbing a tree? Mr. Morris adds that he has caught fish with the fruit of the tucuma (*Astrocaryum tucuma*), but this was the first time he ever found actual live bait in the trees.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—District of Maryland.

EMIGH *vs.* BALTIMORE AND OHIO RAILROAD COMPANY. STEVENS *vs.* SAME. STEVENS, USE OF EMIGH, *vs.* SAME.—PATENT RAILWAY BRAKE.

Bond and Morris, Judges:

1. The question in controversy is, "What saving did the defendant derive from the use of the Stevens brake for the period covered by that patent above what it would have derived from the like use of the Hodge brake during that period?"

2. The difficulties of proving the exact money value of this saving are exceptionally embarrassing.

3. Although this rate may possibly be less than the defendant's actual gain, in the absence of more exact means of computing what that gain was, the court determines upon twenty-five dollars per car per year as the proper rate of profits to be decreed to the complainants in all three of these cases.

4. On these sums the court does not allow interest.

United States Circuit Court.—District of Massachusetts.

ROOT *et al. vs.* LAMB.—SPIRAL TUBES.

Lowell, J.:

1. Where an invention relating to the method of forming spiral tubes was described in terms used in the art of making welded tubes, it not appearing that sheet metal tubes could be made in the manner described: *Held*, that the invention is thereby limited to the making of spiral welded tubes.

2. In describing his invention a patentee may misuse words, but in seeking his meaning the ordinary signification of the words he uses must have weight.

3. A patentee's invention cannot be given a broad construction, so as to cover later inventions, when it appears from the state of the art that there was no opportunity for a great original discovery and the claim is properly limited to the specific improvement.

Bill dismissed.

Mexican Pyramids.

On his return from his tour of antiquarian research in Southern Mexico, M. Charnay reported the discovery of a ruined Toltec city in Tabasco, near the Gulf coast, a city which covers a wide area and must have been in its day a place of considerable importance. The long forgotten town is surrounded and dotted over with small hills, and the builders had utilized these natural elevations by erecting thereon a number of temples, pyramids, and palaces, and had connected their sites by bridges. The largest of the pyramids is 500 feet in height and a second is fully 300. Nature had had more to do with these monuments than art, as the builders had merely shaped the hillocks into pyramidal form and afterward faced them with stone, and steps were also cut in the sides, paved with a mixture of cement and pebbles. From a careful study of the remains of this ancient city M. Charnay is inclined to believe that it was founded between 1150–1180, and that it was in a perfect state of preservation at the time that Cortez invaded Mexico. This opinion was strengthened by a conversation with two well-informed Spaniards whom the explorer encountered in San Juan Bautista, who declared that there were to be found in ancient Spanish records statements to the effect that this city was not destroyed until after the town of Vera Cruz was laid out. M. Charnay is satisfied from indications he observed that there are remains of at least two other Toltec cities further up in the adjacent mountains, but further investigation is postponed for the present.

The Moquis.

In the history of the aboriginal races of this country little is said regarding the Moquis, a branch of the Pueblos, living, where possibly they have lived for a thousand years, in a rocky stronghold in a sandy desert of Arizona. This people number about two thousand five hundred, and occupy six villages, with houses built of stone cemented with sand and clay. These villages, says Dr. Loew, of Wheeler's surveying expedition, are built on the tops of four sandstone mesas, which are separated from each other about eight miles. They occupy the entire width of the mesas, and, standing immediately before the houses, one may look vertically down a depth of three hundred feet. In many places the sides of the mesas are terraced, being used as sheep corrals. In appearance the Moquis come rather nearer to the Caucasian than the rest of his race. These Indians are well clad, and the females especially so. Indian corn is the principal food—the sheep are raised for their wool rather than for the table. From the wool a good blanket is made. The seed corn is planted about one and a half feet from the surface, at which depth sufficient moisture is found to develop and sustain the plant. The Moquis have neither church nor any other place of worship, and the Spanish Jesuits were unable to gain a foothold among them.

Engineers' Club, Philadelphia.

At a recent meeting Mr. C. W. Buchholz read an interesting paper, calling attention to the rapid increase, during late years, in the weight of the rolling stock of railroads, especially in the locomotive, in the concentration of enormous loads upon one pair of drivers. He described the effect of this heavy weight, when hurled at the rate of 60 miles per hour, or 88 feet per second, upon a light iron bridge. He urged the great necessity of employing competent engineers to design and build such bridges, and of holding them to a rigid responsibility. He doubted the efficiency of trussed bridges with parallel chords and pin connections for spans under 150 feet long, under the present condition of large railroads using modern locomotives and running at a high rate of speed. He suggested solid plate girders and riveted arched trusses as being stiffer and more permanent. In conclusion, he drew especial attention to the great care the modern locomotive imposes upon the engineer in designing the details of all bridges and in determining and proportioning their floor systems.

Notes on the sewerage of Memphis were read by Mr. Wm. Henry Baldwin, giving some personal experiences while engaged in the construction of the work, and also describing some experiments and observations recently made by Major Humphreys, engineer, in charge of the sewers, showing their present condition.

Some topographical features of Memphis were described, showing that, although situated on a bluff, it does not overlook the river, but its surface descends rapidly to a small stream of water in the interior, separating the business from the suburban and rural parts of the city. To avoid polluting this stream, intercepting sewers were placed on each side. Their location, through private property for much of their length, was described, showing how, by avoiding all angles and using curves of 100 feet or more radius, these mains were reduced, practically, to straight lines.

The Memphis sewers being intended to carry off only household waste, the adjustment of their size was shown to be so proportioned that the nearly uniform supply of water afforded a sufficient midday flow to fill the sewers at least half full every day, thus keeping them constantly flushed. Hence the necessity for the entire, and not the partial, exclusion of rain water; for its admission, even from the roofs of dwellings, would render this adjustment of size, and hence the daily flushing of the sewers impossible.

The entire system is thus shown to be self-cleaning, except the upper end of the smaller branches where the water furnished by houses is not sufficient to half fill a six inch pipe, and here the flush tank is required to discharge once a day water enough for this purpose. The operation of flushing being required only at the dead ends, it will be seen that the tanks are widely distant from each other, that their action is entirely independent, and that the failure of any of them to operate would cause only local inconvenience, and have no possible influence on the rest of the system.

The fact that the pipes are entirely clear has been established by passing through them metallic balls but little smaller than the sewers themselves. The velocity of flow in the mains, as determined by recent gaugings, was shown to be such that any substance introduced into any part of the system would be discharged into the sewer in the course of two or three hours, in fact, long before it would have time to stagnate or become foul; and this, together with the complete system of ventilation described, by which a burning piece of paper is drawn into the sewer and not blown out, shows the complete success of the Memphis system of sewerage as a sanitary work.

Mr. Chas. G. Darrach read extracts from the reports of the chemical experts on the present condition of the water supplied to the citizens of Baltimore. This water is supplied from Lake Roland, and when drawn from the taps has such a disagreeable taste and odor as to be useless for domestic purposes. One of the experts found that there was present a volatile nitrogenous substance unknown to chemistry, which he believes to have been the cause of the offensive smell and taste. Whether this organic substance is injurious to health or not he is unable to say, that being a question for physicians. The other expert thought that, as the water was taken from near the bottom of the reservoir (some 25 or 30 feet below the surface), the water needed air. Mr. Darrach advanced the same theory, and in proof stated that the surface water of Tumbling Run Dam in Schuylkill Co., when visited in 1875, was good, while that drawn from the bottom was very offensive to both taste and smell. The water taken from the Fairmount pool during winter, when the ice remains for any unusual length of time, becomes very disagreeable.

Disinfection of Ships.

In devising a system for the thorough disinfection of vessels on board of which cases of smallpox had occurred, the Austrian Government, through its medical experts, resorted to the following method: Sulphur to the extent of twelve grains per cubic meter of the space to be disinfected was first burned in an earthenware vessel or basin, placed in the center of a mass of sand to prevent all risk of fire; every article of clothing, all the linen, etc., were hung across the cabin, the latter being then hermetically closed for three hours, and afterward exposed to the strongest possible draughts of air for twelve hours; finally, the walls, floor, ceiling, etc., were washed with one kilogramme of lime, or one half a kilogramme of chloride of zinc, to every hundred liters of water.

Prospects of Aerial Navigation.

An interesting and suggestive paper by Dr. Bell Pettigrew F.R.S., was lately read at a meeting of the Balloon Society of Great Britain in the Royal Aquarium. Mr. W. H. Le Fevre, C.E., president of the society, took the chair. Reviewing the principal structural differences of the bodies and limbs by which animals were fitted to move on land, through water, or in air, Dr. Pettigrew pointed out that the analogy which obtained between water and the air as supporting media had strangely and gravely complicated the problem of flight, the idea uppermost in most minds being that a flying creature must float upon the air as a ship floats upon the water. It was this idea that led to the discovery of the balloon, though the balloon could not in any sense at present be regarded as a flying machine. Until endowed with the means of moving from one place to another independently of the wind, as he hoped it would soon be by the ingenuity of a member of the society, a gallant officer, whose plan had not yet been made public, the balloon would remain merely a lifting apparatus. The balloon was inefficient because of its levity; the flying creature was efficient because of its weight. The manner in which wings produced what was practically a solid basis of support in the thin air raised the whole subject of flight.

After describing minutely the structure and action of natural wings, he said, with regard to the speed at which they were driven, that the common housefly moved its wings 330 times per second, or 19,800 times per minute, the butterfly managing only 9 movements per second, or 540 per minute. That the wing was driven more slowly in proportion to its length had been proved by experiment, and this fact was hopeful for the future of flying machines, as there could be no doubt that comparatively slow movements would suffice for driving the long powerful wings required to elevate and propel flying machines. It was evident from what was seen in nature that flight was to a large extent a question of weight and power of body and size and speed of wing. It was satisfactory to find that a solution of the difficult and important problem of artificial flight was being attempted by men of the highest scientific attainments, and that aeronautical societies had of late years been established in France, Austria, and this and other countries. Classifying the various machines by which aerial locomotion had been attempted, he pointed out the causes of failure and the means by which partial success had in some cases been obtained. One of the main difficulties in the way of constructors of machines for aerial transit was the want of a sufficiently powerful and light motor, and in the use of compressed air for this purpose he saw a probable means of doing without the heavy steam or electric engine. Aerial navigation might well appear Utopian to the mass of mankind. It was not, however, on that account impossible. It was a question of time, perseverance, and ingenuity, simply a very complex physical problem, and the *data* for its solution were being slowly but surely accumulated.

Pasteur's New Disease.

In the *Lancet* for February 5, we called attention to the remarkable effects which M. Pasteur had obtained by inoculating rabbits and guinea pigs with the saliva of a child which had died from hydrophobia. The animals, it will be remembered, died thirty-six hours after inoculation, and in their blood was found a bacterial organism, which was quite peculiar, which could be cultivated, and then produced, when inoculated into other animals, symptoms identical with those observed in the others. M. Pasteur did not assert that this was the special microbic organism of rabies, but he considered that his experiments and the microscopical characters of the organism warranted the assertion that the disease was not septicæmia, but a malady altogether new to experimental pathology. In order to ascertain whether a similar affection can be produced by the inoculation of the saliva of persons who have died from other common diseases, M. Pasteur has made some inoculations with such saliva, but without any results. But since the case of hydrophobia was in a child, M. Pasteur applied to M. Parrot for some saliva from children dying from diseases which are regarded as non-specific, and received some from the bodies of three children who had died the preceding day from broncho-pneumonia. In rabbits inoculated with this saliva there was found precisely the same organism as had been discovered in those which had been inoculated with the saliva from the case of hydrophobia. He thinks it certain, therefore, that this organism may often be found, and that it is one of those which have their habitat in the commencement of the alimentary tract. Hence, as he points out, it is not in any way connected with rabies, but it is a surprising fact there should exist in the saliva, at least of children, a special organism which is capable of causing so rapidly the death of rabbits and dogs, even when inoculated in very small doses. It is a fact of very great importance in the etiology of diseases which may be ascribed to microscopic organisms.—*Lancet.*

The Treatment of Tetanus.

Dr. Ria believes that tetanus consists essentially of an exaggerated reflex irritability of the spinal cord, which may be indifferently caused by traumatisms, toxic influences, or so called rheumatic action. Since the motor tracts of the cord respond in a morbidly exaggerated manner to all sensitive impressions, the main object of treatment will have to be to lessen sensory excitation; for, if this be accomplished, the cord will gain rest, and thus a return to its normal condition will be made possible. Ria, therefore, emphasizes strict isolation of the patients. They are to be separated from their friends, and to be kept from all possibility of sensory impressions. Even the physician or attendant should exercise great care in his intercourse with the patient, lest the latter be disturbed.

Four cases have been successfully treated by the author. In addition to complete and prolonged isolation, several drugs were employed. Thus, in the first case, in which tetanus developed after an amputation of the thigh, chloroform was applied externally by the use of the atomizer. Nearly three ounces were used daily. A gentle sleep was also maintained by the exhibition of chloral hydrate and morphine. The cure was complete in two weeks. In the second case, that of a youth twenty years old, the same plan of treatment was adopted. But one-sixtieth of a grain of atropine was given in conjunction with the chloral hydrate. A cure took place in twenty days. In the third and fourth cases the external use of chloroform was not enforced, and the last case was treated by bromide of potassium and isolation. This one recovered after forty days.—*Medic.-chir. Rundschau, January*, 1881.

Strength of Bronzes.

In a paper lately read before the American Society of Civil Engineers, Professor R. H. Thurston describes a new bronze alloy of maximum strength. The properties of this alloy were ascertained by Professor Thurston in the course of his examination in the mechanical laboratory of the Stevens Institute of Technology of a series of 36 alloys of copper, tin, and zinc, in which the proportions of the copper were varied from 10 to 89 per cent; of the tin, from 10 to 80 per cent; and of the zinc, from 10 to 70 per cent. The results of these experiments pointed to an alloy of the proportions of copper, 55, zinc, 43, and tin, 2, as likely to be that possessing maximum strength, and on Professor Thurston making the alloy he found it to possess a good color, to be close grained, and susceptible of high polish. It was also found to have immense strength, considerable hardness, and moderate ductility, while it could also be forged if carefully heated. For purposes demanding toughness as well as strength, Professor Thurston found, however, an alloy with less tin to be preferable, and he gives the proportions of copper, 55, tin, 0·5, and zinc, 44·5, as affording the best results. This alloy, he states, has a tensile strength of 68,900 lb. per square inch of original area, and 92,136 lb. per square inch of fractured area, while it elongated from 47 to 51 per cent (length of test sample not stated), and reduced to 0·69 to 0·71 of its original diameter before fracture. He also states that the shavings produced by the action of the turning tool on this alloy curled closely, and were tough and strong like those of good iron. Professor Thurston also refers to an alloy discovered several years ago by Mr. J. A. Tobin, but which appears not to be generally known. This alloy, which consists of copper, 58·22, tin, 2·3, and zinc, 39·48, had, when cast, a tensile strength of 66,500 lb. per square inch of original section, while when rolled hot its tenacity rose to 79,000 lb. per square inch, and when moderately and carefully rolled cold, to 104,000 lb. per square inch. It could also be bent double either hot or cold, and was found to make excellent bolts and nuts, while it could be forged at a low red heat.

Fight with a Porpoise.

Mr. R. R. Tanguey, the veteran Rochester sportsman, recently had a fight with a porpoise. In a letter from St. John's River, Florida, he says:

"I will write you of my last struggle with a large porpoise. I was rowing up in what we call the 'witch-tide,' when this monster came running between me and the bluff. I struck him on the head with my oar. He gave a sudden dart and went ashore like Jersey lightning, and I went almost as quickly after him. Then he rushed for the deep water again, but chanced to open his huge mouth. This was my chance, and I rammed the ore in his mouth and down his throat. Then came a tussle—he pulled and I pried. After a long struggle he quieted down; I ran for the boat and got my largest sword. With it I gave him a gash in the throat which made him wild with pain. After a while I got a chance to make him fast to the boat with a line around his tail. A man came to my assistance and we pounded him with clubs until he was dead. We waited for the next tide, as it was hard work to tow a dead porpoise. He doesn't float when dead. By hard work we got him ashore and to camp. Then we measured him. He was nine feet ten inches long, two feet three inches in diameter, and would probably have weighed more than six hundred pounds."

Foreign Bodies in the Eye.

Dr. Thos. R. Pooley (*Archives Ophthalmology*) reports some interesting experiments with the magnetic needle for detecting foreign substances in the eye. He concludes: 1. The presence of a steel or foreign body in the eye, when of considerable size, and situated near the surface, may be determined by testing for it with a suspended magnet. 2. The presence and position of such a body may most surely be made out by rendering it a magnet by induction, and then testing for it by a suspended magnet. 3. The probable depth of the inclosed foreign body may be inferred by the intensity of the action of the needle near the surface. 4. Any change from the primary position of the foreign body may be ascertained by carefully noting the changes indicated by the deflection of the needle.

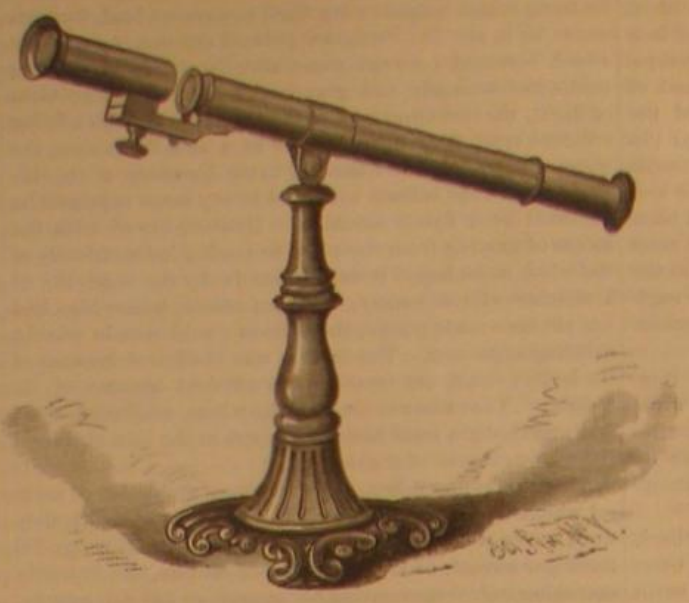
IMPROVED OPTOMETER.

We give an engraving of a novel instrument for measuring the focal lengths of lenses, which is capable of measuring the focus of any lens from three inches to seventy-two inches, while the length of the instrument is only thirteen inches. This is effected by the employment of a convex lens of short focus which shortens the focus of the lens under test. The instrument is in some respects similar to a camera, the object being held in the short detached tube, the lens to be tested being placed between the two tubes; the image of the object is formed on a ground glass carried by the movable tube. There is a scale on the movable tube, and when the image on the ground glass is sharp, the scale indicates the focal length of the lens.

The great utility of this instrument will be understood when it is known that scarcely any spectacle or eye glass has the correct focus marked upon it; and it is often very essential that the exact focus of a lens be known, for example, in matching a glass when its mate is broken, or in supplying spectacles which are but very little different from those already worn.

This instrument is as well adapted to testing concave as convex lenses, and it may be used by any light. It is an ornament to the showcase of a dealer, and will be found very useful by any one dealing in spectacles as well as the regular optician.

This invention was recently patented in this country, and is manufactured by Messrs. Scharpf & Adam, Smith's Arcade, Rochester, N. Y.



NEW OPTOMETER.

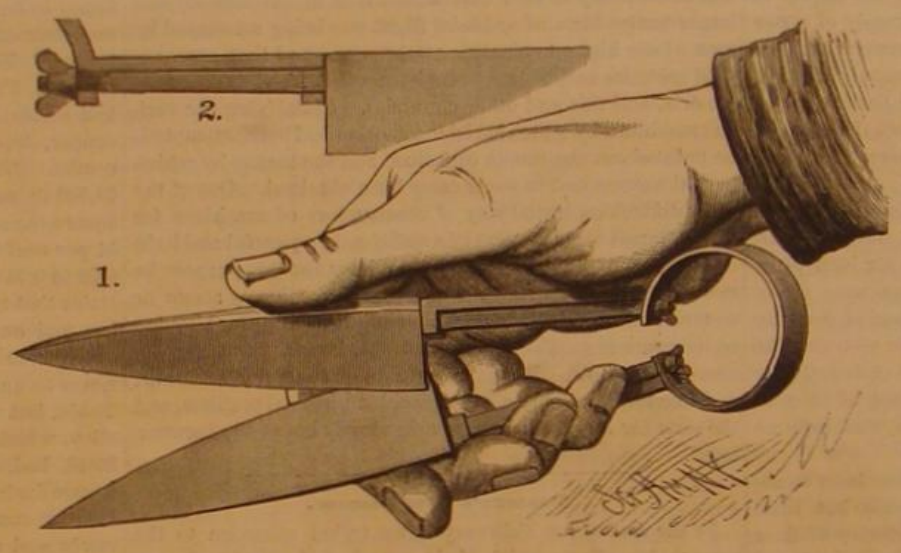
IMPROVEMENT IN ANIMAL SHEARS.

The shears shown in the engraving differ from ordinary sheep shears in having the blades separable from the handle. This construction admits of readily detaching the blades so that they may be ground separately, saving a great deal of time in grinding and avoiding rounding the points and corners and breaking the spring, a thing that often happens with shears of the ordinary construction.

The construction of the shears will be understood from the engraving, Fig. 1 showing the article complete, Fig. 2 being a detail view of a portion of the spring and the end of the shear blade.

The handle of the shears is made with a central spring in the usual manner. On the outer and inner ends of the arms of the handle are formed sockets to receive the shanks of the blades. The apertures of the eyes are made square and slightly tapering, and the shanks are made square and are tapered, so that when the shanks have been drawn snugly into the eyes the blades will be held firmly and rigidly. On the ends of the shanks are cut screw threads to fit wing nuts, by which the shanks can be drawn snugly into the eyes and held securely. The backs of the blades project a little beyond the shanks to form shoulders to rest against the ends of the arms of the handle, so that the backs of the blades and of the arms of the handles will be in line and will form a smooth surface.

This invention was lately patented by Messrs. C. Benavides and J. P. Arthur, of Laredo, Texas.



IMPROVED ANIMAL SHEARS.

The Piute Census.

The statistics of the Nevada Indians were collected by Indian enumerators, whose outfit consisted of a pencil and a sheet of paper. A circle on the paper represented a wigwam or a camp. Within each circle the enumerator placed figures to represent the number of persons counted, squaws and children being represented by different signs. Chief Numana, the supervisor of the Indian count, made up his report from the paper sheets by taking a number of sticks of various lengths to denote adults and children of different sizes, notching those representing females, and sending the sticks in bundles to the Census Office.

This method, though rude, has served to furnish an accurate census of the Piutes.

Proposed Lake Erie and Ohio River Ship Canal.

A report of surveys made by Major John M. Wilson, U. S. Engineers, describes two possible routes for a ship canal connecting Lake Erie with the Ohio River.

The first is by way of the Erie and Wabash Canal to the navigable waters of the Wabash River, which would then make the connection through to the Ohio. This would necessitate the enlargement of the entire route from Toledo to Lafayette to a width of 70 feet at surface and 52½ feet at bottom, with double locks 110 feet long, 18 feet wide, with a depth of 7 feet on the miter-sill, enabling it to pass boats of 240 tons burden, capable of carrying 8,000 bushels of grain, the amount transported by a train of 20 ordinary freight cars.

The second route is by the Miami and Erie Canal, which joins the Wabash and Erie Canal, 10½ miles south of Defiance, thus connecting Toledo and the Lake with the Ohio River. It is proposed to enlarge the entire canal from the Ohio River to Junction City, Ohio—where it unites with the Wabash and Erie—to the dimensions of the New York and Erie Canal: the prism to be 70 feet wide at water surface, 52½ feet wide at bottom, with a depth of 7 feet: all locks double, with a length of 110 feet, width of 18 feet, and a depth of 7 feet on the miter-sill; all canal structures of solid masonry, the superstructure of highway and railroad bridges of iron.

The estimated cost of the first plan from Toledo to Lafayette, Ind., is $24,236,135.17; that of the second, from Toledo to the Ohio River at Cincinnati, is $28,557,173.13.

IMPROVEMENT IN WATER ELEVATORS.

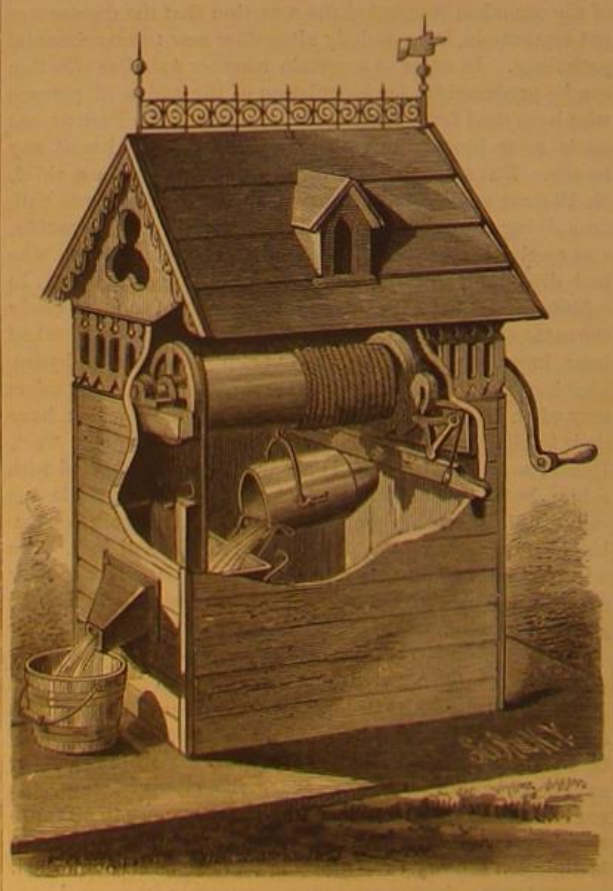
Although the devices that have been invented for elevating water are almost numberless, it must be admitted that there is nothing so free from objections as the old open bucket. The old-fashioned devices entailed considerable labor in raising the filled bucket, but no one doubts that the water was sweeter and better than it would have been had it been drawn from a closed well with a pump of any kind.

Our engraving shows a water elevator embodying all that is good in the old open bucket, and having new features which avoid all objections to the windlass and bucket. In this elevator there are neither brakes nor springs, and the mechanism is so contrived that no accident can occur from the running back of the empty buckets. There are two buckets, worked by the same windlass, one ascending while the other is descending, thus insuring a perfect balance of the buckets and doubling the capacity of the elevator. Ratchets and pawls are dispensed with and noise avoided, yet the bucket is stopped automatically at any given point in its ascent or descent. The mechanism by which this is accomplished is exceedingly simple, consisting of rubber balls placed in tapering pockets on opposite sides of a wheel on the windlass shaft, and in a lever operated by the tilting bucket so as to displace one or the other of the balls and allow the empty bucket to descend, while the ball, remaining in contact with the wheel, serves as a check on the filled bucket being raised.

This elevator is adapted to a well of any depth, since its buckets are perfectly balanced. The shaft of the windlass is mounted on roller bearings, reducing the friction to a minimum.

For the sake of convenience an indicator is placed on top of the housing and connected with the lever that shifts the rubber balls, and shows which way the handle of the windlass should be turned. The size of the curb is two feet by two feet four inches.

Further information in regard to this useful invention may be obtained by addressing Mr. Samuel I. Demarest, agent, Englewood, Bergen county, N. J.



IMPROVED WATER ELEVATOR.

Dangers of Athletic Training.

Absolute health is attained only by the symmetrical development of all parts of the body. The man with muscles of steel and a diseased heart cannot be said to be in good health, and diseases of stomach, heart, and nervous system are often—it may even be said usually—produced by that system of development known as training. At a recent rowing match in Philadelphia, two plucky lads in contesting boats fainted as soon as the race was over. Their condition, which was apparently good, was actually abnormal, and their systems gave way because the strain which their muscles met was too great for their vital functions. Recently a similar but more serious calamity occurred at Sag Harbor. A Brooklyn lad who had taken part in a pedestrian contest, when removed from the track, fell down dead. He had prepared himself for walking and running, and depleted his vital organs to build up his limbs. When the strain came the impoverished and most important part gave way. The severe muscular exercise of college athletes has carried off many fine young men by consumption, heart disease, and other disorders, directly traceable to the absurd overwork required of their bodies. There is a limit of human endurance. That limit is reached when the body is impaired in one quarter to benefit special organs. The severity of the test by which athlete prizes are won seems designed rather to award the laurels to him who is the least healthy, because more unevenly developed, than to the really best man.—*Boston Jour. Chem.*

MISCELLANEOUS INVENTIONS.

With vulcanizers in which the required temperature is obtained by confining the steam, especially those used by dentists, the proper regulation of the temperature is of the utmost importance, and has heretofore been attended with difficulty. The usual method is to regulate the flow of gas to the steam generator by hand; but such method is unreliable. Mr. William E. Gwyer, of New York city, has patented an improved governor for vulcanizing apparatus worked by the steam pressure, by which the pressure, and consequently the temperature, is maintained at a nearly uniform point. The invention consists in a gas cock opened by a spring and closed by steam pressure, for regulation of the flow of gas.

An improved snow shovel, which is simple, light, and durable, has been patented by Mr. Henry E. Vosburgh, of Auburn, N. Y.

Mr. James H. Egan, of St. Johnsville, N. Y., has patented an improved cone attachment for stoves which is designed as an improvement on the cone attachment for which letters patent No. 229,684 were granted to the same inventor July 6, 1880, and its object is to supply air to the cone without interfering with the draught through the grate.

An improved umbrella and sunshade has been patented by Messrs. J. T. Liley and F. S. Liley, of London, England. This umbrella or sunshade is provided with means for automatically expanding or opening it when released from the catch or tip cup which retains it in the closed position.

Mr. Charles R. Gorgas, of Wooster, Ohio, has patented an apparatus that may be readily used by the surgeon without assistance, and in the case of fractures dispenses with bandages. The invention consists in a frame provided with an extension slide that is fitted for operation by a rack and pinion, so that the power required may be readily applied.

An improvement in spoons and forks has been patented by Mr. Norman S. Boardman, of East Haddam, Conn. The invention consists in combining with the bowl of a spoon or tines of a fork a brass wire and glass tip. The wire is soldered to the bowl at one end, and provided at the other with a glass tip cast on.

Mr. Thomas Harding, of Brooklyn, N. Y., has patented an improved reclining chair that may be readily adjusted to form a reclining chair or bed, and also folded closely for transportation.

An improved road grader has been patented by Mr. James F. McGarry, of Caldwell, Ohio. The object of this invention is to furnish a road grader so constructed that it can be readily turned and used in narrow places, will throw no weight upon the horses' necks, either when loaded or unloaded, and when dumped can be readily drawn back to the place of loading.

An improved nose piece for eyeglasses has been patented by Mr. Fred Terstegen, of Elizabeth, N. J. The object of the invention is to allow the nose rest to be moved in or out of the same plane with the glasses, and by the pressure of a spring to be confined in any particular position, thus insuring firmness to the nose rests, and avoiding the chance slipping of the glasses from their position, and thus injuring the wearer.

An improved stove board has been patented by Mr. A. I. Griggs, of New York city. The object of this invention is to produce a stove board that will not tarnish, and that may be made ornamental without the labor and expense of varnishing and baking the boards.

An improved steam chest for hot-air drying, patented by Alexander Winward, of Accrington, county of Lancaster, England, consists in a sheet of tubes provided with cross pipes as well as inlet and outlet pipes. These tubes may be separate for the greater portion of their length and connected to each other at either end, the tubes opening at each end into a cross pipe or steam way, in such a manner that the steam may pass through them all; or the outsides of the tubes may be joined to each other by a central web extending the whole of their length.

An improved self-chalking holder for chalk lines which chalks the line perfectly, and does not waste or break the chalk, has been patented by Mr. Chauncey Wing, of Greenfield, Mass. The invention consists in a tubular roller or barrel, upon which the string or line is wound, the barrel being provided with two loose end pieces united by a spindle, upon which a cylindrical piece of chalk is loosely mounted and pressed against and into one end of the end pieces by an adjustable spring in such a manner that the end surface of the piece of chalk is pressed against the string or line, which passes through a recess formed by the end surface of the piece of chalk, and a laterally projecting flange of the corresponding end piece.

Mr. John Nagele, of Clarendon, Ark., has patented an improved vehicle wheel hub designed especially for buggies and light wagons, and also adapted to heavy vehicles. The invention consists of a hub provided with open-sided spoke mortises for staggering spokes, of annular caps or flanges fitted over the ends of the hub against the outer faces of the spoke tenons, and of a projecting band or collar, in combination therewith, that encircles the hub between the two sets of spokes and supports them on their inner faces.

MANUFACTURE OF REAL LACE BY MACHINERY.

Considerable attention has lately been paid in Europe to the manufacture of lace by machinery. A company has been organized in Paris with a capital of 2,500,000 francs to develop M. Malhère's lace loom.

This loom is a marvel of mechanism, having from 1,800 to 2,000 spindles, which are put in motion at the same time

Fig. 1.

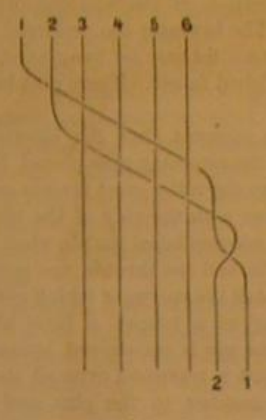


Fig. 2.

that 200 to 300 pins are placed or displaced. But the inevitable complication of the members of which it is composed, though a just object of admiration, is a legitimate cause of apprehension as to the regular working of the apparatus. In order to work economically the lace machine must move with great rapidity, and without very frequent interruptions; but whether these conditions can be realized is a matter that can be proved only by experiment.

This loom makes real lace, imitating hand work. We give a photographic reproduction of a sample of Valenciennes lace made with this machine, also a study of the rounded mesh of Valenciennes from Bruges. The pattern is not the work of a regular designer of lace, but was composed spontaneously by M. Malhère, who invented the loom; this explains its lack of elegance.

It is claimed that this loom can produce all kinds of lace, and that competent judges, and even lace makers, confound the lace which it produces with that made by hand. The microscope demonstrates to the incredulous that the weaving is the same as hand-made lace, without the least resemblance to the imitation.

For the principal facts we are indebted to the report written on this subject by M. Jousselin, engineer. The report begins by explaining how the inventor was led to construct the machine.

M. Malhere, in studying with a magnifying glass the intertwining of the thread of the lace made by hand, ascertained that in all kinds of lace, in the network and in the flowers, the thread is subjected to the same operation. This was the first conception of the possibility of producing these operations mechanically. Indeed, if one considers a twist forming the mesh of the Valenciennes and the knot of the figure constituting the flower, it is ascertained that the thread No. 1 (Fig. 1) crosses successively over thread No. 2, over thread No. 4 (which was crossed over No. 3), and under No. 3, in order to return, passing over and under the threads until it resumes its original direction, forming thus, with the three other threads, a twist of four threads. In Fig. 2, the adjacent threads, 1 and 2, pass suddenly in a transverse direction, twisting with a half revolution, and passing in alternation over and under threads 3, 4, 5, 6.

This problem, then, is reduced to making a twist of two contiguous threads from right to left or from left to right, according to the requirements of the design, and making it in such a manner that this twisting will be effected at will from right to left or from left to right in order to reverse the thread below or above.

In consequence of this it is necessary to accomplish mechanically the transposition of the threads in order to put in proper relation those threads which are destined to be worked together, and M. Malhere conceived the fundamental idea of making a machine employing rotative disks, which contain two threads capable of being twisted together by a half revolution or a complete revolution. These disks are tangent and in pairs, capable of transferring the thread from disk to disk, and are arranged in the segment of a cylinder, in order that the threads between the disks and their converging point may be as nearly as possible of a uniform length. The lace is produced in the geometrical center of the segmental frame. Several bands of lace are produced simultaneously by the superposition of the thread carriers. M. Malhere has also invented a comb with independent teeth which replaces the pins of the hand lace worker. The movements of the several independent members of this machine are controlled by the Jacquard arrangement of perforated cards. Such is the succession of ideas which led to the invention of the lace loom.

The lace from the spindles of the hand lace-worker is not made like net or imitation lace, by two distinct groups of threads, warp and woof, but by veritable twisting, in the interlacing of which all the threads may concur, following the fancy of the designer.

The interlacing threads are collected and fixed in the central part of the machine (corresponding to the pillow of the hand lace-maker) by means of pins. This hand method of making lace suggested to M. Malhere the peculiar form which he has adopted for the frame of his automatic loom. It consists of two concentric cylinder segments supported at a convenient height upon a cast iron table. As all parts of

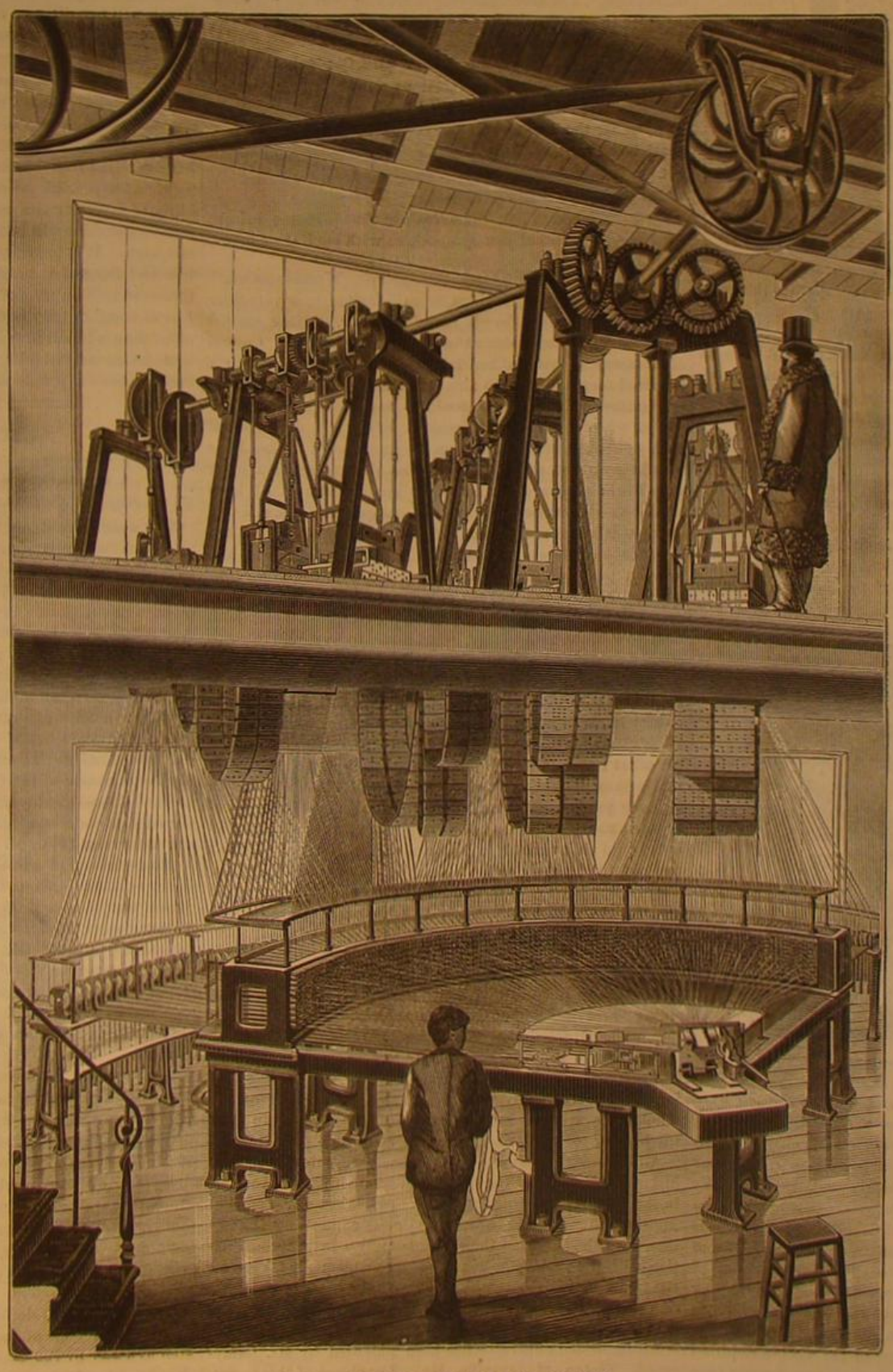


Fig. 5.—MALHERE'S LACE LOOM

the segmental frame are nearly equidistant from the converging point of the threads, the tension of the thread is uniform, and this arrangement allows each one of the bobbins to circulate in the interior of the cylindrical surface without any displacements of the threads. In the work by hand the lace-maker chooses among the suspended spindles around the drum those that she needs successively; she rolls them between her fingers, either to the right or to the left, in order to twist the threads and interlace them; then she sets the pin which fastens this portion of the mesh, until by another interlacing another mesh is formed, when she withdraws the pins from the portion of the work already finished. Then three kinds of movements are required: A conveying or removal of the selected spindles; rotation of the spindles to the right or to the left; the fixation and displacement of the pins

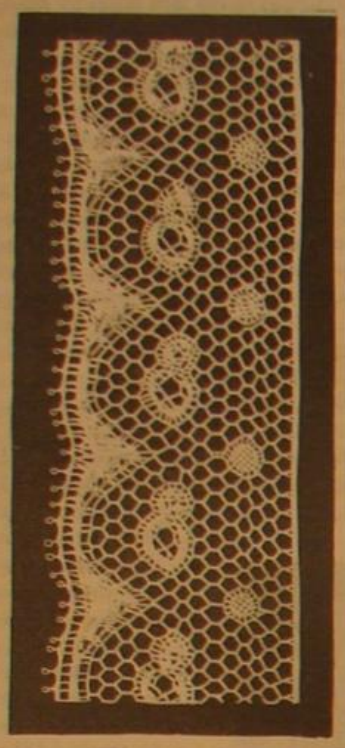


Fig. 3.—Bruges Valenciennes made by the Lace Loom.—From a Photograph.

From what has been said, it will be seen that each thread must work in a manner absolutely independent, and this independence of the different elements constitutes the great difficulty of the mechanical problem.

If one places himself in the center of the Malhere loom, having in front of him the lower segment, it will be seen that this segment is perforated over all its circumference, and that each one of the holes is filled by a metallic cylinder which manipulates the thread, and is operated and controlled by the Jacquard mechanism. According to the piercing of the pasteboard of the Jacquard band, the carriages carrying the bobbins are pushed from the groove of one pin to the groove of another, by little pushers, and may occupy successively all the disks.

In order that the threads leading from the bobbins to the rollers, which occupy the center of the loom, may be interlaced or twisted, the transposition of the bobbins must be by circular motion.

Fig. 4.—Bruges Valenciennes.

An arrangement of rack work and pinions worked by a double chain is controlled by another set of perforated cards, giving an intermittent traction to the chains. This latter Jacquard arrangement is capable of imparting to the cylinders a quarter or half revolution as is needed. We have said that the heads of the pins are tangent in a vertical direction and in a horizontal direction. This construction is not only designed to increase the height of the segments and the number of rows of pins, but to allow the transport of the bobbins from a determined horizontal row into the row situated immediately below or above it. When a bobbin is to be transferred from one row to another, the pins in the Jacquard mechanism corresponding to the motion required cause the pin in the segmental frame to turn a quarter of a revolution only, the sliding groove assuming a vertical position, then the bobbins are moved forward in a vertical direction, and a second quarter revolution of the pin places the bobbin in a horizontal position in such a way as to renew the interlacing of the threads.

The heads of the pins may be compared to the turntable of a railroad. The aim is to remove or add threads, as cars are added or removed in the composition of trains.

The insertion of the retaining pins may be from above or below. The inventor has preferred the latter method, as it furnishes a solid base for the pins and facilitates the removal of the finished fabric. These pins have a lateral and vertical motion.

At the moment that the interlacing of the threads is effected, the retaining pins placed behind and at a little distance from the roller must remain pressed down in order not to interfere with the play of the thread. When the interlacing is accomplished the pin rises in the angle formed by the threads, and the threads are separated by the horizontal movement of the carriages which carry them.

Arriving at a height a little above the upper net of threads, the pin is maintained laterally by a metallic platform, which is traversed over all its surface by radial slots equal in number to the pins, and the lower end of each pin is attached to a slider, moving in a vertical guide, which is capable of moving towards the roller, bringing the pin against the twist previously formed, where it is arrested by a stop, and the pin continues stationary as long as it is necessary to maintain the mesh. In order to release itself and before returning to the point of departure, it falls below the net of threads, in such a way as not to touch them in its retrograde movement. These quadrangular displacements of the pins are effected independently, being controlled by Jacquard mechanism.

Such, in general terms, is the lace loom of M. Malhere which has been recently exhibited in Paris. The apparatus is certainly a masterpiece of mechanism, and is an ingenious conception. The accompanying engraving indicates in some measure the intricacy of the machinery.—*La Nature.*

Bro. Gardner on Labor and Capital.

The Lime-Kiln Club is a facetious creation of the Detroit *Free Press*, and the reports of the imaginary meetings of the club, under the imaginary presidency of Brother Gardner, furnish the readers of the *Press* with perennial supplies of wit. The following is a specimen:

The Secretary read the following:

CHICAGO, March 30, '81.—*Bro. Gardner*—Please inform your friends whether you sympathize with capital or labor, and oblige a

WORKINGMAN.

"In the fust place, dar' am no call for me to sympathize with either," replied the old man in answer. "One am jist as necessary to the odder as two wheels to a wagun. Capital cl'ars away a spot an' builds a factory an' gins fifty or a hundred men a chance to airn a fa'r support fur demselves an' families. Dat factory wouldn't be dar' 'cept fur capital, an its wheels can't move widout labor. If dis' workin' man wanted to draw me out on the question of strikes I has only a word to say. I believe dat de average employer pays his help a f'ar price an' all he kin afford to. I b'lieve he knows his business, an' am mo' competent to run it dan de men who labor fur him. If I can't work fur a man fur de price he offers I stan' aside. If I hire a man I pay him do goin' price, an' I doan' let him tell me dat I mus' do thus an' so. Men strike bekase dey can't dictate, but de same men wouldn't be willin' dat deir employers should dictate to dem how much rent to pay, what close to buy, and how to spen' deir wages. As I said befo' dar am no call fur sympathy in de case. De mo' strikes we have de less money will be put into manufactures. When a capitalist kin loan his money at good interest he am foolish to put it into a factory whar' demagogues kin hariss an' ruin him. Jist you remember what I'm talkin'. De mo' unions de less factories. De mo' strikes de less work. Do you fink I'm foolish 'nuff to take my $800 out'n de bank, whar' principal an' interest am safe as a rock, an' put it into a coopershop, whar' three workmen could sink de hull of it in one strike bekase I couldn't pay mo' fur makin' de bar'ls dan de same would sell fur? Shoo! Fings am comin' to a putty pass when de man wid a shovel on his shoulder kin boss de man whose factory turned out dat identical tool!"

AGRICULTURAL INVENTIONS.

Mr. Bishop L. Smith, of Loogootee, Ind., has patented a riding revolving horse rake for raking stalks, grain, and hay, so constructed that it can be easily and conveniently controlled by the rider.

Mr. Charles S. Giger, of Highland, Ill., has patented an improved harrow, so constructed that either side or the whole harrow can be readily raised from the ground to clear the harrow teeth of trash.

An improved mower and reaper has been patented by Mr. Milan D. Farnam, of Ira Hill, N. Y. The invention consists in the peculiar construction of the mechanism for connecting the cutter bar and shoe, and also for connecting the pitman with the shoe and the cutter bar; also in the combination with the various bearings of mechanism for taking up the wear; and in the combination with the brace or coupling of a mechanism for holding the brace bar and the shoe at the desired distance from the ground.

An improved cultivator has been patented by Mr. Lafayette K. Tipton, of Maysville, Mo. The object of this invention is to furnish a cultivator so constructed that it can be readily adjusted to work deeper or shallower in the ground, that the points of draught attachment can be adjusted directly in front of the centers of resistance, and that the mechanism will not be broken should the plows strike obstructions.

Mr. William J. Powell, of Marshfield, Mass., has patented a cotton harvester, which gathers cotton from the plant while in the field by means of a vacuum.

Mr. John L. Scharff, of Womelsdorf, Pa., has patented a bean pod stringer for removing the string or threads from bean pods, and cutting off the ends of the pods. It consists in three bars, forming a clamp, clamping screw, a block or blocks having a semicircular flange, and a curved knife for removing the strings from the pods.

Mr. Thomas W. Hogsett, of Edray, West Va., has patented an improved churn, which is simple, easily operated, and the working parts of which can be adjusted for the operator while either sitting or standing, and which working parts can be placed aside altogether when the churn is to be cleaned.

Exploration of the Beni River.

The April number of the Kansas City *Review of Science* contains an article by Professor John D. Parker announcing the recent important discoveries by Dr. E. R. Heath in South America. Dr. Heath has solved the problem of the Beni River, and completed in this respect the work of Professor Orton, left unfinished by his untimely death. He has discovered two new rivers, one of which has been named in honor of Professor Orton, and explored the hitherto unknown mouth of the Madre de Dios, which is 2,350 feet wide where it empties into the Beni. The "multitudes of man eating savages," so long believed as existing along the Beni River, proved to be a myth, and the superstitious fear that has so long hung over this portion of the Beni River has been dissipated. He accomplished this perilous exploration in a frail canoe with two Indians, at his own expense. Dr Heath will hereafter be remembered and counted among the discoverers of South America.

The Chagres River Dam.

Late advices from the Isthmus of Panama state that the engineers of the proposed ship canal have sunk a shaft 100 feet deep, where the Chagres River dam is to begin, and have not yet found bed rock. This is not an encouraging sign, as the possible success of the canal hinges on the feasibility of diverting the course of the river by the proposed dam. The dam will have to be over a mile long and 150 feet high. It is proposed to make it 3,150 feet wide at bottom and 780 feet at top, the lake created by it to contain a thousand million tons of water. This is a stupendous project at best; and if the foundations of the dam must be laid more than a hundred feet below the surface, the successful issue of the undertaking to which it is preliminary becomes more than ever problematical.

Correspondence.

A Remarkable Hailstorm in Arkansas.

To the Editor of the Scientific American:

We were visited on the afternoon of April 11 by the most terrific hailstorm ever witnessed in this region. The atmosphere had been oppressive for twenty-four hours, the thermometer reaching 73° Fah. at 2 P.M., and the hygrometer showed the air to be nearly saturated with moisture. About 5:30 P.M. the air was "hot" and suffocating. Two cloud masses appeared moving upon us, the one from the southwest soon presenting the peculiar "boiling," jagged appearance so often noticed in precursors to hail; the other, from the northwest, very black and moving rapidly. A little before the time of meeting the sky overhead was of a livid green color. The first dash of hail was from the west, but the direction of the falling stones was quickly shifted to northwest, and finally almost from due north. It was observed that the stones fell, for the most part, at an angle of not more than 10° or 15° from the vertical, and their effective force indicated a fall from a considerable height. The storm continued about fifteen minutes, and the noise produced was almost deafening. I was able to make some measurements, which will convey a better idea of the size and nature of this hail. One stone measured 7 inches in circumference, and weighed 5·6163 ounces avoir. Six stones showed an average diameter of 2·2 inches, and together weighed 14·119 ounces avoir. Other stones were picked up later which would measure nearly 3 inches in diameter.

The stones were formed by ten to fourteen concentric layers of snow and ice around a single nucleus, the outside layers being chiefly snow, and deeply corrugated. The shape, in many cases, was not spherical, but more like that of an apple, having two flattened and pitted surfaces opposite. The average number of stones found upon the level ground was about 135 per square foot. I hardly need say that the damage has been very great. The iron roofs in the town have been well nigh ruined. The tin roofs fared, in some cases, better, but present very much the appearance of a waffle iron. The destruction of glass has been immense, the heaviest double thick offering no effective resistance. A number of small animals were killed or injured. Men exposed to the storm were badly bruised. Is not this the champion hailstorm of the season? C. P. C.

Fayetteville, Ark., April 13, 1881.

COFFEE.—ITS USES AND MEDICINAL QUALITIES.

BY HENRY SEGUR, M.D.

Doctor Bock, of Leipsic, says:* "The nervousness and peevishness of our times are chiefly attributable to tea and coffee;" he says that "the digestive organs of confirmed coffee drinkers are in a state of chronic derangement, which reacts on the brain, producing fretful and lachrymose moods. Ladies addicted to strong coffee have a characteristic temper, which may be described as a mania for acting the persecuted saint," etc.

I cannot agree with Dr. Bock that the nervousness and peevishness of the present time are to be attributed to the use of coffee. If people are more nervous or in worse humor now than formerly, we may find other causes arising from the customs and habits of society much more likely to produce such a state of things than the use of this particular article of diet. I have no intention of pointing out many changes and peculiarities in the habits of the age to show many other more prominent reasons for people being in bad humor besides the use of coffee. My object is to defend coffee from a slander aimed at one of our best friends—a friend more likely to relieve the morbid state of things complained of than to produce it. Who that has experienced the good effects of coffee can sit quietly and hear it abused? especially by an estimable physician who has written learned books on the nervous system. The nerves of every honest friend of coffee tremble with the shock of an attack from such a quarter.

Let us examine the effects of coffee on the economy. Taken in moderation it is a mental and bodily stimulant of a most agreeable nature; and, followed by no harmful reaction, it produces contentment of mind, allays hunger and bodily weakness, and increases the incentive and capacity for work, makes man forget his misfortunes, and enables those who use it to remain a long time without food or sleep, to endure unusual fatigue, and preserve their cheerfulness and contentment.

Jomand says: "An infusion made with ten ounces of coffee enabled me to live without other food for five consecutive days, without lessening my ordinary occupations, and to use more and more prolonged muscular exercise than I was accustomed to without any other physical injury than a slight degree of fatigue and a little loss of flesh."

The mental exhilaration, physical activity, and wakefulness it causes, explain the fondness for it which has been shown by so many men of science, poets, scholars, and others devoted to thinking. It has, indeed, been called "the intellectual beverage."

It supported the old age of Voltaire, and enabled Fontenelle to pass his hundred years.

The action of coffee is directed chiefly to the nervous system. It produces a warming, cordial impression on the stomach, quickly followed by a diffused, agreeable nervous excitement, which extends itself to the cerebral functions, giving rise to increased vigor of imagination and intellect, without any subsequent confusion or stupor, such as are characteristic of narcotics.

Coffee contains essential principles of nutrition far exceeding in importance its exhilarating properties, and is one of the most desirable articles for sustaining the system in certain prostrating diseases; as compared with the nutrition to be derived from the best of soups, coffee has decidedly the advantage, and to be preferred in many instances.

Liebig says: "We shall never know how men were first led to the use of coffee, but that we may consider the article so remarkable for its action on the brain and the substance of the organs of motion, and as an element of food for organs as yet unknown, which are destined to convert the blood into nervous substance, and thus recruit the energy and the nervous moving and thinking faculties."

The medicinal effects of coffee are very great. In intermittent fever I have used it with the happiest effect in cutting short the attack, and if properly managed is better in many cases than the sulphate of quinine. In that low state of intermittent, as found on the banks of the Mississippi River and other malarial districts, accompanied with enlarged spleen and torpid liver, when judiciously administered it is one of the surest remedies. In these cases it should be given in decoction made with four ounces of well roasted and ground coffee, boiled in a quart (16 ounces) of water in a covered vessel, down to half a pint (4 ounces), and two tablespoonfuls given hot every two hours, commencing six hours before the expected attack, and keeping the patient well covered in bed.

It has been found that in typhus fever coffee increases the elimination of urea, and so far purifies the blood without increasing the destructive metamorphosis of tissue, and that it lessens coma and low delirium.

In yellow fever, from a long experience, I consider coffee as my chief reliance, after other necessary remedies have been administered; it restrains tissue change, and thus becomes a conservator of force, in that state in which the nervous system tends to collapse, because the blood has become impure; it sustains the nervous power until the depuration and reorganization of the blood are accomplished, and has the advantage over other stimulants in inducing no injurious secondary effects.

In spasmodic asthma its utility is well established, whooping cough, stupor, lethargy, etc.

In the hysterical attacks of some females, for which the physician can form no diagnosis or cause for the peculiar and eccentric symptoms manifested; a screaming, crying, staring, kicking patient, with no coherent answer for the medical adviser, at the same time with an evident tendency to act the persecuted saint—give her a cup of well made, strong, black coffee, she becomes quiet, revives, smiles benignly, as if she had swallowed a panacea that had suddenly delivered her from the clutches of the imps of Satan and wafted her from all the miseries of a condemned and tortured spirit to the Elysian fields of Houris.

We have used it as a remedy in croup, diphtheria, nephritis, chronic dirrhea, etc. In poisoning from opium it is well known as the best remedy, and always on hand.

Hayne says: "That in a case of violent spasmodic disease, attended with short breath, palpitation of heart, and a pulse so much increased in frequency that it could scarcely be counted, immediate relief was obtained from a cup of coffee, after the most powerful antispasmodics had been used in vain for several hours," etc.

After a hearty meal a cup of coffee will relieve that sense of oppression so apt to be experienced, and enable the stomach to perform its offices with comparative facility.

In fact, coffee carries healing on its wings. It is opposed to malaria, to all noxious vapors; as a disinfectant it has wonderful powers; as an instantaneous deodorizer it has no equal; for the sick room, the fetid odors arising from cutaneous exhalations are immediately neutralized by simply passing a chafing dish with burning coffee grains through the room.

It may be urged that an article possessing such powers and capacity for such energetic action must be injurious as an article of diet of habitual employment and not without deleterious properties; but I have never noticed any corresponding nervous derangement after its effects have disappeared, as is seen in narcotics and other stimulants. The action imparted to the nerves is natural and healthy, and I must positively deny that the habitual use of the article is injurious.

Habitual coffee drinkers generally enjoy good health and live to a good old age. Some of the oldest persons I have ever known have used it from earliest infancy without feeling any depressing reaction, such as is produced by alcoholic stimulants.

In Porto Rico our fairest part of creation, at the tenderest age, have been induced to forget the delicious draught from the maternal fountain by the substitution of a decoction of coffee, which soon becomes the daily beverage.

Mayaguez, Porto Rico, 1881.

* SCIENTIFIC AMERICAN, September 6, 1879.

What Is the Legal Fence?

The Indianapolis *Journal* has taken pains to gather information as to the laws regarding the fencing of railroads in sister States. In Massachusetts the legal fence is four feet high. A "sufficient barrier" only is demanded, whether the equivalents be furnished by streams, ditches, live growths, or constructions in wood, stone, or other material. Vermont and Connecticut legal fence is five and a half feet high, with provisions essentially as above. In Maine and New Hampshire the legal fence is four feet high; Rhode Island, stone or wood fences must be four and a half feet high; hedges and ditches are elaborately described.

New York.—The town meetings prescribe what shall be deemed a legal fence in each town. Assessors and commissioners of highways perform the duties of fence viewers. Four and a half feet is the usual height prescribed.

Pennsylvania.—Towns and counties secure special legislation for fencing railway lines, and to prevent running of the stock at large.

New Jersey.—Fences are to be four feet two inches high, of wood, brick, or stone, and four and a half feet if of other materials.

Delaware.—Four feet, with a ditch within two feet, is a lawful fence. Wood or stone fences, or hedge, four and a half feet high.

Maryland, Virginia, North Carolina, Georgia, Florida, Alabama, Arkansas, Tennessee.—Legal fences five feet high.

West Virginia.—Legal fences four and a half feet high.

South Carolina.—Fences must be six feet high, of wood or hedge, or ditches equivalent as barriers.

Missouri.—Hedge five feet, fence four and one half feet.

Kentucky.—"All sound or strong fences five feet high, so close that stock cannot creep through," is the definition of the legal fence.

Ohio.—"A fence, of whatever material, constructed in all respects such as good husbandmen ought to keep." Statute of 1865.

Illinois.—"Fences four and one half feet high, of whatever material the fence viewers shall deem sufficient."

Michigan.—"Fences four and one half feet high of rails, timber, boards, stone, or other things deemed equivalent thereto in the judgment of fence viewers."

Wisconsin.—"Fences four and one half feet high," etc. By act of April, 1878, barbed wire fence is defined as a legal fence.

Minnesota.—"Fences four and one half feet high," etc. Barb fence defined by the act of 1877.

Iowa.—"Four and one half feet high, or fifty-four inches." Barbed wire fence prescribed as legal fence, 1876.

Texas.—"Five feet high." Barbed wire defined as legal fence.

Kansas.—"Worm fences four and one half feet; turf, four feet with ditches; wire fence, posts twelve feet apart."

Nebraska.—The legal fence is described as "such a fence as good husbandmen generally keep."

California.—The legal fence is described with great particularity. Wire, post and rail, brush, picket; ditch and pole and hedge wire fences, not less than three separate strands, the first eighteen inches from the ground, the others two and one foot apart.

Colorado, Arizona, Montana, and Utah.—Four and one half feet high.

New Mexico, Idaho, and Washington.—Four feet high.

In Washington Territory barbed wire fence must carry a top rail of wood.

Indiana.—Any structure in the nature of a fence, such as good husbandmen generally keep.

Tobacco Smoke.

In further research on this subject Dr. LeBon finds that collidine, the new alkaloid existing in tobacco smoke (with other aromatic principles, and prussic acid, as well as nicotine), is a liquid of agreeable and very penetrating odor, and as poisonous as nicotine, the twentieth part of one drop sufficing to paralyze and kill a frog. It is the prussic acid and various aromatic principles that cause headache, giddiness, and nausea in smoking certain tobaccoes that contain little nicotine. Other tobaccoes, rich in nicotine, have no such effects. The tobaccoes containing most prussic acid and collidine are those of Havana and the Levant. The dark semi-liquid matter which condenses in pipes and cigar-holders contains all the substances just named, as well as carbonate of ammonia, tarry and coloring matter, etc. It is very poisonous; two or three drops of it will kill a small animal. The combustion of tobacco destroys but a small part of the nicotine, and most of this appears in the smoke. The proportion absorbed by smokers varies according to circumstances, but hardly ever falls below 50 centigrammes per 100 grammes of tobacco burnt. About the same quantity of ammonia is absorbed at the same time. Naturally, more of the poisonous principles are absorbed where the smoke is breathed (as in a room); less in the open air. A frog placed in a receiver containing a solution of nicotine, with about one drop of that substance to a little of water, succumbs in a few hours. Tobacco smoke contains about 8 milliliters of carbonic oxide per 100 grammes of tobacco burnt. The poisonous properties of tobacco smoke are not due to this gas, as has been maintained in Germany.

The Absorption and Scattering of Heat by Leaves.

In order to rightly understand the *role* of heat in the growth of plants, it is important to know what part of the heat rays which strike the leaves is absorbed by them, what part is thrown back and scattered, and what part passes through them to lower organs. An inquiry of this nature has been recently made by M. Maquenne. Of his method we will merely say that he used as constant heat source a Bourbouze lamp (in which a platinum wire is kept glowing by a regulated mixture of coal gas and air); and for some experiments with low temperatures he employed Leslie's cubes. The results of the research are briefly as follows:

1. All leaves scatter a part of the heat they receive vertically to their surface; with the Bourbouze lamp this diffusion is about 0·25 of the whole heat, with a Leslie cube a small percentage.

2. Generally the under side scatters more than the upper, but the reverse sometimes occurs.

3. Leaves absorb a good deal of heat from the Bourbouze lamp, the absorption being due to the presence of absorbing substances, especially chlorophyl and water, in the tissue, and to the diffusion taking place internally at the surface of each cell; it is generally greater at the upper side than at the lower.

4. Thick leaves absorb more than thin leaves.

5. The absorptive power of leaves for the heat of boiling water is very nearly equal to that of lampblack.

6. Leaves let heat pass through better the thinner or younger they are.

7. The radiating power of leaves with a great excess of temperature is pretty near that of lampblack; it decreases a little when the inclination increases.

8. The absorptive power of chlorophyl is, on an average, equal to that of water for rays of the Bourbouze lamp, and increases proportionately to withdrawal, in one direction or the other, from the heat *maximum*.

Lime in Agriculture.

All writers on agricultural subjects seem to agree that the use of lime on clayey soil is of great benefit, crops thus treated showing the advantage of its mixture with the soil. A correspondent to the *Farmer's Review* writes from France that the European farmers coincide with our agriculturists in this respect, and concludes as follows:

The extending use of lime is excellent for clay soils. Argil augments in volume when moist—diminishes when dry. Carbonate of lime possesses neither of these properties; applied then to cold clay soils it enables the air and heat to penetrate more readily, thus making the land friable. On light soils the action of lime is weak, and on those very light the use of lime is misplaced. But as the action of lime rapidly transforms the nutritive capital of the land, its success cannot be permanent unless rationally supplemented by direct fertilizers, as farm yard manure, etc. Hence, the adage, Lime enriches the father, but ruins the children. If the soil have an excess of acids, lime "sweetens" by neutralizing them; all cultivated soils are slightly acid, such being necessary for vegetation. Too much, however, acts directly on plants, and indirectly by the formation of soluble and noxious salts of iron.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) E. L. asks: Which is the strongest acid, HNO_3, H_2SO_4, or HCl? Please state their respective strengths. A. If you mean which acid most rapidly corrodes or dissolves metals, a mixture of nitric (HNO_3) and hydrochloric (HCl) acids (aqua-regia—HCl 3, HNO_3 1) would head the list, followed by nitric, hydrochloric, and sulphuric acids. Hydrochloric (cold) acid does not attack silver, yet it decomposes a solution of that metal in nitric acid, forming silver chloride. Sulphuric acid does not attack lead, yet it is capable of decomposing the nitrate or chloride of that metal to form a sulphate.

(2) C. H. L. asks how to make white writing ink. A. Triturate together 1 part of honey and 2 parts dry ammonia alum, dry thoroughly, and calcine in a shallow dish over the fire to whiteness. Cool, wash, and rub up with enough gum water for use. Pearl white (nitrate of bismuth) may be used in a similar manner.

(3) J. S. T. asks how to make a good drier for printer's ink. We frequently get ink, especially job ink, that is off set; can hardly handle the work. If drier is not what it needs, please state what it does need. A. A small quantity of perfectly dry acetate of lead or borate of manganese in impalpable powder will hasten the drying of the ink. It is essential that it should be thoroughly incorporated with the ink, by trituration in a mortar.

(4) W. J. B. asks for a receipt for making a gum to attach muslin to leather. I think the sample sent is made of gum arabic, but I am not positive. A. The gum on your samples is gum dextrine or British gum, a commercial article. It is simply dissolved in hot water to mucilaginous consistence, applied with a brush and allowed to dry.

(5) J. P. M. asks: Which do you consider best for the arch of press, a heavy cast iron one or a lighter one of cast steel, malleable iron or a wrought iron forging? A. Use steel or wrought iron. They will spring under the pressure and not break.

(6) G. A. W. asks: 1. How can I get the manganese oxide out of some coke, which I had in a Leclanche battery? A. Coarsely powder and wash in a gentle stream of water. With care the lighter coke may be washed away from the heavier oxide. 2. Can you refer me to a paper which describes the ice machine? A. See "Ice Making and Ice Machines," SUPPLEMENTS 85 and 91.

(7) J. C. B. asks: What composition is used in the manufacture of articles made of sawdust, for holding the particles together? A. Blood, or blood freshly mixed with a little finely powdered lime. Weak glue size has also been used with sawdust in a similar manner. The articles are moulded under heavy pressure.

(8) D. Bros. ask: Can you inform us where to get some red indelible ink to use with stamps on linen? A. Liquefy 1 pint of balsam of capivi by aid of heat, and gradually stir in 2 ounces of thoroughly dry white curd soap, cut in thin shavings, and stir until properly diffused. Then introduce a sufficient quantity of vermilion, and stir occasionally until cold. This ink is suitable for stamps.

(9) J. H. W. asks: 1. Please give some formula by which I can prevent the fungus growths on cedar trees. A. Wash the trunks occasionally with lime water. 2. How can I cheaply extract nitrogen from the air and hydrogen from water? A. Pass dry air slowly through granular charcoal heated to redness in an iron tube, then through several copper tubes containing red hot oxide of copper, then over dry slaked lime. The hot carbon forms carbonic acid and carbonic oxide with the oxygen of the air; the carbonic oxide is converted into carbonic acid by the oxide of copper, and the carbonic acid is absorbed by the lime leaving nearly pure nitrogen. Pass steam through a large quantity of red hot iron turnings; a portion of the steam is decomposed by the hot iron. The hydrogen resulting may be collected in a reservoir with the unchanged steam, the latter condensing on cooling. 3. If hydrogen is compressed to one-half its natural volume will it be one-fourth as light as air or one-seventh? A. About one-seventh as heavy.

(10) R. T. asks: Which are the best acids for tin, lead, and antimony, or an acid for a composition of these three metals together? A. A warm mixture of 1 part nitric and 3 parts hydrochloric acid will dissolve these metals with the greatest facility.

(11) A. R. writes: Having broken my 17x21 glass bath from top to bottom (the zigzag or center lines show the breakage), I would like to know if you have any sure means of cementing it together. I have thought of gutta percha, but as this should be put on hot, I am afraid that parts would get cool. I have also thought of this stratena cement. Would it resist nitric acid? A. Dissolve shellac in alcohol enough to form a liquid of the consistence of molasses. Clean the parts dry, smear them with this, press the parts firmly together, and allow to remain under pressure twenty-four hours; then coat the inside over the joint with a strong solution of gutta percha in benzole, and let it harden before wetting. The shellac solution should be perfectly smooth and free from lumps.

(12) E. L. H. asks: How can a physician's thermometer be tested to know if it is correct? A. Only by comparison with the indications of a standard thermometer under similar circumstances.

(13) R. H. C. asks: What is the proper temperature for an incubator? A. 104° Fah.

(14) R. H. B. writes that A. S. R. will find on page 57, vol. xli., SCIENTIFIC AMERICAN, an elaborate article on the "Manufacture of Indian Arrowheads," by F. H. Cushing.

(15) A. S. writes: We have standing throughout our factories water barrels in case of fire. The water in these, after long standing, becomes offensive, and I should judge unhealthy. Will you please tell me what preparation put in fresh water will keep the water sweet for any length of time? A. The solution of a quarter pound ordinary green copperas (sulphate of iron) in each barrel of water is recommended.

(16) E. H. asks: Is it necessary to have the brass tubing or condenser of a steam yacht tinned? If so, how is it done? A. It is better to have them tinned. You can purchase them already tinned much better and cheaper than you can do it yourself.

(17) H. E. asks: Will polished steel plated by being immersed in a solution of sulphuric ether and gold chloride last long? A. The film of gold deposited in this way will not wear as well as an electro deposit. See page 116, current volume.

(18) E. D. V. writes: You recently advised to use No 30 copper wire for acoustic telephone. My experience suggests otherwise, and I submit it. No. 22 is generally sold for this use. On a very short line No. 30 would answer, but on lines of usual length it will break too easily between supports, and too many supports interfere with the transmission of sound. On a line of 3,000 feet I use No. 22, and six supports between the terminal ends; that is, supports are 500 feet apart. The wire has stood for four years, worked well, and no breakage. No. 30 would not do at all. I have tried many varieties of telephone—wood, metal, leather, and cloth for diaphragm; steel, iron, and copper wire. No. 22 copper wire, and wood diaphragms, one-sixteenth inch thick and 3 inches diameter, make the best combination. Chamois skin for longest lines makes best diaphragm, but it soon needs replacing. Steel wire produces too much roaring.

(19) R. B. writes: About two years ago I put down in my well a double cylinder pump. The hose at the end of the suction pipe is 18 feet from the pump (water level only 6 feet). The water has to be forced 75 feet high in a tank which is 12 feet above the well and ground level. The suction pipe is 3 inches, delivery pipe 2¼ inches, each cylinder of pump 4 inches diameter, stroke 8¼ inches. The pump worked well for six months, but since then has worked by fits and starts; that is, it will work for half an hour, and suddenly stop forcing water; it always draws water as high as the pump, but will not force it up. I have had some of the best pump fitters at work at it and they can do nothing. There is no leak whatever anywhere; all joints are tight. The pump is worked by a three horse power horse wheel. Can you or any of your correspondents say why the pump will not work, and what I should do to get it to work? A. There is probably some defect in the delivery valves which permits the water to fall back into the pump on the return stroke.

(20) C. B. C. asks for a receipt for making ink fireproof, and also one for making paper fireproof. A. We know of no means by which ordinary paper may be made practically fireproof. Paper made of pure asbestos fiber resists a high temperature without material alteration. An ammoniacal solution of nitrate of silver, colored with a little India ink, will preserve a legible copy when written with on such paper and subjected to strong heat. Ordinary writing inks cannot be made fireproof.

(21) G. C. F. asks: 1. Is pulverized raw lime better than burned slaked lime as a fertilizer? A. The old slaked lime is best. 2. How much pressure can be produced at the bottom of 1,000 feet of tubing in an artesian well by a rotary pump with a cylinder one foot in diameter run at 200 revolutions per minute pumping air? A. The limit to the pressure would depend entirely upon the perfection of the pump and of the joints and connections of the pipe.

(22) H. B. S. Co. writes: We have two steam pumps running at our store for the purpose of exhibition. They pump Schuylkill water from a tank in the cellar and return it to the same tank continuously. The water, although in constant circulation during the day, becomes very offensive. We have been unable to correct the trouble with lime, etc. Please suggest something that will keep it sweet and harmless, without injuring the working parts of the machinery. A. A small quantity of copperas (ferrous sulphate) will not injure the pumps and will deodorize the water.

(23) A. P. H. asks (1) for a receipt for a good harness blacking oil. A. Melt together 2 oz. asphaltum and 3 oz. beeswax; remove from the fire and add ½ oz. fine lamp black and ½ dr. of Prussian blue in fine powder; then reduce to a thin paste with neatsfoot oil.

(24) P. P. writes: I have several hundred pounds of metal, principally lead, with some tin and antimony, which comes from a smelter but is not refined, and therefore does not run freely. Can you tell me of a cheap process to accomplish this, or will you name some work from which I may obtain the desired information? A. Melt and heat the metal nearly to redness in No. 2 well annealed sand pots, and for every 10 lb. metal stir in (gradually) about 6 oz. dry nitrate of soda. Cool somewhat and skim off the dross before pouring. Save the latter for reduction, as it contains much lead oxide, beside stannic and antimonic oxides.

(25) E. E. P. asks how to dissolve isinglass. A. If you mean fish gelatin, dissolve in hot water, after soaking over night in a little cold water. Mica, sometimes improperly called isinglass, cannot be dissolved without decomposing it.

(26) A. G. B. asks how to make ammoniated opodeldoc. White soap, cut in small shavings, 2 lb.; camphor, 5 oz.; oil of rosemary, 1 oz; oil of origanum, 2 oz.; wine spirit, 1 gallon. Heat over a water bath until solution is effected, cool somewhat, strain, and add 11 oz. ammonia water. Bottle and stopper immediately.

(27) R. G. asks for a receipt for making a paint for roofs, etc., composed of coal tar or pitch, and ground slate or oxide of iron. A. Melt in a capacious iron vessel for at least four hours, 28 lb. each common pitch and asphaltum; then gradually stir in 20 lb. of finely powdered and dry iron oxide or red ocher, and continue the heat another hour or until a drop of the mixture on cooling rolls up very hard. Then remove from the fire, let cool somewhat, and stir in gradually (to avoid accident) a sufficient quantity of good benzine.

(28) J. C. B. asks: Has the question of the formation of ice been conclusively settled, that is, whether it forms on the upper or lower surface? A. Ordinarily ice forms at the surface of water. On cooling, water contracts in volume—becomes denser—until it reaches a temperature of about 39·2° Fah.; if cooled below this point it gradually expands—becomes lighter—until at about 32° Fah., it congeals. Water chilled at the surface contracts and sinks, the warmer and lighter water rising to the surface. This continues until the whole body of water is chilled to 39·2° Fah. From this point to 32° the colder water remains at the surface and there congeals. In shallow and turbulent water ice sometimes forms at the bottom, and, becoming attached to stones, rocks, etc., does not rise. See answer to D. M., page 302 (21), current volume.

(29) D. S. writes: In the construction of wrought iron cylinders, as the flues or shell of a boiler, what is the correct rule for the shrinkage, or, in other words, how much is allowed for the bending of the iron over and above the circumference of a given circle? For instance, for a shell 60 inches diameter, ¾ inch thickness of iron, how many inches of iron will it take to form the above? A. If the iron is laid out correctly for 60 inches diameter inside, it, is supposed that in the bending the outer part of the plate will draw or stretch to its proper length.

(30) R. L. S. asks: 1. Can you give me a solution that will take the taste out of pine wood vessels? A. Washing with hot dilute hydrochloric acid (acid 1, water 3) will in a measure effect this. They should be thoroughly washed with hot water after this treatment. 2. Have you a receipt for making a paste that will make labels stick on a polished surface for any length of time? A. See answer to R. S., page 303 (26), current volume; also cements, SUPPLEMENT, No. 158. 3. Is there any method, besides sealing air tight and

drying, for preserving fruits so they will keep in any climate? A. There is no other practical method, we believe.

(31) W. M. L. asks (1) if there is any way by which a large tower bell that is cracked can be mended so as to be serviceable and also sound well. If so, how? A. A mode that will improve (but not restore) the tone of a cracked bell is, to drill a small hole at the extremity of the crack and make a saw cut the whole length of the crack. 2. What is the best compound for setting iron posts in stone? A. Salammoniac (powdered), 2 oz.; flowers of sulphur, 1 oz.; iron borings (free from oil), 5 lb.; water, q. s. to moisten.

(32) C. T. W. asks: 1. What is the horse power of a steam engine, cylinder 2 inches bore by 4 inches stroke, with 60 lb. of steam in the boiler, and running at the rate of 300 revolutions per minute? A. About two-thirds of one horse power. 2. What size boiler is needed for the same? A. A boiler with 25 square feet heating surface. 3. If such an engine be made to run the largest possible electric machine, how many lamps would the machine supply? A. One, and possibly two. With small machines and small power, electric lighting is not economical. 4. What is the candle power of an ordinary Edison lamp, such as is used for lighting dwellings? A. About 16. 5 How many candle power would be required to properly light a room 36 feet long by 17 feet wide by 13 feet high? A. 100 would do it well.

(33) W. B. A. writes: A firm in this city use three boilers in one battery, set in brick work the usual way. They now intend to do away with the water line, tile, and back plates, put cast iron arches over the top, and fill with brick, leaving the boilers naked and exposed to the action of the fire. The boilers are 25 feet by 42 inches, 4 flues; have been in use about eight years, and fired hard. Do you think this a safe plan, and is there any benefit to be gained by so doing? A. It will be liable to injure the boilers and may lead to accident. 2. If the fire flue of a Cornish return flue boiler be 24 inches diameter and 16 feet long, working pressure 100 lb., what kind of iron should be put in the flue? A. Half-inch or nine-sixteenth inch thick, and should have strengthening rings.

(34) H. T. asks how to make dynamite. A. Dynamite is prepared by mixing infusorial silica (a fine silicious sand resembling tripoli) with about 75 per cent of nitroglycerine, which it readily absorbs. It is exploded by percussion priming. See answer to F. & S., page 202 (3), current volume.

(35) R. I. M. asks: 1. Will coke injure a boiler? A. No. 2. How can I prevent coke from clinkering? A. Pure coke will not clinker, there must be some impurity in your coke. It might be beneficial to burn it at a lower temperature.

(36) R. H. M. asks if the linear expansion of thick iron is greater than that of small wires. A. No. 2. What would be the probable linear expansion of one-eighth inch wire 100 feet in length? A. Iron wire for an increase of temperature of 180° expands $\frac{1}{1000}$ of its length. 3 Does expansion in length cause corresponding contraction in thickness? A. No. 4. Does contraction and expansion cause displacement of molecules? A. No permanent displacement, unless the iron is under strain. 5. Is there a point in temperature where heat and cold cease to expand and contract iron? A. No such point has been discovered.

(37) J. H. H. asks: 1. How much bituminous coal is required under a tubular boiler to evaporate one gallon water? A. With a good boiler you should evaporate from three-quarters to one gallon of water per pound of coal. 2. What power would be required to put the water at 60 horse power into boiler at 90 lb. pressure to the inch. Does it require more power to put in water at 200° to 212° than at 75° Fah.? A. It does not require more power at 200° than at 75°. To determine the power required we must know the quantity of water to be delivered in a given time.

(38) J. F. S. asks: Does the piston in engine driving machinery stop while the machinery is in motion? A. Yes, it stops twice every revolution of the crank.

(39) A. H. H. asks: 1. Can anything be done to apple trees, the bark having been eaten off above the ground by rabbits? A. Wrap with common gunny or jute bagging and whitewash. 2. Can you give me a composition for welding cast steel at a low heat, which will be cheap and more efficient than borax, and what is the philosophy of its action? A. Try the following: Fuse together in a crucible, at a quick heat, borax, 2 parts; potassium chloride, 3 parts; boracic acid, 1 part; cool and powder. It melts at a low red heat and readily dissolves iron oxide, thus cleaning the metal.

(40) H. L. writes: On our line shaft is a pulley 42 inches in diameter, fastened by set screws, which supplies power to our exhaust fan. These set screws are constantly slipping, and I propose to reduce strain on them by substituting a smaller pulley on line shaft, and interposing a counter shaft geared so as to give same speed to exhaust as before change. Please inform us through your paper if this arrangement will reduce strain on set screws holding driving pulley to line shaft or not? A. It will not reduce the strain on the set screws, if the fan runs at the same velocity. It is the resistance of the fan that determines the strain on the set screws, and not the mode of belting or gearing. Better slot your wheel, put a key seat in your shaft, and drive in a well fitted key.

(41) A. D. writes: I wish to know how I can prepare pulp for casting papier mache heads, similar to masks or false faces, in a plaster cast; or would it be better to make the cast out of some other composition. A. Paper is pulped in a mortar (or pulping engine) and mixed with ordinary glue size thinned somewhat with hot water. Remove the pulp and let it partially drain upon a linen covered frame. Put a quantity of this into the mould under strong pressure, and let it remain until it becomes hard enough to handle. A counter mould is used in casting such thin sheets. Plaster moulds are too fragile. Casts in type metal or fusible metal are much better. See SUPPLEMENT, No. 17.

(42) J. W. asks (1) if there is any cloth or knit work that will conduct electricity. A. Cotton and linen are conductors of static electricity. Cloth having filaments of metal will conduct dynamic electricity. 2. Is there any cloth that will not conduct it, the cloth or goods being dry? A. Silk is a non-conductor of electricity, but of course a static discharge would pass through a silk fabric. 3. Give some simple method of telling whether a battery gives a current of electricity or not. A. Touch the ends of the wires to the tongue when they are connected with the battery, and then do the same thing when they are detached from the battery. If you discover no difference the current must be very feeble or absent altogether.

(43) S. B. D. asks: 1. How can I regain the silver from an emulsion as described under the head of "Emulsion for Amateurs," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 256? A. Mix with about three times its weight of warm water, slightly acidified with hydrochloric acid, and let it stand. Collect the chloride of silver upon a filter, wash it with warm water, and mix it with a few fragments of clean zinc and enough dilute sulphuric acid to cover it. When the chloride is reduced pour off the acid liquid, pick out what remains of the zinc, wash the spongy metal with hot water, and dry it. It may be obtained in the form of a button, if desired, by mixing it with a little borax and heating the mixture strongly in a small black lead crucible. 2. How can I make the iron develop for the same? A. Protosulphate of iron, 2 drachms; dissolve in 8 oz. water and add 2 drs. glacial acetic acid and 2 drs. alcohol. 3. How is albumen paper made? A. Albumen can be obtained from any dealer in photographic goods. It is ordinarily prepared by beating up egg albumen to a froth with a little floured salt (about 15 grs. salt to each egg), and after this has stood twelve hours to subside, floating the paper upon its surface in such a manner that every part becomes uniformly coated, after which it is fastened to frames to dry in the air. 4. Can I use French gelatine? If not, where can I obtain Nelson's? A. Yes. See our advertising columns and Hints to Correspondents. 5. I am making an induction coil of the following dimensions: Core 3 inches long by ⅛ inch diameter of No. 18 annealed iron wire; primary, two layers of No. 18 copper cotton covered wire; secondary, 14 layers of No. 36 silk covered copper wire, with a condenser of 300 square inch surface. What size spark can I get using two Leclanche batteries? A. You may be able to get a spark from one-eighth to three-sixteenth inch long. The coil is rather small for sparks.

NEW BOOKS AND PUBLICATIONS.

THE MAGAZINE OF ART. Cassell, Petter, Galpin & Co., 739 Broadway, New York.

The April number of this *Art Journal* is, like the previous issues, full of engravings of choice and artistic works, consisting of elaborately carved oak furniture, ancient mosaics, and other art objects of rare beauty. The most interesting of the various subjects illustrated is an engraving of the French artist, Bonnat's, famous painting of "Ribera at Rome," which was recently sold by Knoedler & Co. for about $12,000 to a gentleman in this city well known in art circles, as a collector of rare and costly pictures. This number also contains a portrait of Bonnat the artist.

SWINTON'S SUPPLEMENTARY READERS. IN SIX BOOKS. I. EASY STEPS FOR LITTLE FEET; II. GOLDEN BOOK OF CHOICE READING; III. BOOK OF TALES; IV READINGS IN NATURE'S BOOK; V. SEVEN AMERICAN CLASSICS; VI. SEVEN BRITISH CLASSICS. Edited by William Swinton and George R. Cathcart. New York and Chicago: Ivison, Blakeman, Taylor & Co.

These readers are intended to supplement any series of school readers, the volumes falling in severity of requirement between the several numbers of the more technical and formal school books in use. In this way they offer half a dozen oases in the ordinary desert of elementary instruction in reading, and are open only to the possible objection that children may not take kindly to the less charming books of the regular series after enjoying these. Certainly in beauty of mechanical make up and illustration, as well as in the excellence and appropriateness of the selections for reading, they far surpass anything in the line of school readers that have come to our table.

THE MICROSCOPE.

Charles H. Stowell, M.D., and Louisa Reed Stowell, M.S., both of them writers and observers of distinguished ability, have commenced the publication, at Ann Arbor, Mich., of a new bi-monthly magazine, entitled "The Microscope and its Relations to Medicine and Pharmacy." It is a handsome periodical, and cheap enough in price, namely, one dollar a year. We welcome this new work. The first number is highly creditable to the editors.

THE DIET CURE. By T. L. Nichols, M.D. New York: M. L. Holbrook & Co.

An essay on the relations of food and drink to health and disease. The author believes that men eat and drink too much, both in quantity and variety, and that the average death rate is double what it would be were temperance and intelligence more the rule in eating and drinking. He also has a vast assortment of notions and crotchets about food and drink which are much less worthy of general acceptance. The professional dietarian is too prone to set up his individual likes and dislikes as rules for all men, overlooking the obvious fact that, injurious as indiscriminate and excessive eating and drinking may be, the extreme of water drinking vegetarian dietetics is quite as bad; if anything the latter is less conducive to, or at any rate less associated with, forceful and enjoyable living than the former. The men and women who determine and control the world's affairs, who are strongest in thought and deed, are not generally or exclusively fed upon brown bread and roots.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 5, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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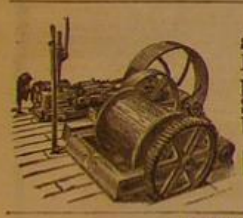

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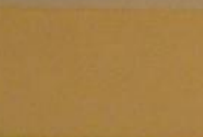

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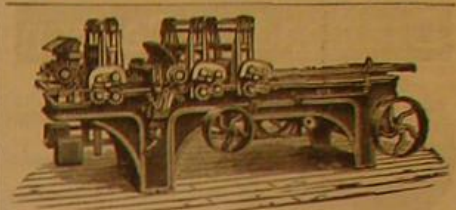

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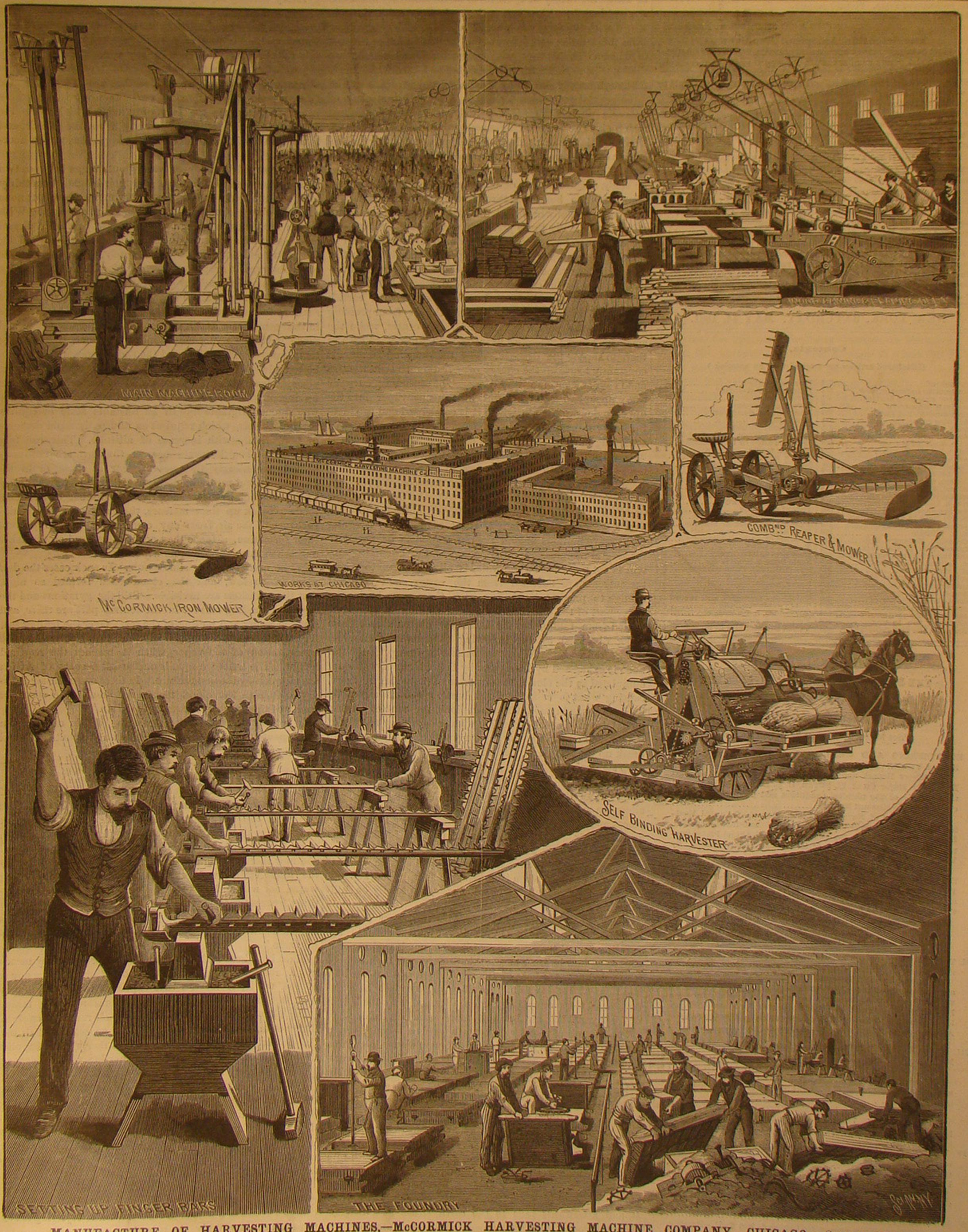

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NEW YORK, SATURDAY, MAY 14, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 280,

For the Week ending May 14, 1881.

Price 10 cents. For sale by all newsdealers.

TORNADOES, HAILSTORMS, AND WATERSPOUTS.

At this season of the year, when storms of limited area and great violence are apt to occur, we are equally apt to suffer from outbreaks of newspaper meteorology which are sometimes almost as appalling as the phenomena they attempt to explain. We may be excused, therefore, for assuming that the subject is one of popular interest, and for compiling some of the more significant and certain results of observation and scientific deduction with regard to the origin, conditions, and behavior of this class of storms.

A favorable opportunity for doing this is furnished by the recent publication of the 10th appendix to the report of the Superintendent of the United States Coast and Geodetic Survey, for 1878, containing the second part of Mr. William Ferrel's researches on cyclones, tornadoes, and waterspouts, in which the theory of cyclones is mathematically discussed at great length, with a comparison of the results thus obtained with the facts of observation. We may safely draw from this treatise such information as may seem of interest to landsmen at this time, with reasonable confidence that we shall not be misled with respect either to facts or inferences. Although largely similar to cyclones, and governed by the same general principles, tornadoes form a distinct class of meteoric phenomena. The initial temperature conditions which give rise to cyclones generally extend over large areas. The conditions of tornadoes depend rather upon vertical relations of temperature, under which the unstable equilibrium of the atmosphere is liable to be violently disturbed by slight local changes of temperature causing the under strata of air to burst up through the overlying strata. A cyclone is usually a broad, flat, gyrating disk of atmosphere, very many times greater in width than in altitude; a tornado may be regarded as a column of gyrating air in which the altitude is several times greater than its diameter. The enormous velocities of the ascending currents in a tornado appear to be caused by the differences between the gyratory velocities above and those very near the earth's surface. The former largely prevent the air from pressing in to fill up the partial vacuum near the center, while the smaller gyratory velocities near the earth allow it to rush in there to supply the draught. The tendency of friction is constantly to use up the energy of gyration so that the tornado cannot continue very long. The ascending currents carry up an enormous amount of aqueous vapor into the upper regions of the air, where it is condensed and produces the heavy rains observed in connection with tornadoes. An ascending current of 60 meters a second, which cannot be unusual in tornadoes, would furnish, under extreme conditions of air saturation, four inches of rain a minute, if it were to fall directly back. With such an ascending velocity, however, no rain could so fall. It would be thrown outside the vortex, giving an immense though lighter fall of rain over a larger area, especially if the tornado in its irregular progressive motions should remain stationary or nearly so for several minutes. If the velocity of the ascending current is not so great that the water is all carried up to where the currents are outward from the vortex, and yet great enough to prevent its falling back, there may be in the lower part of the cloud a vast accumulation of rain, prevented from falling by the ascending currents and from being dispersed by the inflowing currents from all sides toward the vortex. When the sustaining energy of the tornado is exhausted by friction or by the weight of water accumulated in the cloud, the water is liable to fall in mass, causing what is called a cloud burst. This is especially liable to occur in mountainous regions, for contact with a mountain must greatly interfere with the gyratory motion of the tornado and the inflowing currents below, and tend to break up the system at once and let the whole load of water drop suddenly.

The water in cloud bursts is generally poured down. Long before the ascending currents are reduced so as to allow the water to fall in drops it seems to collect at certain places and force its way in a solid stream down through the ascending air. Having once made an outlet for itself the water is necessarily accelerated in velocity, so that before reaching the earth the stream may be pouring with irresistible force, cutting, when it strikes, the sharply marked and often deep chasms left by cloud bursts, especially on hillsides.

When the ascending current carries the vapor into the region of frost—which is at a lower altitude within the gyrating funnel than outside of it—the condensed vapor is converted into hail. The small hailstones may then be kept suspended near the base of the snow cloud and enlarged by additions of freezing rain. In this way compact homogeneous hailstones of ordinary size are formed. At the height of 7,000 yards the air has lost more than half its density, yet an ascending velocity of twenty yards a second, which must be no unusual one in tornadoes, would sustain even at that altitude hailstones of considerable size. It is not necessary that the hailstones should remain in the freezing region a long time, or remain stationary. They may be carried from this vortex out where the ascending current is small, and, dropping down some distance, may be carried into the vortex by inflowing currents and again thrown up to the region of frost. The nucleus of large hailstones is usually compacted snow. A small ball of snow saturated with rain is carried higher and freezes; and being of less specific gravity than compact hail it is kept where it receives a thick coating of ice from the unfrozen water dashed against it, and afterwards falls to the earth, either at a distance from the vortex where the ascending currents are weak, or near it after the uprush has been sufficiently exhausted. Sometimes, as in the case of the cloud burst, an almost incredible amount of accumulated hail may fall in a short time, when the energy of the system is suddenly spent.

The formation of large hailstones by concentric layers of clear ice and white snow, laid on like the coats of an onion, will be readily understood from the foregoing. As many as thirteen layers have been observed in large hailstones, showing that they must have made half a dozen circuits, being successively thrown out of the frosty vortex above and sucked in below by the inflowing currents, each time adding to their coatings of snow and ice before their final fall to earth.

When the tornado is very small in the area covered by the gyratory motion, a land spout or a water spout is formed, as it may happen to occur on land or at sea. In these the gyratory velocity rapidly diminishes with distance from the center. Their destructive effects are sudden and often great, but the area of violence is small. In the center of a waterspout, as in that of a tornado when in full force, no rain falls or water descends in any form, though a heavy shower often falls in the vicinity. On land dust and light substances are carried up, and as they are being collected from all sides by inflowing currents toward the vortex below, they assume the form of a cone, which meets the descending spout, falling apparently from the clouds, and thus give the whole phenomenon the appearance of an hour-glass.

The observed diameters of waterspouts range between two and two hundred feet or more, and their heights from thirty to fifteen hundred feet, sometimes very much more; but none of these observations can be regarded as at all exact. With a high temperature and a very low dew point Mr. Ferrel calculates that a water spout might reach a mile in height, but such conditions must occur rarely. Waterspouts are often observed to drop down from a cloud in an incredibly short space of time, and to be drawn up again in the same manner; but this is all an illusion. When the gyrations are such as to not quite reduce the tension and temperature in the center, so as to condense the aqueous vapor and make it visible, a very slight increase at once reduces the temperature sufficiently, and the spout appears from top to bottom almost instantaneously. Just the reverse of this takes place, when the spout breaks, and it seems to be drawn up instantly; it is dissolved, not lifted. Tornadoes and waterspouts originate only in an unstable state of equilibrium of the air, which requires an unusually rapid decrease of temperature with increase of altitude. This can take place only when the strata nearest the earth are unusually heated; accordingly they never occur at night, or in the winter, and but rarely in cloudy weather. If any agitation of the air, such as that arising from the discharge of cannon, tends to break up these meteors, then any considerable disturbance of the air from any cause must tend to prevent their formation. Hence they occur at sea and on the lakes only when there is little or no wind.

White squalls are invisible spouts. In such cases the dew point is so low, and the cloud when formed so high, that the gyrations are invisible. Still the gyrations and the rapidly ascending current in the central part are there, and also the rising and boiling of the sea. Over the boiling sea, high up in the air, is a patch of white cloud, formed by the condensation of the vapor when it reaches the required height. The bulls-eye squalls on the west coast of Africa are of precisely the same nature. In these cases the air is too dry to furnish the cloud necessary to make the spout, or center of the gyratory movement, visible.

In hot dry climates these ascending whirls of air form sand spouts or pillars of sand. Both water spouts and sand spouts are hollow.

HEAT, LIGHT, AND POWER WITHOUT COST.

One of the greatest difficulties that beset the progress of the brave men who venture upon explorations in the Arctic regions is the terrible cold and the deprivation of light. But if we may believe in the theories of Professor Gamgee, as set forth in the remarkable specification of the patent for his new thermo-dynamic engine—date of April 19, 1881—the future Arctic investigator will have no trouble in keeping warm, nor will darkness trouble him, for the harder everything freezes the faster the engine will run.

Says the Professor in his patent: "I utilize heat in this system downward to 0° Centigrade, and below towards absolute zero."

Since both heat and electricity may be produced by means of a rotating wheel, in degrees proportionate to the power of the wheel, it follows that explorers to the north may hereafter make themselves entirely comfortable by taking along a few of Professor Gamgee's self-running engines. These extraordinary machines depend on *cold* for their motive power, the very article that the northerly world supplies in the greatest abundance, and that has heretofore been regarded as a drug in the Greenland market.

If Gamgee and the Patent Office are right, then the owners of coal mines may as well shut up shop. Fuel will no longer be required to produce either motive power, heat, or light. These great factors in human welfare will in future be enjoyed by mankind without labor or cost, all the industries of the world will be revolutionized, and a majority of them discarded for lack of further use.

In view of these considerations we would ask the Commissioner of Patents if he considers that he has done the fair thing in granting a patent to Gamgee, while rejecting the application of poor Keely, the prior inventor?

ANOTHER NEW MOTOR.

The latest candidate among inventors for immortal honors is Prof. John Gamgee, of London, now residing in Washington, for he claims to have found out how to prevent a large part of that celebrated ninety per cent of loss which has hitherto been incidental to the use of steam for dynamical purposes. We learn from the newspapers that President Garfield, Secretary Windom, and others, have examined the new engine, and that Chief Engineer Isherwood has prepared a report on the subject to Secretary of the Navy Hunt.

A correspondent of the *Evening Post* says: "One of the examiners of the Patent Office tells us he regards it as the most important patent since the telephone. If it succeeds at all, however, it will be of far greater consequence than that or any other invention of modern time." The patent is dated April 19, 1881, and is entitled "Thermo-dynamic engine;" also the new engine is called a zeromotor, in recognition of the fact that it is designed to operate it at about the temperature of zero.

The patent clearly and fully describes the invention, and the few paragraphs which we quote will make the matter pretty plain.

"My invention," says Prof. Gamgee in his patent, "relates to the employment as a motor fluid of a liquefiable gas or vapor of adequate tension, the product of a liquid which boils at or near the temperature of surrounding objects.

"I find that by working such a gas or vapor expansively in one or more engine cylinders, its heat can be converted to such an extent into mechanical energy or motion that at the exhaust it will have returned in great measure to its original liquid condition, from which state it may be again caused to assume the condition of a motor vapor or gas by exposing it to the needed temperature.

"It is this feature, viz., the working of such a vapor or gas expansively to the extent of more or less complete liquefaction, and the reconverting it from the liquid to the vaporous or gaseous condition for use again as a motor fluid, which mainly characterizes my invention.

"The vapor having expended its energy, and being mostly liquefied by the conversion of its heat into motion, is discharged from the engine cylinder into a close exhaust vessel protected or insulated from environing heat. The maintenance of the exhaust at the boiling point (for atmospheric pressure or thereabout) of the liquid used may be insured in various ways; for instance, by means of an injector or pump.

"By the injector or pump, or both, the cooled vapor is forced into an apparatus for convenience sake termed a 'boiler,' where it is exposed to the temperature needed to restore it to its original tension, and thence returns to the engine.

"It will thus be seen that it is my object to obtain in a motor engine the conditions of a closed circuit with a liquid boiling at a low temperature relatively to water transformed into vapor, the molecular energy of which is converted into the mass as molar motion of the piston, so that its initial condition is restored.

"In this way in a heat engine I expend the temperature within which the heat is utilized downward in the direction of the absolute zero, instead of upward above the temperature of surrounding objects.

"The intense heat of boiler furnaces, the internal work heat necessary to the formation of water steam, the abundant exhaust waste of the steam engine, difficulties of lubrication, etc., are one and all avoided by my invention.

"The cycle I propose can be performed more or less satisfactorily with almost any liquid yielding expansive vapor below the temperature at which water boils; but in developing most power with most compact apparatus it is essential to use a compound which has a maximum amount of latent heat.

"The agent which I find in practice most available for this purpose is anhydrous ammonia, the boiling point of which at atmospheric pressure approaches closely to 34·4° C. At 0° C. its vapor tension is about four atmospheres, while at 10° it attains to six atmospheres. When the mean temperature attains 20° C., no less a pressure is exerted than nine atmospheres, and at 30° C., or tropical heat, it reaches over ten and a half atmospheres in tension. Since at blood heat two hundred pounds to the square inch is available it is evident that the usual temperature of ocean or river water is most desirable in practice and best in my opinion when below 9° C.

"The latent heat of ammonia is about 900°, as against 960° for water. It is this latent heat which I use in developing energy so as to reduce the amount of rejected heat to a minimum and obtain a maximum rate of liquefaction. Although high pressures are attainable at low temperatures, it will always be found best in practice to work below rather than over 100 pounds to the square inch.

"From the fact that I utilize in this system downward to 0° C. and below toward absolute zero, I propose for convenience to name the apparatus which I employ 'zeromotor.'

"The operation is as follows: The ammonia gas or vapor passes from the boiler into the smaller or high pressure cylinder, where it is worked expansively, the cut-off being adjusted, for instance, to one-tenth of the stroke. In thus expanding and doing work, the gas parts with its heat to a considerable extent. It then exhausts into the second or low pressure cylinder, where it is cut off, say at one-half the stroke, and is thus caused to do further work expansively. The result is that the vapor, by the time that it passes from the second cylinder into the exhaust, has been almost entirely liquefied, only an exceedingly small proportion of the ammonia retaining vaporous form. The engine thus may be said to act not only as a motor, but as the condenser. From the exhaust vessel the ammonia is, by means of the compound pump and injector, forced back into the boiler, to be again brought to the condition of a motor or gas."

The specification continues the subject through various details of construction, but the matter quoted above is sufficient data for a full consideration of the pros and cons. We are obliged to find, however, that Gamgee's motor is mostly delusion; it is likely to be literally a zero-motor. The trouble is not with the ammonia. Dr. Lamm, of New Orleans, Tellier, of Paris, and others have made ammonia motors which had a measure of success. Gamgee's theory would fail with steam or air. A motor vapor during its expansion is a useful source of power, but after it has expanded it is wholly unavailable. It may be brought again to the expanding or condensed condition, but if the cost of the restoration be computed, not the smallest fraction of gain can be discovered. Gamgee's motor would make one stroke, but never another of its own accord. Think of a steam engine which exhausts directly into its boiler! Prof. Gamgee has made an interesting invention, and if he can find some spot in nature where it may rest it promises to make a sensation.

It is certainly a curious incident of this matter that Chief Engineer Isherwood may become an advocate of working engines expansively, the cut off being adjusted, for instance, to one-tenth of the stroke.

THE KEELY MOTOR DECEPTION.

The stock in this lunary enterprise has of late fallen very low, and a new exhibition of its incomprehensibleness has been deemed necessary. The last performance, given on the evening of April 22, in Philadelphia, is thus described by a reporter of the New York *Herald:*

"The first public exhibition of the Keely engine was given this evening, in the presence of a large body of New York men. Among others present were J. Nelson Tappan, City Chamberlain of New York; Thomas Rowland, of the Continental Iron Works; George H. Peabody, E. F. Searls, General John Carrier, secretary of the American Wrecking Company; J. J. Smith, Edward W. Denny, and others. A private showing was given a few days ago before Major Conway, United States Ordnance Department; Commander Gorringe, United States Navy; Mr. Blanchard, vice president Erie Railway; Commodore Kane, New York Yacht Club; President Sayre, of the Lehigh Valley Railroad; E. J. Randall, Erie Railway, and twenty others. Commander Gorringe frankly declared that Mr. Keely had thoroughly removed the strong prejudices which he had had against both inventor and discovery, and that the exhibition was a wonderful one. To a *Herald* correspondent Commander Gorringe said: 'I am amazed at what I have seen. It is certainly one of the most remarkable curiosities I have ever looked upon, and appears *bona fide*.'

"To-night's exhibition was a very extended one. The two parts of the 'motor,' called the 'generator' and the 'engine,' stand in separate rooms on the second floor of a building on Twentieth street, in the vicinity of Girard College. Without expressing any opinion whatever regarding the scientific principles alleged to be involved, a simple narrative of the evening's occurrences may be set down as follows:

CURIOUS EXPERIMENTS.

"When the visitors, almost completely filling the front room, had been seated, they saw before them an odd-looking machine built of steel, that shone like a mirror. The only description possible to give without an illustration to accompany it is, that it is wholly unlike any other collection of globes and tubes that has ever been exhibited. The first act was to remove every cock and tube, ostensibly to show that the apparatus was empty. Lights were placed underneath it and the visitors were invited to look into and through the various chambers. All the plugs and attachments having been replaced, one of the company drew a glass of water from the hydrant and poured the contents into half a dozen funnel-topped tubes, and in exactly twenty-nine seconds a force was generated sufficient to raise a six-foot lever (one inch fulcrum) upon which were hung 700 pounds of iron. The pressure was asserted to be fifteen thousand pounds to the square inch. The vapor said to create this pressure was then stored in a steel cylinder about thirty inches long and five inches thick, through the center of which is stretched a piece of piano wire. The vapor thus confined was then further 'vivified' by external vibrations of great energy obtained from a tuning fork of immense size. This done, a long tube of very constricted orifice was attached to this steel chamber, to form the connection with the engine in the rear room. Thither, then, all the visitors moved. The engine is called a 'compound' one, which is explained to mean that 'it can be worked with equal effect by positive or negative energy.' After a few cocks had been opened, the 'spirophone' contained in one of the drums began to roar, and the shaft, carrying a belt-wheel, began to revolve with great velocity. The whirring sound (much resembling the rising of a flock of quail), gradually became regular and harmonious, and the engine settled down to a regular speed of about sixty revolutions per minute. Some curious experiments were then made, to exhibit what was denominated 'vibratory energy.' The revolutions of the engine were increased or diminished at will by Mr. Keely striking an iron disk or a gigantic tuning fork, or drawing a bow over a tightly stretched steel wire. The change from the negative to the positive 'energy' was made, resulting in an almost instantaneous reversal of the engine. This reversal, Mr. Keely declared, could be made at the very highest velocity without breaking anything. A brake, specially made with wooden lining, was then applied to the belt wheel with a leverage of five feet and the weight of two of the heaviest of the party, but no perceptible diminution in the speed resulted. Many other strange experiments with the vapor gun and other appliances of the alleged invention were given, after which the party separated.

"The experiments lasted three hours, and were in every way successful. A vote of thanks was given Mr. Keely, on motion of Mr. Tappan. The party returned to New York on the midnight train."

It will be seen from the foregoing that the Keely managers still look to the New York men. It was from them that their first treasure was extracted after the original first exhibition; and the new show is doubtless expected to yield another yellow harvest.

THE GAMGEE PERPETUAL MOTION.

In another article we give the substance of Professor Gamgee's ideas, as expressed in his patent, concerning the principles and operation of his new motor, the practical value of which is alleged to be indorsed by the Patent Office Examiner, by Chief Engineer Isherwood, and by prominent officials of the American Navy Department.

In Professor Gamgee's engine the ammonia vapor expands against and drives the piston, then issues from the back end of the cylinder as a liquid, which runs to the front end of the cylinder, where it expands again as vapor against the piston, then runs back to the front end, and so on, in one perpetual round or "cycle" of duty, without any vulgar assistance from artificial condensers, or from coal, oil, gas, or other common fuel. Cold water—below 66° Fahr.—is the best fuel for him, says Professor Gamgee, in his patent. Water at 66°, he avers, gives heat enough to yield 100 lb. pressure per square inch on his piston. Water at blood heat, or 98° Fahr., would give him, he says, 200 lb. pressure per square inch, more, in fact, than he requires.

A correspondent of the *Tribune* lately asked Professor Simon Newcomb, the eminent physicist, for his opinion of the new device of Professor Gamgee.

Professor Newcomb said: "The question is purely one of physics, and not of steam engineering. The proposed machine, as Mr. Gamgee has explained it to me, and as I see it described in Mr. Isherwood's report, lacks the essential conditions which all experience shows a steam engine must fulfill; not merely because ammonia is used instead of steam, but because no source of external cold or exit for the vapor is employed, except that furnished by the engine itself. I think there is some mistake in describing the respective functions of the high and low pressure boilers in the printed remarks in the *Tribune;* but I think I see clearly what the essential principle is. We have a boiler of liquid ammonia exerting an enormous pressure at ordinary temperatures. A quantity of the vapor from this boiler is admitted into the cylinder of the engine, and thus presses upon the piston, expanding and moving the piston. Its heat is changed into force communicated to the piston, and it thus becomes in the cylinder intensely cold, so cold that a portion of it liquefies.

"So far there is no trouble in the action of the engine. It will make one stroke without doubt. The question now is to dispose of this cool and expanded vapor. The great mistake made by the promoters is in supposing that they can, by some ingeniously contrived machinery, force the vapor back again, so as to act again on the engine and still have a surplus of force left over. It is a perfectly established law of gases—as certain and universal as that of gravitation—that a gas when condensed generates the same amount of heat and exerts the same pressure as in expanding. The consequence is that, when the gas is condensed without some external source of cold, all the power expended in its expansion is used up again in contracting and heating it. Unless, therefore, as in the ordinary steam engine, some external source of cold is provided to absorb the heat which would thus be generated, the machine cannot act. Now this is the very condition which Mr. Gamgee proposes to dispense with. With the ammonia engine working at ordinary temperatures, the external source of cold must be as low in temperature as the expended ammonia itself, and therefore the ammonia cannot be used for the cold.

"To judge of all this we must remember that there is absolutely no new principle claimed in connection with the machinery, and claims made for it are in direct contradiction to the second law of thermodynamics. Yet I do not think a prudent physicist would claim that it was impossible to find in nature some mechanism by which this law could be evaded. All we can say is that to reach this result some radically new discoveries in the properties of matter must be applied. As there is nothing new in any of the principles called into play in the proposed engine, it may be pronounced a chimera with as much safety and certainty as we call perpetual motion machines by that name."

THE TOKIO EXHIBITION.—The National Industrial Exhibition at Tokio, Japan, was opened by the Mikado March 1. The attendance is said to be large.

DOSE-MEASURING BOTTLE.

The engraving shows a novel form of bottle for containing liquid medicines, such as are usually taken in prescribed quantities. It is designed to enable the user to measure and pour out only so much as may be desired, it being provided with a measuring receptacle, formed in the neck in such way that, by first tilting or turning the bottle so as to cause the liquid contents to flow into the measuring device, and then turning the bottle so as to leave a portion of the contents in the measuring receptacle, they may be poured out without discharging any portion of the liquid contained in the body of the bottle.

The neck is suddenly and considerably enlarged or bulged out at one side, immediately beyond the point of its junction with the body of the bottle, so as to form a hollow or receptacle designed to hold a given quantity of the liquid from the bottle. The neck of the bottle may be provided with indicating lines or a scale. This design may be considerably varied without affecting the efficiency of the device.

The engraving shows modifications of the bottle in which there is no bulging receptacle in the neck, which in one case is placed at one side.

A perforated partition divides the body of the bottle into two compartments, and by holding it in a substantially horizontal position, with its shorter side down, and then turning it axially to bring the longer side or line of the body down, the chambers will stand full to the same level, but their contents will be separated by the partition.

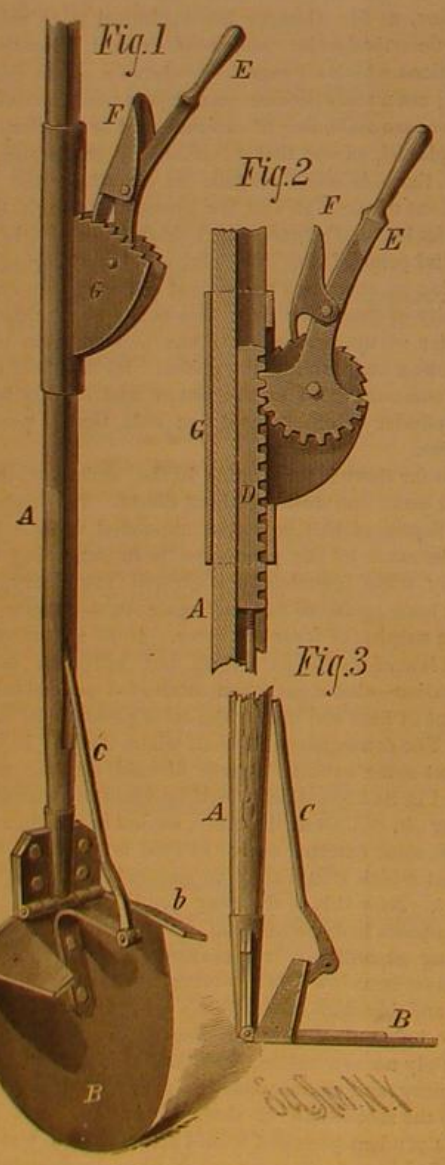
Another modification is shown in the engraving, in which the bottle has its interior divided into two compartments by a solid partition, a tubular passage being provided between the compartments. In this form of bottle the measuring and separate discharge of the desired quantity of the liquid contents of the bottle may be accomplished in the manner above described.

This invention was lately patented by Mr. James M. Dodge, of Chicago, Ill.

DOSE-MEASURING BOTTLE.

IMPROVED POST HOLE DIGGER.

The engraving shows an improved implement for digging fence post holes, which can be inserted in the ground like an ordinary spade, and when inserted to the proper depth can be transformed into a lifter, by which the earth may be readily removed. The handle, A, carries a blade, B, at its lower end, which is hinged so that it can be made to assume any position with respect to the handle, varying from a straight line with it to a right angle. The shovel, at its shoulders, is provided with extensions, *b*, reaching forward at or about right angles to the blade, which form stops to limit the extent of its insertion into the ground to permit of shifting the position of the blade without hinderance. To the blade of the shovel is secured a bent arm, to which is pivoted the end of a curved rod, C, extending backward to the handle, and provided with a sliding rack, D. To the handle is secured a sleeve, G, having a longitudinal slot and two parallel standards, between which is pivoted a lever, E, having a toothed segment, by means of which the rack may be moved back and forth to operate the shovel blade. The rear edges of the standards are provided with ratchet teeth, and the lever with a pawl, F, adapted to engage the teeth so as to hold the lever and other parts in any desired position.



POST HOLE DIGGER.

When the blade is in line with the handle it may be driven into the ground after the manner of an ordinary spade, and when inserted to the proper depth, by operating the lever it may be brought at right angles to the handle, so that the earth may be lifted vertically and removed.

This invention was lately patented by G. B. Van Vleet, of Lodi, N. Y.

Microscopic Tests for Poisons.

Professor Rossbach has just published, in the Vienna *Klinische Wochenschrift*, some remarkable delicate tests for the presence of poisons when they are in too minute quantities to answer any chemical tests.

As small animals, like frogs, mice, etc., are known to be very susceptible to the action of certain of the poisonous alkaloids, so this fact is taken advantage of and very weak solutions introduced into their circulation. Delicate and wonderful as the tests are as applied to frogs, etc., still Professor Rossbach gives far more delicate ones. A drop of water containing infusoria is placed on a glass slide and examined uncovered. The infusoria are examined carefully as to size, form, color, etc. Then a drop of the solution is placed just to the edge of the fluid containing the infusoria. If organic poisons be present the infusoria are instantaneously destroyed, becoming a formless sediment. He startles us with his figures. "If a drop of water containing infusoria and weighing 0·001 grain be used as a test the quantity of strychnine required to cause remarkable changes will be 0·00000006 of a grain. In this way one fifteen-millionth of a grain of atropine can be detected." Thus, he says, if the stomach of a person poisoned by strychnia contains a *liter* of fluid and only three-quarters of a grain of the alkaloid, a single drop of this fluid will contain forty times as much strychnine as necessary for the test.

The Bending of Glass Tubing.

When glass tubes are not too wide they may be easily bent over a common gas jet. A burner, made by attaching a lava tip (such as are now commonly used in illuminating burners) to the stand or base of the ordinary Bunsen burner, will be found convenient. The tube is held horizontally in the flame in such a manner as to be entirely surrounded by the flame, and so all possible draughts are avoided and the flame does not flicker. The tube is soon covered with carbon; then it becomes glowing, and bends, in consequence of the weight of its free end, in an even and uniform manner, without making any wrinkles inside the bend or angle. Wide tubes are first filled with sand, and then suspended over a broad flame burner. A broad tube with flattened end, which exactly fits the Bunsen burner, may easily be procured. Thin glass tubes may be bent in the flame of a simple spirit-lamp, but if they are at all thick a Berzelius lamp becomes requisite. In this case the tube must be held across the flame, for then it would become heated in two places and remain cold in the center (*i. e.*, between). It is, therefore, best to hold it tangent to the flame. If it does not bend freely, it is well to assist the operation with the hand, by slightly pressing the free end in the desired direction. This operation requires a certain amount of skill and dexterity in order to prevent the formation of wrinkles on the interior surface of the bend. These wrinkles not only offend the eye, but so contract the tube that a free current of the gas is prevented, and, in case of distillation, etc., condensable products are caught in the cracks, and the experiment spoilt.—*M. B., in Journal of Education.*

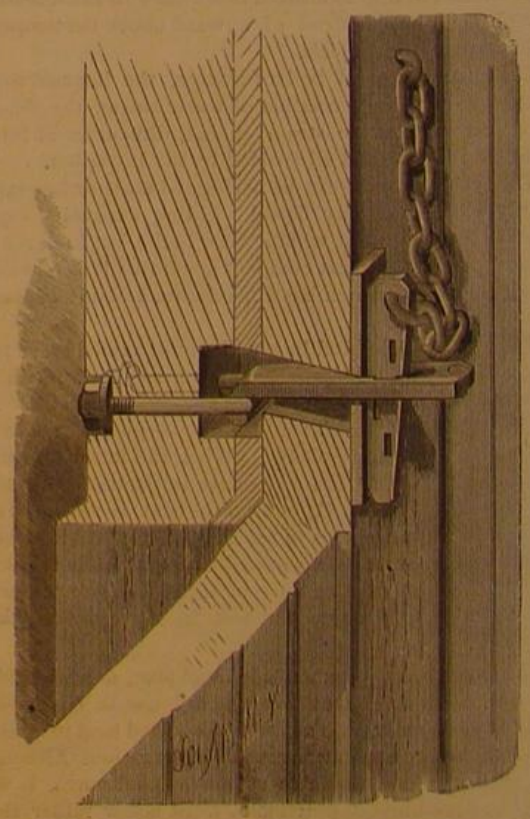
British Scientists to be Invited.

It is rumored that at the next meeting of the American Association for the Advancement of Science, to be held in Cincinnati in August of this year, a proposition will be brought forward to extend an invitation to the British Association to depart from their usual custom so far as to come over to this country in 1883, and hold their annual meeting for that year in conjunction with the American Association, at some place hereafter to be fixed upon. A number of the most prominent scientific men in the States and Dominion are known to be in favor of the plan, and doubtless the members of our association will be glad to send such an invitation as a mark of our cordial feelings toward the students of science in the mother country. It will give us great pleasure if it should prove practicable for the English body to accept. We hope that the proposition may be happily successful. The advantages of such a gathering of scientific men from two countries having a common language, are as evident as they are great. The meetings of the American Association have proved of inestimable value by bringing the investigators of the continent into personal contact with one another. Every scientific man has not only new facts to present, but also theories and hypotheses which may not be sufficiently complete, or justified by positive knowledge, to be put into print, yet it is precisely these vague ideas which are the most valuable stimulants of discovery, because they are the store from which new and sound ideas can be selected. By no other process can this selection be rendered so efficient as by personal discussion with others whose studies are in the same direction. If the suggested meeting be actually held, it will certainly prove as profitable as delightful. There is no room to doubt that on our part we would be lavish of pains to make the meeting successful, and we think our reputation for hospitality is a guarantee that our guests will have a pleasant as well as a profitable visit.—*American Naturalist.*

IMPROVED DOOR FASTENER.

We give an engraving of a very simple and effective door fastener, patented by Mr. F. M. Alexander, of Marshall, Texas, and intended more particularly for application to car doors.

The staple is fastened in the side of the door frame with its outer end in a recess of the frame. The stile of the door is traversed by an oblique mortise covered on the outside by an iron plate having a slot, through which passes a short flat bar or hasp having a hook turned on its inner end and having in its outer end a rivet which prevents it from slipping inward through the plate attached to the door. The hasp has a mortise for receiving a key or pin attached to the car door by means of a chain. This key is mortised transversely for receiving a lock or seal. The staple is flush with the front of the door frame, and the locking of the door is effected by hooking the hasp over the staple and inserting the key as shown in the engraving. It will be seen that by means of this device the car door may be drawn tightly against the door frame, and the car will be securely locked.



ALEXANDER'S DOOR FASTENER.

When the hasp is disconnected from the staple it hangs down upon the car door, its hooded end engaging the plate on the face of the door.

This fastener is very strong and effective, and at the same time inexpensive. The inventor informs us that railroad men who have seen it fully indorse it.

AMERICAN INDUSTRIES.—No. 73.

HARVESTING MACHINES.

Inventions which have resulted in great industries and the development of great natural resources will always be subjects of deep interest to the student of history and political economy. The cotton gin rendered available the vast agricultural resources of the Southern States, and the correspondingly great cotton manufacturing interests of England and New England. The reaper did as much for Northern agriculture, making possible the harvests which have taxed the powers of transportation, reversed the balance of our trade with Europe, and carried our national prosperity to the highest level.

America is the birthplace and home of the reaping machine. Here it was invented and first successfully introduced, here its greatest achievements have been won, and here it has proved itself one of the factors in transforming a continent from a state of primitive solitude to be the home of fifty million enterprising people engaged in all the arts and manufactures of civilization.

When we look back fifty years and remember that the reaping hook and grain cradle were the only means the farmer then had of securing his crop, we are led to wonder how many centuries must have elapsed before the land west of the Alleghanies could have been settled as it is to-day, not only to the Mississippi, but from ocean to ocean. The reaping machine has not only made this possible, but has made farming profitable on a scale never dreamed of before. In Minnesota and Dakota there are grain farms of from ten to thirty thousand acres, whose princely owners purchase and operate reaping machines by the score and by the hundred.

The first successful reaping machine put in use was invented and constructed by Cyrus H. McCormick, a native of Rockbridge County, Virginia, in 1831, a patent upon which was granted by the United States in 1834, and this original machine is recognized as the type and pattern after which all others of subsequent date have been modeled.

The manufacture of this machine was commenced in Virginia, but not until 1845, at Cincinnati, Ohio, did the annual product reach a large number. During that year 500 were constructed and sold. In 1846–7–8 some machines were manufactured at Brockport, N. Y., on "royalty." With discriminating judgment Mr. McCormick foresaw that Chicago was to be the center of trade in the Northwest, by reason of its favorable geographical position and superior shipping facilities, and he therefore transferred the manufacture to that city in 1847, building 500 machines in the new shops. In 1848, 700 machines were made and sold, and in 1849 the figure reached 1,500. Here the first works for making the reaping machine were erected, and the improvement of the machines themselves vigorously commenced, and from that time onward the development of this great industry has been commensurate with the strides which Chicago has made.

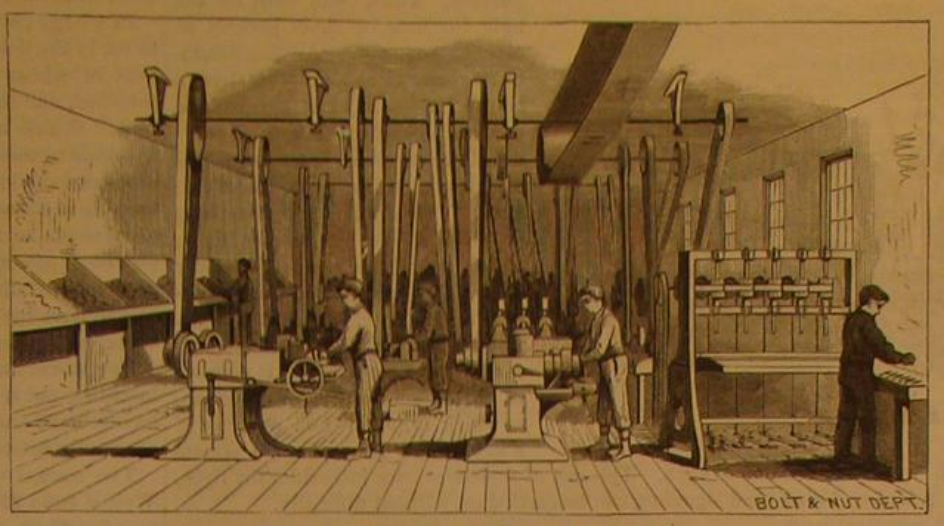
Soon after this, Mr. McCormick induced his two brothers, William S. and Leander J., to come from Virginia to Chicago to assist him in the manufacture of the machine. The former continued with him until his death in 1865, and the latter until now having an interest of one-fourth in the corporation, the remaining three-fourths belonging to Cyrus H. McCormick.

The works of the McCormick Harvesting Machine Company, a view of which, together with the various departments, we have represented on our first page, are situated in the southwestern portion of the city of Chicago, upon the bank of the river, and at a point where all the vast network of Chicago railroads centers.

Ten rooms, 100x60 feet, occupied by the wood working department, are fitted with the most improved machinery for planing, sawing, shaping, and dressing the various wood parts of the machines. The construction of the main wheels for the harvester is an interesting study in itself, and in this alone are involved more than a dozen processes in wood and iron work. We have shown in the engraving the last operation in its construction that of putting on the tire.

The greatest interest to an observer centers in the machine shop. Looking down the long aisles of machinery, the attention of the visitor is drawn to the many curiously shaped machines of special design necessary in the various processes of the iron work.

The tendency now is toward the extensive use of *iron* in the construction of the machines, which insures greater strength and lightness, and gives the machine a more attractive appearance. As a consequence, the lathe work necessary is largely increased, and this renders specially designed machinery and tools indispensable. For example, the introduction of the inclosed gear frames for reapers, mowers, and droppers necessitated a machine which could bore all the holes required for shafts, etc., at one operation, and several of these are in use, which cost thousands of dollars to build.

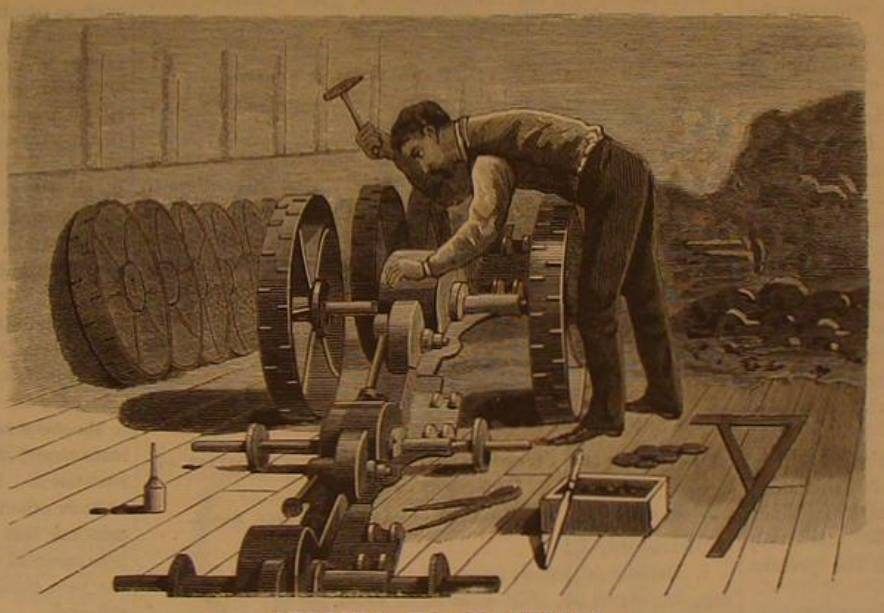


BOLT AND NUT DEPARTMENT.

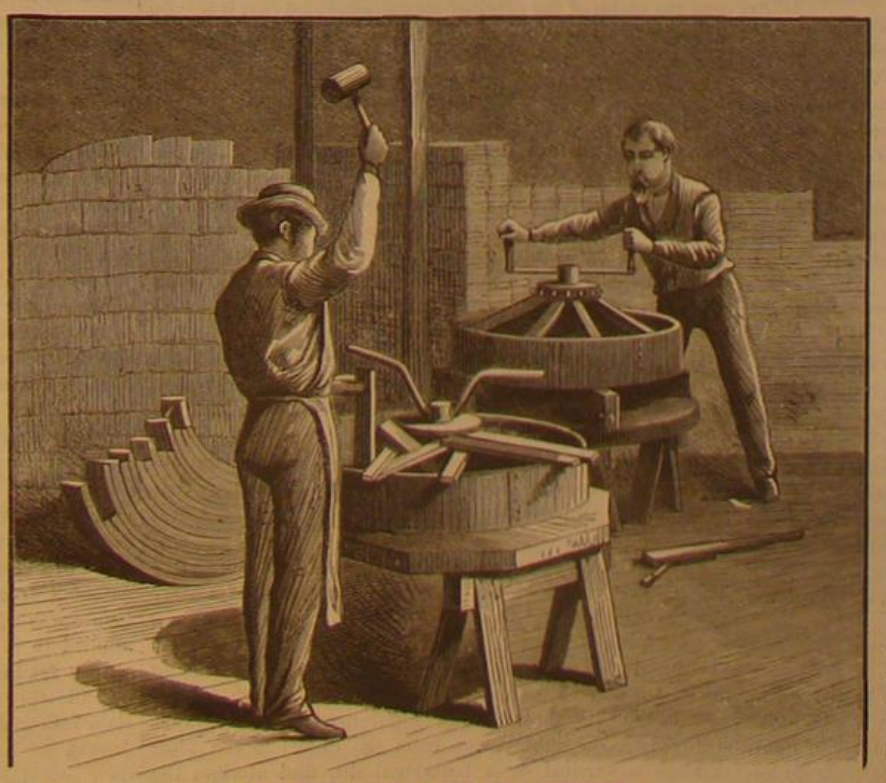
The boring of the rake posts, cams, iron frames of binders and reapers, and many other parts of the machines needs such special machinery as we have alluded to.

This perfection of the work renders easy the renewal of any part in the field, should any piece become broken or worn, and insures the exact duplication of it at any time thereafter, so long as the patterns may be preserved. The blacksmith shop is a large building provided with all the appliances for cutting, punching, forging, and shaping the various pieces of wrought iron used in the construction of the machines.

The foundry is a fine structure, 245x90 feet, with two wings, one of them 80x60 feet. Here about 75 tons of pig-iron, from its two cupolas, are daily transformed into castings of all descriptions.



SETTING UP MACHINES.



MAKING HARVESTER WHEELS.

The foundation of all reaping machines is the sickle-bar, which our artist has graphically represented on the first page, and it is well worthy of note that the original cutting apparatus invented by Cyrus H. McCormick, fifty years ago, has never been superseded or improved in its essential features. A large building in the center of the rectangle contains the grindstones upon which the knives are ground, the tapping machines for serrating the edges of the sections or blades, the machines for rolling the bars, and the room for assembling all the parts necessary to form the complete cutting apparatus.

From the iron and wood working departments all the material for the construction of the machines passes to the paint shops, where the rude contrasts of wood and iron in their natural colors are made to blend harmoniously and with pleasing effect to the eye, by means of the artist's skillful brush. The spacious paint shop, comprising more than a dozen rooms, 100x60 feet, are constantly crowded to their fullest extent, and only the most skilled labor is employed in the final decoration of the machines.

The packing departments, which we have not space to illustrate, are of unusual interest to the casual observer, this work being a science peculiar to itself. The contents of the packing boxes are of such varied shapes and sizes that only long experience and practice on the part of the packers enable them to place them in perhaps one-half the cubic space that an unskillful person would require. The shipping is conducted with great system, and the facilities are such that from twelve to twenty cars can be loaded and dispatched each day. The repair department is a small world of business in itself, embracing as it does the parts of all the McCormick machines made during the past twenty years. All the duplicate parts on hand can be known at once, and any part that is wanted for repairing any McCormick machine can be produced on demand.

That the machines may constantly meet the requirements of the farmer in every respect, and for experimenting with new devices, a corps of draughtsmen, pattern and model makers are employed.

The company finds itself under the necessity of enlarging its manufacturing facilities during the coming season to meet the naturally increasing demand for its productions.

A most interesting department to all scientific persons, in this manufacture, is found in the patented inventions which enter into the construction of the machines, and in the patents which the company hold for the use and protection of their business. To one not familiar with the details of this interest, the importance and magnitude of the operations herein involved would be almost incredible. The original patents of Cyrus H. McCormick, granted in 1834, 1845, and 1847, expired before any material return for his labors accrued to the inventor, and when endeavoring to obtain their extension at the Patent Office—a right which was accorded almost every other inventor of such prominence—Mr. McCormick's claim was refused, not on the ground of its invalidity, but because the invention was of *too great importance* to the world at large to admit of being placed virtually under the control of one man, as would be the case should the patents referred to have been extended. Thus were the essential features of his invention made public, and the inventor was forced to come into competition with other manufactures of the product of his own brain. In improvements upon the original, therefore, lay his greatest chance of success, and in this, as in the first machine, he was foremost. With the introduction into general use of the reaping machine, the attention of inventors on every hand was drawn toward further improvement in this direction, and applications for patents upon every conceivable mechanical devices which could be utilized in connection with harvesting machines have flooded the Patent Office from that time to the present. To the extensive manufacturer, therefore, it becomes a matter of necessity to protect himself from being assailed on every hand by speculators in patents upon every important new feature developed by him, and by obtaining control of or interests in such patents as might bear upon the forms of his construction and manufacture. It affords, therefore, to the McCormick Harvesting Machine Company a power not possessed by other competing manufacturers, that they are the owners of and hold interests in hundreds of patents of this nature. Especially in the development of their twine binder is the

value of this self-protection evident, for claimants are constantly arising to share, if possible, in any advantage which may accrue from the use of a particular device tending toward the improvement of the machines.

Comparing the machines which the McCormick Harvesting Machine Company and all their competitors now manu-

THE 1847 MACHINE

facture with the original reaper invented by Cyrus H. McCormick, as constructed by him in 1847, it will be found that all the vital elements of successful and practical work are retained intact, namely, the cutting apparatus, divider, reel, platform, attachment of the horses; yet from step to step the advancement has been in taking away all manual assistance from the machine, making it as far as possible entirely automatic. The addition of a seat or stand enabling the raker to ride on the machine instead of walking by its side; the substitution of the self-rake for the hand rake; the placing the binder stand upon the machine, whereby the men bound the sheaves while riding, instead of lifting them from the ground; the substitution of the automatic binder for the manual labor; and, finally, the automatic trip, whereby the size of the sheaf throws the binding mechanism into operation, are all consecutive steps in the progress of invention and development of the reaping machine.

Few of our readers can have any idea of the magnitude of this branch of industry. In all the harvest fields of the world the McCormick machines are at work, and the farmers of Australia, New Zealand, France, Italy, and Russia, are as familiar with their superior merits as are the farmers of Illinois, at whose doors they are manufactured. We believe that the verdict of the leading scientific and mechanical authorities of the present day is unanimous in placing the McCormick machines in the lead of all others. At each successive World's International Exposition, from the World's Fair at London, in 1851, to the Melbourne Exposition of 1880, the highest honors have been without exception awarded to the McCormick reaper.

The great extent of this trade at home and abroad will be better understood when we say that there have been built and sold over 300,000 of the McCormick machines since 1849, beginning with an annual product of 1,500 machines, and increasing as the country developed, until the present annual production exceeds 30,000 machines.

It is estimated that there are at this time 200,000 McCormick machines in existence, capable of harvesting annually 60,000,000 acres of grain and grass, an area equal to the entire surface of the great States of New York and Pennsylvania, requiring an army of 200,000 men and 400,000 horses, and furnishing employment for tens of thousands engaged in handling and transporting the vast grain crops of the world. And the man whose brain evolved the idea of a successful reaping machine, and who carried the thought into deeds, and whose energy and shrewdness put this vast force at work, is alive among us to-day, enjoying his well-merited honors and success. His name will go down to posterity as one of the great benefactors of the human race whose victories have been won in the successful effort to lessen toil and bless mankind. What the future of the reaping machine will be when the vast territories of the unexplored far away Northwest—the great grain belt of the world—shall have been brought under cultivation, we leave to the imagination of the reader, our duty as journalists being to trace the early history and present standing of this very important branch of national industry.

Simple Ventilator.

Dr. McKinnon, of Windsor, Ont., has sent to the *Canadian Lancet* a sketch of a stovepipe ventilator, which may not be new in principle, but which will, no doubt, be found useful as it is simple. The stovepipe is surrounded by a cylinder of sheet iron, having a diameter large enough to leave 2½ inches of space between it and the pipe. The vitiated air of the room is admitted through an opening or openings at the lower part, and it passes upward as it is heated between the pipe and cylinder for 18 or 20 inches, according to the height of the latter, and then enters an opening in the stovepipe and passes away with the smoke.

The Heliograph in War.

The extensive use of the heliograph by the British forces in the Zulu and Afghan campaigns has given a wonderful impetus to the art of signaling by means of flashes of light. The heliograph itself as now perfected leaves little to improve upon; but it is of course only applicable so long as the sun is above the horizon. Hence, the attention of inventors is chiefly concentrated upon improvements in lamps for signaling at night. As our readers are aware, the alphabet used is a combination of short and long flashes, corresponding to but not exactly identical with the dots and dashes of the Morse telegraph system. The most obvious plan for signaling at night is to use a lamp with a movable diaphragm, which will shut off the light for long or short periods as may be required. An English inventor some time since contrived a lamp in which a jet of pyrotechnic mixture, consisting largely of powdered magnesium, was propelled into a spirit flame by means of bellows. This arrangement gives long or short flashes of intense light, which would be visible for many miles. M. Mercadier has lately proposed a cheaper, and at the same time an efficient form of apparatus for the same purposes. It consists of an argand burner for oil or gas, to which is supplied on pressure of a key (like a Morse key), a stream of oxygen. This gas of course at once intensifies the light, and signaling can be carried on without difficulty.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—District of New Hampshire.

MONCE *vs.* WOODWARD.—PATENT GLASS CUTTER.

Clark, J.:

Letters patent No. 91,150 to S. G. Monce, June 8, 1869, for tool for cutting glass, declared invalid in view of testimony establishing the fact that similar tools had been made and used before the invention thereof by Monce.

This patent was for the rotary disk glass cutter—a steel cutting wheel set in the end of a handle.

Supreme Court of the United States.

CROUCH, APPELLANT, *vs.* ROEMER.—PATENT SHAWL HANDLE AND STRAPS.

Shawl straps with handles attached to a leather cross-piece having loops at the ends being old, it is no invention to stiffen by artificial means the leather cross-piece, which had before been made as rigid as it could be by thickness, doubling, and stitching. The use of known equivalents for some of the elements of former structures, to make them somewhat better, is not invention.

Appeal from the Circuit Court of the United States for the District of New Jersey.

Mr. Chief Justice Waite delivered the opinion of the court.

United States Circuit Court.—Southern District of New York.

WARING, JR. *vs.* JOHNSON.—PATENT CHECK BOOK.

Blatchford, J.:

1. Reissue of letters patent No. 8,199, granted to G. Waring, Jr., April 23, 1878, held to be valid.

2. Where an invention is claimed as the "combination, in a check book, of checks and stub-pieces of substantially the same size, so united that two checks lie between every two stub-pieces, substantially as specified and set forth," it is immaterial, in view of the state of the art, whether the defendant's book has the line of perforation between the check and the stub leaf at the top or bottom of the stub leaf or at the leaf end of the check.

3. It will not invalidate the reissue that the claim is broader than the claim of the original patent, provided that it is "for the same invention" shown and described in the specification and drawings.

William Ennis.

William Ennis, inventor, of Troy, New York, died at sea, March 29, in his fifty-ninth year. Like so many of our persistent and successful inventors, Mr. Ennis acquired the knowledge utilized in his inventions by actual experience and personal study and investigations, his opportunity for early schooling having been but the slightest. Most of his inventions were improvements in furnaces and related apparatus for domestic and manufacturing purposes. For many years he was engaged in the manufacture of hot air furnaces. He invented the duplex heating furnace, and took out a number of patents for improvements in metallurgical processes. His later work was in connection with an apparatus for economizing fuel, and the sea voyage which ended his life was undertaken to make the necessary preparations for the application of his invention to the steamship Richmond, of the Old Dominion Line.

PHENOMENA OF OPTICS AND OF VISION.—M. TREVE.—The author mentions the fact that the flame of a lamp appears brighter, and that a vertical shaft, a post, or mast is seen more distinctly through a vertical than through a horizontal slit, while a house, a landscape, or the disk of the sun or moon is perceived more clearly through a horizontal slit. He finds similar differences in photographs according as the light passes from the object to the plate through a vertical or a horizontal slit, and ascribes the results to the action of diffused light.

Correspondence.

Fuel from Hay, Straw, Flax, Etc.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of the 16th inst., you refer to the want in parts of the West of a machine for preparing flax straw for burning as ordinary fuel. This is true. Not only is a machine needed for preparing flax straw, but all other kinds of straw and also prairie hay.

In a large portion of the West straw of all kinds is allowed to rot in the field or is burned in the stack. Thousands of tons of wheat straw are burned every year as soon as thrashed, and this, too, in a country where fuel is scarce and high. Prairie hay that costs only the cutting and stacking also goes to waste in vast quantities. If this wealth of hay and straw could be compressed into bricks convenient for burning in an ordinary stove, thousands of dollars might be saved to the hard working farmers on our Western prairies—provided, of course, that the desired machine be not too expensive, or could do its work cheaply. Possibly it would be best to have the hay or straw cut into short pieces before being compressed.

Hay stoves have been invented and are in use in some localities, but it takes a large amount of time to twist up the hay by hand and feed the stove, besides keeping the room constantly littered with loose particles.

The market value of prairie hay in this portion of the West is from $2 to $3 a ton. Plenty of it may be contracted now for $2.50. Straw has no market value. The writer of this, last fall, burned the straw from 160 acres of wheat land as soon as it was thrashed in order to get it out of the way, and in doing this only followed the common practice of the country. At the same time wood is worth $6 to $6.50 a cord, soft coal $4 to $6 a ton, and hard coal $10 to $14 a ton.

W. C. HAYWARD.

Garner, Iowa, April 18, 1881.

[Our correspondent's suggestions are useful, and we hope that some of our ingenious readers will be led to study the subject of utilizing the products he mentions. But if soft coal can be had at $4 a ton, we doubt whether hay fuel, no matter how compressed, could compete with it. The fibers will probably have to be utilized in some other way than as fuel. Paper pulp might be made, for example.—EDS.]

The New Mineral Hiddenite.

To the Editor of the Scientific American:

A late publication in your "Correspondence" column from Mr. J. A. D. Stephenson, of Statesville, N. C., in which he claimed the discovery of this mineral, demands answer from me.

The definition of hiddenite in Dr. J. Lawrence Smith's own words is, "an emerald-green variety of spodumene," and it is this variety only that I consider myself the discoverer of.

To show to you that it was in truth a discovery, I will state that I was not searching for the mineral when I discovered it. It was while I was at work here with a corps of men pushing forward a systematic investigation of this mineral belt for the purpose of discovering a mine of the true emerald (species beryl), that I unexpectedly came upon the vein eight feet below the surface that contained the new mineral.

Mr. Stephenson said to me last week that "the specimens he obtained were either colorless or only slightly yellowish green." He had never seen them having a pure emerald-green color until he saw those I had unearthed.

Now it follows, then, that the mineral he obtained was not hiddenite, but simply a variety of spodumene, not characteristic enough in color to merit a new name.

Mr. Stephenson has never made or caused to be made any scientific investigation of either the locality or of the mineral, and by reason of such neglect has forfeited any rights he may have had in this matter.

As you are well aware, it is to the person who gives the animus or momentum to an investigation that leads to a discovery who receives the honor.

Even the discovery of the variety Mr. Stephenson obtained does not belong to him, but very properly, under the laws of priority, to the farmer (Mr. J. W. Warren) who first found it in the soil here and subsequently sold it to Mr. Stephenson.

I would only too cheerfully accord to Mr. Stephenson any rights he might have in this matter; and I do freely accord to him, and to the mineral specimens he has sent North from this interesting region, the incentive to my present work here, and whatever, if any, success I have attained.

WM. EARL HIDDEN.

Stony Point, N. C., April 26, 1881.

A Remedy for Scale Bugs.

At a recent meeting of the California Academy of Sciences, Dr. Gibbons exhibited a large bunch of beautiful roses of exceeding fragrance, and in full bloom, which he gathered from a bush in his garden which two months before was overrun with scale bugs and nearly dead. He applied to it a mixture of crude petroleum and castor oil, with a feather, daubing it slightly on the leaves and stem, not allowing any to fall to the ground or reach the roots. Rain followed, and the plants were throwing out their first growth of leaves, to which the scale bugs were directing their attention. Now no sign of any scale insect can be seen in the whole garden.

NEW INVENTIONS.

In the concentration of certain liquors or extracts in vacuum pans, where very dense or thick extracts are required—such, for instance, as in the case of dyewood extracts—it is found that, owing to the low temperature that exists in the vacuum, it is impossible to remove sufficient of this moisture to secure the required concentration. Hence it is usual to destroy the vacuum at intervals by opening the valves and admitting air, and then allowing the mass to heat up to the temperature allowed by atmospheric pressure, after which the exhaustion is again effected, which insures an increased disengagement of the moisture from the mass, now heated much beyond the vacuum temperature, so that a more dense concentration is thus effected. As this system, however, requires repeated and alternate stages of heating and exhausting, its action is slow, and the repeated abrupt renewals of the vacuum are manifestly wasteful of power. Mr. Jacob G. Reed, of New York city, has patented certain means whereby the vacuum or partial vacuum in the pan may be kept constant, or nearly so, while at the same time an influx of hot dry air is discharged in regulated jets up through the mass of fluid, so that the moisture is absorbed or evaporated from all parts of the mass, and the mass kept at the same time in constant motion during the influx and exhaustion, insuring uniform liquidity and the reduction of the mass to the desired density in a constant, rapid, and economical manner.

Mr. George W. Thorp, of Wellington, Kan., has patented an improved holdback, in which the tongue cap is provided with screw holes in its lower part and the separable holdback stop with a screw thread upon the end of its upright arm, to screw into one of the screw holes of the cap, and a hole in the end of its inclined arm, through which a screw passes into a hole in the cap or into the tongue, so that the stop can be adjusted forward or back as the size of the horses may require.

An improved ore-washing apparatus has been patented by Mr. James H. Totman, of Plattsburg, N. Y. The object of this invention is to provide a simple and effective device for keeping the journal bearings in ore-jigs and other machines free from dust, sand, and other substances that otherwise get in them and cut the journals and bearings. It consists of a double ring or annular box closed at the bottom and open at the top of the annular space between its sides, and having a lateral opening from said space for the introduction of water therein, it being designed to set said water box about a journal or journal bearing, and to force a constant stream of water through the lateral opening, so that said water shall flow out of the annular space in the box against the journal or bearing, and thereby keep off all dust, sand, etc., which might otherwise lodge on or in it.

An improved device for feeding fine fuel to furnaces, forges, etc., has been patented by Mr. Augustus Greiner, of Somerset, Ohio. It consists of an air-tight coal dust vessel provided at one end with an inlet adapted to be connected with an air or steam supply, and at the other end with an outlet adapted to be connected directly with the furnace.

A Long-Lived Community.

Some curious statistics of local longevity are furnished the Providence (R. I.) *Journal* by a correspondent at Thompson Center, Windham County, Conn. At the beginning of April—the letter is dated the 11th—the resident population of the school district—excluding transient "help"—was 331. Of these 5 were over 90 years of age, 14 were between 80 and 90, and 28 between 70 and 80. The average of the first five (all men) is 93 years. The average of the next 14 (4 men and 10 women) is 82 years. The third group (8 men and 20 women) average 75½ years of age.

Percentage of population			over 90 years	1·51
do.	do.	do.	between 80 and 90	4·23
do.	do.	do.	over 80	5·74
do.	do.	do.	between 70 and 80	8·46
do.	do.	do.	over 70	14·2

The first houses beyond the district limits, in three directions, are occupied by aged women, two of them of 87 years, the other 83 years old.

Evidently the district is a healthy one. It is pretty evident also that, like so many New England districts, it is a good one to go away from. So large a proportion of aged inhabitants indicates the early migration of most of the youth of the community to more active though possibly less healthy towns.

Mountain Mahogany.

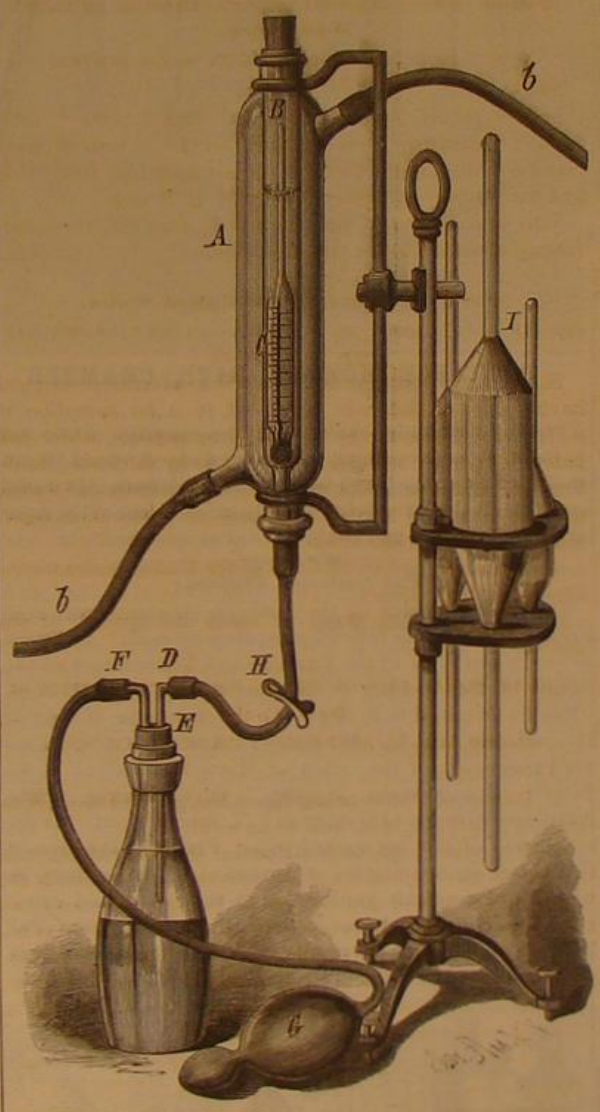
This wood is indigenous to Nevada. The trees do not grow large; one with a trunk a foot in diameter is much above the average. When dry the wood is about as hard as boxwood, and of a very fine grain. It is of a rich red color and very heavy. When well seasoned it would be a fine material for the wood carver. In the early days it was used in making boxes for shafting, and in a few instances for shoes and dies in a quartz battery. Used as a fuel it creates intense heat, it burns with a blaze as long as ordinary wood would last, and is then found (almost unchanged in form) converted to a charcoal that lasts about twice as long as that of ordinary wood.

L'Electricité states that M. Dohrn has introduced the telephone in connection with his scientific explorations of the bed of the Bay of Naples. By its use the diver and the boatmen overhead are able to communicate with each other quickly and intelligibly.

ARAOMETRIC METHOD FOR THE ESTIMATION OF FAT IN MILK.*

The principle of this method does not occur in any of those in use. It is as follows: A known quantity of milk, caustic potash solution, and ether are shaken together; the fat, as is known, dissolves completely in the ether, which, after standing for a short time, rises to the surface. A small portion of the ether, which is always constant, remains dissolved in the alkaline solution, but does not contain any fat, as the ether in the water does not dissolve the slightest trace of fat. The remaining portion of ether forms with the fat a solution whose concentration varies as the amount of fat present in the milk. The concentration of this ethereal solution of fat can be ascertained by the estimation of its specific gravity with as certain and accurate results as those obtained by estimating the amount of alcohol in an aqueous solution with the alcoholometer, as the difference between the specific gravity of fat and ether is as great as between that of water and alcohol.

Apparatus and Materials.—(1.) Apparatus for the determination of specific gravities, with three pipettes for measuring the milk, caustic potash solution, and ether respectively, and several bottles in which to agitate the mixtures. (2.) Caustic potash solution, of sp. gr 1·26 to 1·27, prepared by dissolving 400 grms. fused caustic potash in a half liter of, water, which after cooling is made up to one liter; or by dissolving 400 grms. caustic potash in 870 grms. water. (3.) Ether saturated with water. This is obtained by shaking commercial ether with one-tenth to two-tenths of its volume



Dr. Soxhlet's Apparatus for the Estimation of Fat in Milk.

of water at the ordinary temperature. (4.) Commercial ether. (5.) A large vessel of at least 4 liters capacity, filled with water at a temperature of 17° to 18° C. When several estimations are to be made at the same time the vessel must be larger. When the temperature of the room is warmer, the temperature of the water should at first be 17°, when cooler, 18° C.

Manner of Procedure – The milk being thoroughly mixed, and at a temperature of 17·5° C., 200 c.c. are measured by the largest pipette and discharged into one of the bottles for agitating, which should have a capacity of 300 c.c. In the same manner 10 c.c. of the potash solution are measured, discharged into the bottle containing the milk, and mixed; 60 c.c. ether saturated with water are then added. The ether, when measured, must be between 16·5° and 18·5° C. The bottle is now closed with a cork or India-rubber stopper, shaken violently for half a minute, placed in the water at 17·5° C., and shaken every alternate half minute for a quarter of an hour. After standing a quarter of an hour longer, a clear layer of the ethereal solution of fat forms in the conical part of the bottle, the collection and purification of which is accelerated by giving to the contents of the bottle a gentle circular movement. It is indifferent whether the entire solution of fat, or only a portion, has collected, if there be sufficient to cause the aräometer to float. The ethereal solution must be perfectly clear. With milk containing a large amount of fat (4½ to 5 per cent) the separation takes longer than a quarter of an hour; sometimes, but exceptionally, from one to two hours. In such cases, if the vessel containing the water is large enough, it is judicious to lay the well-closed bottle in a horizontal position in the water; the way for the ascending drops is thus considerably shortened, and the collection of ether hastened. When the bottle can again be placed in an upright position, the purification may be assisted by the gentle circular movement.

In order that the following manipulations may be understood the apparatus for the estimation of the specific gravity of the ethereal solution will be described.

The stand has a holder fitted with a movable screw for holding the cooling tube, A, to the tubes of which are attached two short India-rubber tubes. The holder of the tube, A, turns on its axle, so that A can be placed in a horizontal position. In the center of A is fastened a smaller tube, B, whose diameter must be 2 mm. greater than that of the float of the aräometer. At the lower end of B are fastened three small pieces of glass, to prevent the aräometer from adhering to the sides, while the upper end is closed by a cork. The scale of the aräometer, C, is divided into degrees from 66 to 40, corresponding to the specific gravities from 0·766 to 0·743 at 17·5° C.; these, again, are further divided by smaller and finer lines into halves. In the float of the aräometer is fastened a small thermometer, so graduated that 0·1° C. may be read off. The drawn-out end of the tube, B, which passes through the cork in the bottom of A, is connected by means of an India-rubber tube to the glass tubes D, which passes through the cork, E, of the agitating bottle. The glass tube, F, to which is attached the small hand bellows, G, also passes through the cork. The stand also holds the three pipettes, I, for measuring the milk, caustic potash solution, and ether.

The apparatus is now used as follows: The India-rubber tube connected to the lower tube of A is placed in the vessel containing the water at 17° to 18° C. A is now filled with water by suction at B, and closed by connecting both ends with a glass tube. The stopper of the agitating bottle is now replaced by the cork, E, and the tube, D, so inserted as to dip nearly to the bottom of the clear ethereal solution. The cork at the top of A and the clamp, H, being opened, a quantity of ether, sufficient to cause the aräometer to float, is forced by means of a gentle pressure at G into the tube, B. The clamp is now closed, and the cork inserted in B, in order to prevent any evaporation of ether.

After waiting from one to two minutes till compensation of temperature has taken place, the aräometer is brought as nearly as possible into the center of the tube, and the position of the scale read off. That part of the scale is read off which coincides with the middle part of the deepest curved line on the surface of the liquid (meniscus). As the specific gravity is diminished by a higher and increased by a lower temperature, the temperature during the estimation of the specific gravity of the ethereal solution must be noticed. Therefore, shortly before or after ascertaining the position of the aräometer, the temperature of the liquid is obtained to within 0·1° C. from the thermometer in the aräometer. If the temperature be exactly 17·5° C., the specific gravity will, of course, require no further correction; in other cases, however, the specific gravity obtained by the aräometer can be easily calculated to that at the standard temperature, 17·5° C. For each degree Celsius over 17·5° C., one degree is added to, and for each degree under 17·5° C., one degree is subtracted from, the statement of the aräometer; *e. g.*, 58·9 degrees at 16·8° C., at standard temperature become 58·2; 47·6 degrees at 18·4° C., at standard temperature become 48·5. The temperature of the water in A may fluctuate between 16·5° and 18·5° C. The specific gravity of the ethereal solution at 17·5° C. being found, the amount of fat in weight per cent is obtained directly from table I.

After finishing the determination, in order to prepare the apparatus for a second, the cork of B, and the clamp, H, are opened to permit the ether to flow back into the agitating bottle. B is now filled from the bottle with commercial ether, which is allowed to flow back again. The tube, B, India rubber tube, etc., are now thoroughly dried by forcing a current of air through the apparatus by means of a hand bellows, G. As the aräometer is apt to be injured by coming in contact with B, it is advisable, before forcing the air through, to turn the tubes A and C to a horizontal position.

The estimation of the specific gravity, including the preparation of the apparatus for another estimation, scarcely takes five minutes. From the description of the manner of cleaning the apparatus, it will be seen that there is little risk of the aräometer being injured, as it is never taken out of the tube, B. Allowing half an hour for the mixing and separation of the ethereal solution, an estimation of fat may be made in from forty to forty-five minutes; but five estimations can be made as easily in an hour, when they are carried on at the same time. The method, therefore, not only allows several estimations to be made at the same time, but is also very expeditious.

* By Dr. F. Soxhlet in *Chemical News*.

Steam Sledge for Arctic Use.

A dispatch from Washington relative to the outfit of the relief steamer Mary and Helen, states that Chief Engineer George Sewell, of the Navy, now on duty at New York, has, upon official request, forwarded to the Navy Department designs for a steam sledge which is intended to be self-propelling and capable of towing a number of sledges.

NEW HOT-AIR BATH CHAMBER.

The engraving shows a portable bath chamber suitable for all kinds of baths, but especially designed for hot air in the treatment of disease. The inventor claims that during many years of medical practice in the most unhealthy portions of the South he has used heat as a remedy with such success that he now considers it far more valuable than all other curative agents combined.

Steam being objectionable, he proposes to make the general use of the hot-air bath, among physicians and families, practicable and cheap.

The portable chamber consists of a detachable top in three parts or sections, and the walls are made up of four corner sections, with the doors hung to the free edge of each one of the wings, which, hinged together in pairs, make the corner sections. When required, the chamber sets upon a base frame containing the heating apparatus; however, the chamber may be used independently of the base frame and furnace, when a parlor, office, or cook stove already in use is available.

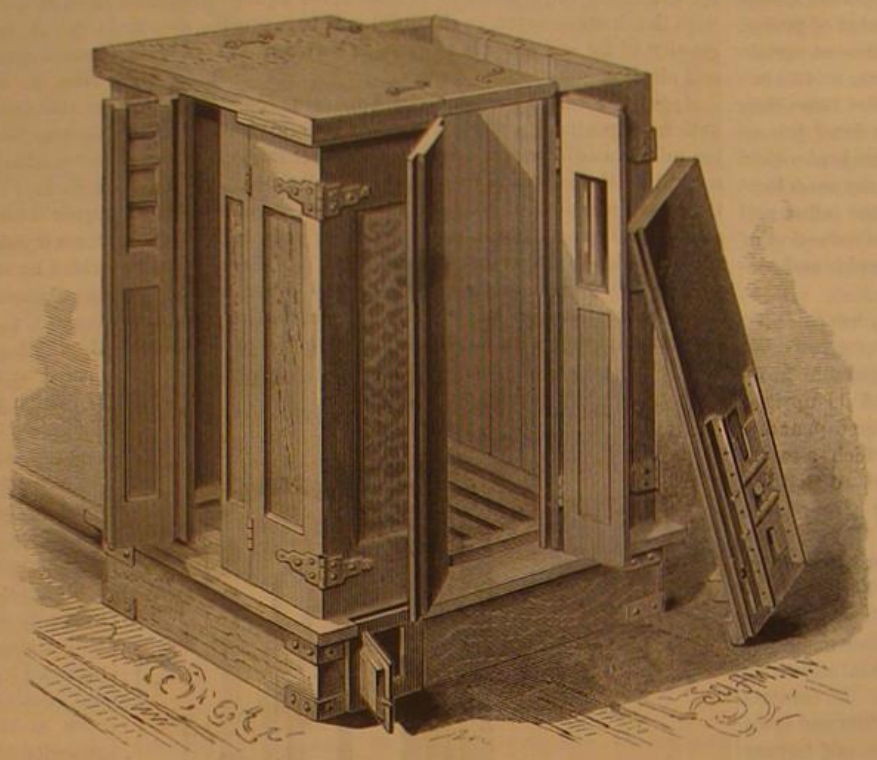
There is a space or recess cut in the top of one of the doors, and also in one of the roof or top sections, the former to fit over the stovepipe if horizontal, the latter if vertical, and are both provided with square shutters fitted to the stovepipe. By means of this ingenious arrangement the chamber can be readily set up about a hot stove without touching the pipe, and where families have even a cookstove in daily use they can avail themselves of the chamber alone without the expense of base frame, furnace, and extra fuel; and when done bathing, the chamber may be removed from the cookstove and set up elsewhere and for other purposes if desired.

This chamber can be taken down in detached parts without the aid of tools; is easily carried from place to place; and may be set up in any room, or, if necessary, around the bed upon which the patient is lying, without creating any disturbance.

The plan of construction is so simple and perfect that each part, whether door, corner, or top section, is interchangeable with all other similar parts, and the door containing the window may be readily changed from one side of the chamber to the other, when desirable. The same is true of the door containing the square shutters for the pipe opening.

It is adaptable to any place or circumstance, and will render the hot-air and Turkish baths practicable with both physicians and families.

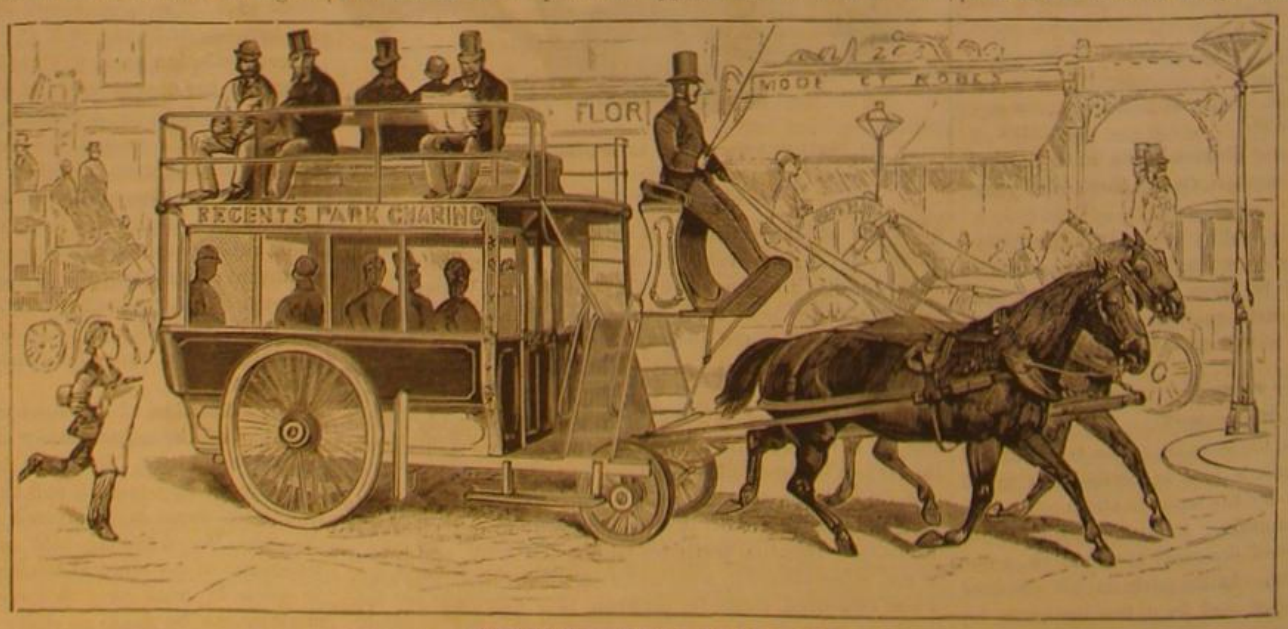
Full information in regard to this novel chamber may be obtained by addressing Dr. Andrew Walker, Natchitoches, La.



PORTABLE HOT-AIR BATH CHAMBER.

NEW ROAD CAR.

The road car shown in our engraving will shortly commence running on various routes in different parts of London, the London and District Omnibus Company (Limited) having entered into arrangements for the purpose with the inventor, Captain Molesworth, R.N. The chief difference between the old and the new vehicles is that the latter are principally supported on the two large wheels, which arrangement not only gives greater facility in running, but by means of the crank axle also brings the car much nearer the ground, passengers being thus able to step easily from the pavement on to the platform in front, which is no higher than an ordinary curbstone. An additional, and perhaps a more acceptable advantage gained in adopting this principle, is that, however rough the ground or however the load may be distributed, the car glides forward with an undulating, easy motion, most enjoyable compared with the rather "rough and tumble" jolting of the old omnibus. The two small wheels in front act rather as a foundation for the driver's seat than as an additional support to the car. This new arrangement affords great facilities for rapidly turning and changing the vehicle's course in crowded thoroughfares, and also enables the driver to have proper command of his horses, to be free from interference from passengers, and also to be in close communication with the conductor, who stands on the platform in front, where, in contrast to the old style, is the door. We have seen and traveled in one of the new vehicles, were much pleased with its comfort, roominess, and brightness, and especially with the novel arrangement of the seats on the top; the "knife board" being abolished for a double row of comfortable garden chairs, so placed as to allow of every one sitting with his or her face to the horses. These chairs are not shown in the illustration, but the majority of the cars are fitted with them.—*London Graphic.*



MOLESWORTH'S ROAD CAR.

Proposed Electric Postal Railway.

Models of a proposed electric railway and letter post delivery were recently exhibited before a scientific club in Vienna. A Siemens electro-dynamic machine was used to furnish the motive power. The chief advantage claimed for the system was that the power was generated at the stations and not carried along the line by locomotive engines. The letter post was intended to supply for long distances the want now filled for short distances by pneumatic tubes. Miniature lines of railway were to be built along the passenger lines, and on them, at an exceedingly high rate of speed, would be run small electric engines and cars to take up letters. It would have the advantage of being entirely independent of the regular passenger road, and could be used at any time.

The National Academy.

The closing session of the National Academy was held Friday, April 22. The following papers were read: "Additions to our Knowledge of the Currents and Temperature of the Ocean in the Vicinity of Behring Straits," W. H. Doll; "Results Obtained with Regard to the Molecular Weight of Hydrofluoric Acid," J. W. Mallet; "A Method of Finding the Proximeters of the Orbits of Minor Planets," C. H. F. Peters; "Incandescent Lighting," G. F. Barker; "The Auriferous Gravels of California," T. Sterry Hunt. At the conclusion of the last named paper, President Rogers said that before announcing the adjournment of the Academy he wished to express his gratification at the variety and excellence of the communications presented during the session. The brilliancy of some of the results, the large beneficence that will attend their practical application, as well as the harmony and fraternal feeling that had characterized their deliberations, were matters for congratulation. The members of the Academy, he said, as indeed all scientific men, constitute a republic; and its government is necessarily attended with some of the inconvenience that attends such a form of government, which encourages the development of strong individuality. The history of the Academy is one of progress, and there lies a grand and brilliant future before it.

RECENT INVENTIONS.

Mr. Henry S. Norse, of 2238 Third avenue, New York city, has patented an improved duplicating press. The object of this invention is to furnish a foot or power press for use in printing from stencil plates, particularly stencils prepared with the Edison electric pen, so that the labor and time heretofore required in such work shall be reduced. The invention consists in a hinged frame carrying the stencil plate, and a vibrating lever carrying the ink roller, combined together and with a fixed platen or bed, and operated by mechanism of novel construction, by which the hinged frame is raised for insertion of the paper, dropped upon the paper, the ink roller brought over the stencil plate with the required pressure, and then withdrawn while the frame is again raised.

An improved barrel hoop making machine has been patented by Mr. Edward E. Thresher, of Reed City, Mich. This machine is designed especially for cutting hoops from boards or planks, and is so constructed as to cut the timber into oval strips and cut each strip into two beveled hoops. The machine can be readily adjusted for sawing lath and making mouldings.

An improved horse power has been patented by Mr. Benjamin F. McCarty and Richard E. Lindsay, of Seale, Ala. The object of this invention is to furnish horse powers designed especially for driving cotton gins, but which can be used with advantage for various other purposes. They are so constructed that they can be built upon the drive wheels of ordinary horse powers.

An improved crate for the transportation of fish, meats, and other like perishable articles, so as to protect them from decomposition during transportation or storage, has been patented by Mr. William S. Braman, of Key West, Fla. It consists of a crate made of a network of galvanized iron, and provided with a series of knees or projections, which keep the sides of the crate from coming in contact with the sides of the box.

Mr. John Flanagan, of Newburg, N. Y., has patented an improvement in hydrant valves. The invention consists in combining with a hydrant case having a side aperture and an apertured extension a cross slotted cylinder provided with annular exterior packing grooves and a valve sustained at the center by arms and carrying at the lower end a packing disk.

Mr. Albert Rousseaux, of Brussels, Belgium, has patented an inhaler by means of which air impregnated with tar or other medical odors can be inhaled for penetration to the bronchial tubes and lungs. The invention consists in a cigar holder or mouth piece fitted with a cigar-shaped portion containing tar or other materials formed with air conduits, and provided with a cover perforated for admission of air, so that by being held in the mouth the user can inhale the exterior air, which, on passing through the cigar and holder, becomes impregnated with the tar, medicine, or other material used.

An improved curtain fixture has been patented by Mr. Benjamin Landon, of Canton, Pa. The object of this invention is to improve the construction of the window shade fixtures for which Letters Patent No. 132, 726 were granted to the same inventor under the date of November 5, 1872, in such a manner as to simplify the construction and promote convenience in operating them.

An improved engraving machine has been patented by Mr. Allan E. Francis, of Garrettsville, Ohio. The improvement relates generally to engraving machines employing a pantograph to which are connected the tracer and the graving tool, and particularly to the means for facing the tool properly and the lever for operating the tool to the construction of the pantograph; to the construction of the tracer arm and the means for adjusting the tracer; to the bed and supports of the machine, and the means for adjusting the pantograph and the work. This invention cannot be described without engravings.

An improvement in wagon gear has been patented by Mr. Horace L. Kingsley, of Racine, Wis. The object of this invention is to provide a cheaper and more durable oscillating gear for platform spring wagons, whereby greater elasticity and freedom of movement is given to the wagon bed. The invention consists of the combination, with the bed piece, of horizontal rocking bars having their inner ends supported in a revolving king bolt plate, and their outer ends in segments that travel over the fifth wheel on the platform.

THE ELECTRIC LIGHT IN AN ART GALLERY.

At a reception held at the Union League Club House, in this city, a few evenings ago, the experiment of lighting a portion of the picture gallery with electric lights was tried with satisfactory results.

One part of the gallery was lighted with gas and the other portion with Maxim's incandescent burners, supplied by the United States Electric Lighting Company, who also illuminated the street and avenue fronting the building with one of their powerful arc lights.

It was considered doubtful if the commingling of the two lights – gas and electric – would be sufficiently harmonious to admit their use together without destroying the harmony of color or richness of tint in some of the ninety beautiful paintings—valued in the aggregate at $265,000—which adorned the walls of the Club House on this occasion. But the result has proved that the electric light is feasible for illuminating galleries of art, and in many respects that it is far better than gas for the purpose.

The quality of the light approaches very closely to that of daylight, hence the artist's conception of color is not distorted as by the yellow tint which gas produces. The picture appears to the observer as it did to the artist when it left his easel.

The electric light takes up none of the oxygen of the room, the exhaustion of which in galleries where gas jets are used renders them uncomfortably warm, vitiating the atmosphere, and thus detracting from the pleasure of visiting such places at night.

The result attending the exhibition the other evening, of using the electric light and gas light together, and then either separately, establishes the feasibility of using the electric light alone for exhibiting pictures to the best advantage or of blending the two and heightening the brilliancy.

The Maxim incandescent burners were placed at intervals between the gas jets on the main pipe which extends around the room, so that the rays of light were projected from the same line, thus avoiding a cross-light, which artists and exhibitors so much abhor.

A Summer School of Natural Science.

The Boston Society of Natural History will open a seaside laboratory at Annisquam, Mass., June 15, the session to end September 15. There will be no stated course of instruction and no lectures, the purpose being to afford opportunities for the study and observation of the development, anatomy, and habits of common types of marine animals under suitable direction and advice.

MISCELLANEOUS INVENTIONS.

Mr. Joseph L. Camp, of Cannonsburg, Pa., has patented a device for facilitating the sealing of cans with wax, whereby the objections to the old method are avoided. It consists of an upright metallic lamp chimney having an inclined open spout or conductor attached at one side, near its base, both chimney and spout being heated by a lamp. There is a slide supported by suitable standards on the lamp holder or case, and inclined toward the chimney, in which slide is placed a stick of wax with its lower end resting against the chimney, above the spout, and as the wax is gradually melted by the heat of the chimney it drops into the spout, and may be poured thence upon a can to seal it.

Mr. Charles G. Trafton, of Slatersville, R. I., has patented an improved thread guide for spooling machines for guiding the thread as it runs from the bobbin to the larger spool. The object of this invention is to relieve the self-adjusting guide of all pressure tending to increase the friction of its movement, so that the action shall be most delicate. It consists in a guide plate pivoted to a supporting rod that is formed with the friction surface over which the yarn runs.

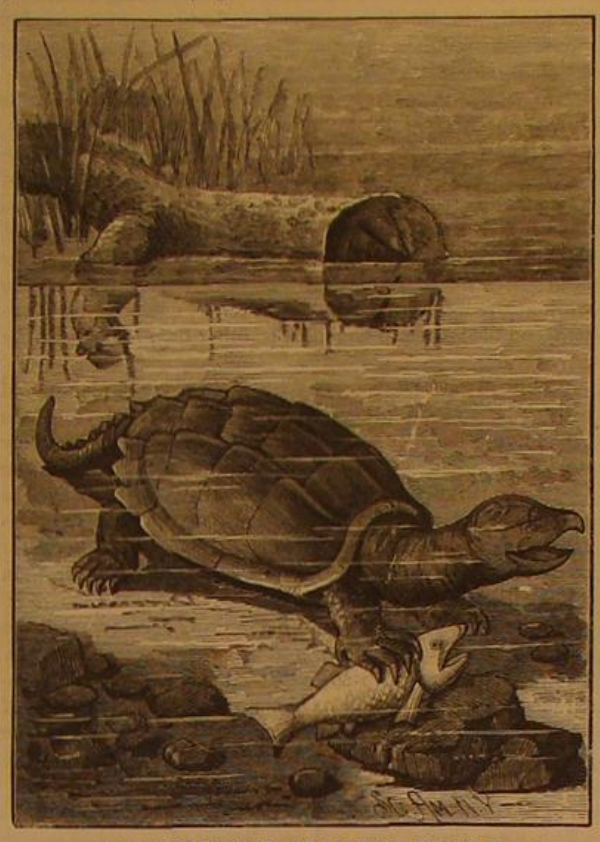
Mr. David Gaussen, of Broughton Hall, Lechlade, County of Glouces ter, England, has patented an improvement in the manufacture of vulcanized India-rubber, etc., which consists in corrugating such sheets on both sides, so as to produce a series of hollow arches or hollow semi-cylindrical formations, such as those usually formed by the corrugation of sheets of galvanized iron, the grooves on the one side being alternate with those on the opposite side of the same sheet, that which is a convexity on one side being itself a concavity on the other side, and on one and the same side a convexity or ridge being followed by a concavity, and a concavity by a convexity.

KRUGG JUGS.

The jugs shown in the annexed engraving are made by the celebrated manufacturer whose name they bear. They are fâience and gris, and exhibit the odd forms and curious decoration once so popular in Austria. The work is minute and the execution fine, and the quaintness of the designs would recommend them to any collector of objects of vertu.

THE ALLIGATOR SNAPPING TURTLE.

The alligator snapper (*Macrochelys lacertina*), the largest of fresh water turtles, has its headquarters in the shallow, tepid bayous of Louisiana, although it ranges up the Mississippi to the Missouri. It bears a strong resemblance to a common snapping turtle greatly magnified in size and ugliness, and in this latter quality might well contest the palm with the South American matamata, a turtle, by the way, of which no correct cut has fallen under our notice. It is usually represented with a thick head and neck, whereas they really look as if a log had fallen on and flattened them. In our present species the head and neck are out of all proportion to the body, giving it an overbalanced appearance,



THE ALLIGATOR SNAPPING TURTLE.

and rendering it impossible for the animal to more than slightly draw the neck beneath its shell. As far as protection is concerned this is of small consequence, for none of the coresidents of its haunts would think of attacking it, their chief concern being to avoid falling into his clutches. Lurking in the shadow of some rock or log, or partly buried in the mud, with neck retracted as far as possible, its rough-brown skin and moss-covered back give it so much the appearance of an old stump that it is unnoticed by the fish sporting in the vicinity, until, perhaps, one ventures too near. Then, with a sidelong spring, at the same time darting out its neck, the turtle seizes his prey, which he devours at leisure, holding the fish down and under him as a dog would a bone. It is so voracious as to cause sad havoc among the fish, while its wariness renders it difficult to capture. A gentleman who had introduced a pair into a small fish pond found them so destructive that he wished to get rid of them. They preyed upon the fish, and also came to be fed whenever the fish were. One was speared while feeding; but the larger kept out of the way until he was tempted to seize a hook baited with a large minnow. Finding himself caught he braced against the rock, and, with a sudden jerk, broke the hook. After this escape he was more careful than ever, and succeeded in keeping out of danger. This turtle occasionally attains a length of 6 feet and a weight of 150 pounds, but the most common size is from 10 to 50 pounds. It is brought into the markets to some extent as an article of food. The eggs, like those of all other turtles, are deposited in the sand and hatched by the heat of the sun. If the eggs are broken the immature young will snap in a feeble way, showing that this part of their disposition is inborn and not the result of education.

FREDERIC A. LUCAS.

KRUGG JUGS.

New Rust Preventive.

A new method of protecting the surface of iron from rust has been brought forward by Mr. Ward, of London. The new "inoxidizing" process, as it is termed, consists in combining a silicate with the metal by the aid of heat. Cast or wrought iron objects are first coated, by painting or dipping, with a silicate glaze, which quickly dries, and the articles are then passed through a furnace, or rather oven. In this way the silicate composition is said to be fused and absorbed into the metal, which upon cooling is found to have assumed a dull black appearance. The coating is said to be so far homogeneous with the metal as to protect it from any change from long exposure to the atmosphere; and at the same time the silicate is not liable to disintegrate or separate from the iron. The articles treated in this manner may be ornamented by combining the silicate wash with any vitrifiable colors. Thus smooth polished colored surfaces may be produced upon iron, which, while possessing features distinct from ordinary enameling, yet present superior and more durable results than those obtainable by ordinary painting and varnishing.

The Matanzas Exhibition.

Late advices from Havana state that the Matanzas Exhibition is likely to prove a financial failure. The attendance is very small, except on Sundays. In the department of industrial products the Exhibition is pronounced a success, but it fails in its display of machinery and agricultural products. The exhibit of the Havana Arsenal is particularly full and well arranged, so that visitors can readily study the successive stages and processes of manufacture of each object. The models of cannon of all sorts and periods, from the earliest to the most modern, are regarded as particularly creditable; but it is not an encouraging sign to see the post of honor accorded to such things in an industrial exhibition.

The Beef Juice Furor.

In the present *furor* for fluid beef juice, says Dr. Fothergill, the necessity for starchy matters is being quite overlooked, or, to be very safe, underestimated. These meat products furnish—the best of them—little glycogen or animal starch, and yet that is the fuel food of the body *par excellence*. We must be guided by rational knowledge, by physiology and not by fashion, in our dietetics. When there is very feeble digestion, then the digested milk and milk gruel advocated by Dr. Roberts is to be employed. – *The Practitioner*

Kentucky Horses.

It is claimed that the fastest horses in the world have been bred in the neighborhood of Lexington, Ky. Among the more notable are Maud Stone, better known as Maud S., record, 2:10¼; Wedgwood, 2: 19; Woodford Mambrino, 2:24; Trinket, 2:19¼; Dick Moore, 2:22: John Morgan, 2:24; Indianapolis, 2:21; and Voltaire, 2:21.

The number of superior carriage, saddle, and trotting horses sent out from this part of Kentucky is very great. A prominent breeder was lately asked the secret of their superiority. He replied: "There is a combination of causes. The great majority of the horses here have some good blood in them, and you will find it crossed somewhere back in their pedigrees. The best strains of running and trotting blood have been taken from here to other States, and they there fail to produce the desired results. There is something in the blue grass, the water, the atmosphere, and the general climatic influence, and much in judicious breeding and training. We force our horses to a gait when they are one year old, and at three years old they are pretty well developed. The Northern men, however, always improve them." "How long have Kentucky horses held their high place?" was asked. The breeder replied: "No one hereabout can tell. I know men who have lived here eighty-five years, and they state that from their earliest childhood they have heard of the superiority of our horses. Their fathers before them had the same story to tell. The fact is that somewhere in the past there was brought into this State a pure strain of thorough blood, derived from the best stock of the mother world, and it has transmitted its qualities from sire to son to the present time. It is a lamentable fact that we have not the exact data upon which to base a history of the Kentucky horse."

The Manufacture of Bromide.

Fifteen years ago a few hundred pounds of bromide per year, imported from Europe, sufficed for the wants of the trade, and the price of the article was about $5 per pound. Since that time the value of bromide of potassium as a

nervous sedative has caused such a demand that a supply of nearly 50,000 pounds per month is absorbed. Bromine, from which bromide and hydrobromic acid is made, is found in the "mother" or "bitter" water yielded by the salt wells of the Ohio valley at Pomeroy, O.; also the Kanawha and Monongahela valleys, tributary to the Ohio from West Virginia and Southwestern Pennsylvania. The two first named regions furnish the wells whose water is richest in bromine, and this element is almost entirely wanting in the salt waters of the Saginaw and Syracuse salt regions. The price of the article has, in the time stated, fallen to less than one tenth that given above, and the demand for bromide shows a steady increase.

BOTANICAL NOTES.

Insectivorous Plants.—Last year attention was called in the *Cronica Cientifica* to the fact that Vayreda, in his work on the "Noteworthy Plants of Catalonia," had asserted that certain Spanish species of catch-fly (*Silene crassicaulis, S. coperta*, and *S. nutans*) possess the property of digesting the soft portions of the bodies of the insects that they capture by means of the viscid secretion which invests their stems. In a recent number of the *Cronica* Sig. Vayreda gives the results of certain experiments made by him on one of the above-named species last summer, for the purpose of verifying his original statement. He found that the viscid secretion on the internodes of the stem began to make its appearance about twelve or fifteen days before the flower buds opened. This secretion is transparent, colorless, and has a faint characteristic odor. Its viscidity is about the same as that of birdlime. It is partially soluble in water and almost entirely so in alcohol, and appears to be an oleo-resin mixed with a volatile oil. It produces a marked narcotic action on insects that come in contact with it. Sig. Vayreda having selected a number of plants of *Silene crassicaulis* of the same age, size, and vigor, dusted the viscid substance of some of them with plaster of Paris and covered that of others with cotton fibers so as to entirely prevent the access of insects to it; other plants he left in their natural state, and carefully watched the results in both cases. After numerous and attentive observations on the plants fed with insects and on those deprived of them, the author was obliged to confess that he could perceive no appreciable difference between them in development, dimensions, color, or physiological evolution, all having thriven equally well. When the seeds were mature, these were likewise compared microscopically and also weighed, but no difference could be distinguished between them. Sig. Vayreda hence draws the conclusion that while there is no doubt at all that the viscid secretion of *Silene* possesses the power of capturing and killing insects and of discoloring their bodies, its purpose is not to prepare nourishment for the plant, but rather to serve as a protection to the floral organs against unwelcome visitors; and, further, he believes that the secretions of other alleged insectivorous plants, such as *Drosera*, are provided for a like purpose. It would prove an interesting matter if some one, following Sig. Vayreda's example, should pursue a series of investigations on some of our American viscid species of *Silene*, the wild pink (*S. pennsylvanica*), for example, with a view of ascertaining whether the viscid secretion possesses the property of dissolving the soft portions of insects' bodies, and, if so, whether this proves of any special benefit to the plant.

Absorption and Diffusion of Heat by Leaves.—In a recent number of the *Annales Agronomiques*, M. Maguenne gives an account of an elaborate series of experiments undertaken by him with a view to ascertain the amount of heat absorbed by and radiated from leaves under given conditions. The author's paper is so long that we can merely give an abstract of his conclusions, which are as follows: "All leaves, it appears, diffuse a portion of the heat which they receive, more or less, according to the source of heat. Generally, but not universally, the lower surface gives off more heat than the upper. The absorption of the heat is due to the presence in the leaf of absorbent substances, such as water and chlorophyl. Thick leaves absorb more than thin ones; but the latter, however, transmit heat better than thick ones."

Changes in the Diameter of Trunks of Trees.—According to the *Gardener's Chronicle*, MM. Kraus and Kaiser have been making some researches, from which it appears that the trunks of trees undergo daily changes in diameter. From early morning to early afternoon there is a regular diminution till the minimum is reached, when the process is reversed and the maximum diameter attained at the time of twilight; then again comes a diminution, to be succeeded by an increase about dawn—an increase more marked than that in the evening. The variations in diameter coincide, therefore, with those of the tension, but they are shown to be inverse to the temperature, the maximum of the one corresponding roughly to the minimum of the other, and so on.

Action of Anæsthetics on Plants.—Claude Bernard has shown, says the *Lancet*, that the vapor of chloroform and of ordinary ether hinder the germination of seeds, and M. Rabuteau has found that this is equally true of bromide of ethyl and bromide of amyl. He finds, also, that all the ethers have the same effect. The experiments were made with grass seeds; but the property of germination is merely restrained. Seeds kept thirty-seven days exposed to the vapor of bromide of ethyl or bromide of amyl germinated, when placed under proper conditions, in two days. The question then presents itself: Have these substances a similar action upon plants which are in full progress of growth? Growing cress was exposed for two hours to an atmosphere saturated with vapor of bromide of ethyl. It then appeared feeble, the leaves hanging down, and it continued in this condition for a day or two, and then revived, but exhibited considerable retardation in its growth compared with other plants of the same age. The leaves of heliotrope become brown, and die in the course of two hours. Acetate of ethyl is somewhat less powerful. Cress lives after it has been exposed to the vapor for three hours, but does not survive an exposure of six hours. Heliotropes are only killed by an exposure of three or four hours. The action of acetate of ethyl is also correspondingly less active on animals.

A Western Oil Flood.

O. P. Yelton, now in Laramie City, Wyoming Territory, has kindly sent the *Era* a copy of the last issue of the weekly *Boomerang*, published in that city, from which the following article is taken:

"We have frequently spoken of the extensive oil wells now being worked by the Rocky Mountain Oil Company, in Sweetwater County, but the facilities for obtaining particulars have been so few that our people are not fully aware of how much is really being done toward developing so rich a deposit as is known to exist there. The company referred to is composed of Omaha capitalists, with Dr. Graff at its head. For the past month he has been superintending the work at the wells in person, and a report of a lengthy interview, on his return to Omaha the other day, appears in the *Herald*.

"Last season the company bored in several places, and collected the oil at other spots where it exuded from the ground, and built six or seven reservoirs to contain it. They stored two or three thousand barrels, but were fated to lose a part of it through an unforeseen casualty. About two weeks ago an ice gorge formed in Popajie Creek, above two reservoirs which held an aggregate of 1,200 barrels. The water poured over and into the reservoirs, and being heavier than the oil displaced it wholly.

"The sea of oil ran over the meadows for several miles about, blackening them as if a prairie fire had swept across. The farmers were incensed, but it was such a loss as the insurance companies would have classed under the heading of 'Acts of God,' and no one charged with fault. Since the gorge passed out the water is being pumped from the wells, which will soon fill to the brim again.

"The company can store from 1,000 to 1,500 barrels of oil a day, when they desire, and can dispose of it, and have reason to believe that theirs is an oil interest larger than that of the whole of Pennsylvania and far easier developed. The president of the company guarantees that they can produce 50,000 barrels per day when they require it.

"The value of Wyoming oil has already been tested. In its crude state, without the least refining or treatment, it serves as an excellent lubricating oil, and the Union Pacific engines are using it. This summer the oil company propose to erect a refinery alongside the Union Pacific railway track, where they will refine it for illuminating purposes, making an excellent head light oil. Dr. Graff has been out to see about building a direct wagon road from the wells to the railroad, instead of following the present roundabout way, the length of the former being seventy-six miles. He was driven back by the winter, the season being too little advanced. Dr. Graff is looking forward to the time when these wells shall supply all the country west of the Missouri."—*Bradford Era.*

Venus and Mercury at Noon-Day.

We had a superb telescopic view of these two planets a few days since nearly at the time when the sun passed the meridian. We first took a peep at our brilliant neighbor Venus with the naked eye, for she may be seen any clear day in the bright sunshine, if one knows where to look. A pinhead of filmy cloud or a dot of molten silver was the modest form assumed by our sister planet in the sun's majestic presence, as after looking intently, she suddenly came into view from the depths of the blue sky. The telescope was then turned toward her, and the cloudy speck was transformed into a charming crescent as large as the moon. The color was pale gold, and the crescent as slender as the waning moon two or three days before her change. The terminator or line between the light and dark portions of the disk was slightly irregular, so that, though twenty-three million miles distant, we were actually seeing the summits of the mountains on Venus illumined by the sun. The crescent Venus comes next to Saturn and Jupiter as an object of telescopic interest.

Mercury was the next subject for observation, and the shy planet, difficult to find even when the sun is below the horizon, quickly made his appearance under the magic spell of the glass. He did not take on a grand aspect, for he is far away and comparatively small in size, but he looked much as Venus now looks to the naked eye, perhaps not quite as large and far less brilliant. He had, however, a distinctly gibbous phase, like the moon after she has passed her first quarter, for both Mercury and Venus, revolving within the orbit of the earth and being nearer the sun, pass through all the phases of the moon during their course, as seen by terrestrial observers.

Only a short time remains in which Venus may be studied in her present phase, for she is rapidly approaching the sun, and will soon be hidden in his light. A good spy-glass will show the crescent form of this bewitching planet. This was all the help that Galileo had, and with its aid he was the first observer who beheld the crescent phase. A good opera glass will accomplish the feat with sharp-sighted observers. A few instances are on record where the crescent has been seen with the naked eye, but this, like detecting the moons of Jupiter, is an exceptional visual gift, which ordinary star-gazers may not hope to enjoy.—*Providence (R. I.) Journal.*

Product of an Iowa Creamery.

The *Farmer's Review* prints the following table showing the amounts of milk received each month last year by an Iowa creamery, with the amount of butter made therefrom, and the percentage of the yield. The average for the twelve months was 4⅛ pounds of butter for each 100 pounds of milk. During six months the milk was received twice a day, the rest of the year but once a day. It was set in cooling cans, in water at a temperature of from 50° to 55° Fah.

	No. of lb. milk.	Lb. of butter.	Yield per 100 lb.
January	50,193	2,225	4·23
February	47,643	2,003	4·20
March	66,986	2,779	4·00
April	98,691	3,795	3·74
May	194,166	8,069	4·15
June	245,047	9,695	4·07
July	244,973	9,977	4·07
August	215,177	8,371	3·90
September	200,437	8,923	4·44
October	169,195	6,793	4·01
November	110,383	4,737	4·29
December	77,597	3,434	4·42

The Second Bridge Between New York and Brooklyn.

The bridge from New York to Brooklyn, crossing Blackwell's Island, is under contract, and the contractors are now busy on the iron work of the pier foundations. The estimated cost of the bridge is $5,000,000; the time fixed for its completion is three years. There will be four piers, one at Ravenswood, another at the coal dock on Blackwell's Island, a third on the west side of the island, and the fourth on the New York side, between Seventy-sixth and Seventy-seventh streets. It is intended that the New York approach shall form a junction with the railroads in the Fourth avenue tunnel, a mile and a quarter above the Grand Central Depot, and that the Long Island approach shall connect with a spur of the Long Island Railroad. The bridge will be 74 feet wide, and will be arranged for two sidewalks, two carriageways, and two steam railroad tracks. The span over the water from Ravenswood to Blackwell's Island will be 618 feet, that across the island 700 feet, and that over the river to New York 734 feet. Each pier will rest on bed rock, the dip of whose strata at all points is nearly vertical. The Ravenswood pier only will stand in the water, and a coffer dam will be placed in position next week to prepare the rock for its reception. One corner only of the New York pier will touch the water. The roadway will be 154 feet above the river at high tide, and 160 feet at low tide. A commission to appraise the land needed on Blackwell's Island has been appointed by the Supreme Court.

Cutting Holes in Glass.

The operation of making holes and sections in glass and porcelain is often a troublesome and unsatisfactory one. The firm of Richter & Co., in Chemnitz, have found a way of so impregnating thin German silver disks (15 to 25 mm. diameter) with diamond, that when fitted to a quickly rotating tool, these cut through glass or porcelain in a few seconds, or effect any desired carving with great accuracy. With cylinders made on the same principle, round holes can be quickly and exactly made. The wear of the implement, even after much use, is hardly perceptible.

Lack of Air.

Some workmen think themselves "tired" when they are only poisoned. They labor in factories, breathe air without oxygen, and live in an atmosphere of death. They are, too often, allowed to smoke, and thus add fuel to the flame which is consuming them. They knock off work "tired" and listless, when they are merely weakened by foul air and made dull and heavy by an atmosphere charged with disease. They keep the windows shut and close the door on health, while they lift the gratings of the tomb by breathing and re-breathing the poison from their own lungs, and the floating particles of matter about them. Open the windows—let in the sunshine and the breeze, stop smoking, and you will soon find that it is the poison of confinement, and not labor, that wearies and tires.—*Montreal Herald and Star.*

Magic Mirrors.

The magic mirrors, which have been a good deal discussed of late, are all of metal. M. Laurent has succeeded in making them of glass, which is sufficiently elastic for the purpose. At first he used pressed glass, polishing the surface opposite to the projections; then he tried the thin glass of commerce, engraving a hollow design. The two methods may be combined. When at rest the mirror is plane, and gives good images. By a blowing or sucking action the characteristic features are brought out. Both sides of the mirror are silvered.

Maple Sugar.

From two groves of maples in North Harpersfield, Delaware County, New York, the yield this year has been seven tons of maple sugar. The groves contain 4,200 trees. In 1875 the town of Harpersfield produced 200,000 pounds of sugar, an amount which this year's crop is thought to exceed.

A New Alkalimetric Indicator.

BY H. W. LANGBECK.

Nitro-phenic acid dissolved in 100,000 parts of distilled water presents a nearly colorless liquid, but if a trace only of an alkali be added a distinct yellow color appears. This delicate indicator is, of course, only useful if colorless or slightly colored fluids are to be examined. In determining, for instance, the temporary hardness of water, I dissolve 1 part of nitro-phenic acid in 5,000 parts of distilled water; I also prepare centinormal potash and acetic acid solutions. 100 c. c. of distilled water are put into one Nessler glass, the same quantity into another, and again 100 c. c. of the water to be examined into a third. To each of them 5 c. c. of nitro-phenic acid solution are added (one is kept for comparing), which leaves the distilled water nearly colorless, while the common water turns yellow to deep yellow according to hardness. From a burette centinormal potash solution is then added to the one glass of distilled water until the color is of the same shade as the common water; each c. c. used is equal to 0·00028 of lime, CaO. To verify the result, centinormal acetic acid is added until the first shade (nearly colorless) returns; the quantity of acid required is, of course, the same as the alkali. The common water is now also treated with the centinormal acid until the first shade is reached; each c. c. used equals 0·0005 of carbonate of lime. I compared, for instance, 100 c. c. of distilled water with 100 c. c. of water of the East London Company. The distilled water required 1·9 centinormal potash solution to color it the same shade as the common water, and also 1·9 c. c. of acid to become nearly colorless again; the water in question contained, therefore, 0·532 lime (CaO) in 100,000 parts. The common water required 29·8 c. c. to return to the first shade. From this quantity 1·9 = lime found must be deducted. Each of the remaining c. c. is equal to 0·0005 carbonate of lime, = 13·95 in 100,000 parts, or total temporary hardness = 14·482.—*Chem. News.*

Judgment and Forethought in the Education of Children.

In a very thoughtful and suggestive inquiry as to the reasons why "promising" children so seldom turn out as parents and friends anticipate, the Philadelphia *Public Ledger* discovers a potent cause of failure in the man which parents will find worthy of serious consideration. After speaking of the more familiar ways of spoiling children by unwise management or improper training, the *Ledger* says:

The truth is, we need more forethought and less self-indulgence in the training of our youth. We please ourselves too much, and study their future too little. It is so easy and pleasant to gratify our own vanity or ambition by stimulating and exhibiting them in points where they excel; it is so hard and comparatively tame to exercise them in what they are deficient, and to foster their most meager abilities. Yet, until educators acquire the necessary self-control and patience to do the latter; until they can work quietly and steadfastly without display, and fix their aim on future results instead of present glitter, the most promising children will continue to sink down into inferior men and women.

The qualities that are the most attractive in childhood are not by any means the most valuable in maturity. We look for determination, will, decision of character, firmness in the man, and refuse him our respect if he have them not. But when the child exhibits these qualities, even in their incipient stages, we are annoyed, and, perhaps, repulsed. Instead of rejoicing in his strength of will and guiding it into right channels, we lament it as a grievous fault in him and a misfortune to us. It is the meek and yielding child who cares not to decide anything for himself, in whom we delight, and whose feeble will we make still feebler by denying it all exercise. Yet, when he grows up and enters the world and yields to temptation, and, perhaps, disgraces himself and his family, we look at him in imbecile wonder that so *good* a child should have turned out to be so bad a man, when, in truth, his course has only been the natural outcome of his past life and training. The power of standing firm and going alone we know to be desirable in the adult, but the child seems more lovable who is utterly dependent upon us, and we therefore strive to cherish this dependence, shutting our eyes to the fact that we are thus actually unfitting him for the life that awaits him. Concentration, too, is a quality that we admire in the adult, but greatly undervalue in the child. We prefer that he may be easily drawn away from what he is engaged in, and quickly turned from one thing to another at our pleasure; and while we praise him for his ready obedience, or rebuke him for seeming absorbed, we are really breaking down the power of concentration, and depriving him of its invaluable results.

It is true that many things are suitable for manhood that are not for childhood, but this is not the case with mental and moral qualities. If it were there could be no such thing as consistent preparation for a good and useful life. Every quality that the man or woman needs is incipient in the child, and needs development and exercise. Our part in his training is not to cherish in him simply what is most attractive to ourselves, or what feeds our own and his vanity, but rather to study his future needs, and to help him to supply what is most lacking. It is where he is deficient, not where he excels, that our earnest efforts are demanded. Not until parents and teachers realize this so fully as to identify with it their highest interest and pleasure in their charges, will promising children fulfill their promises, and the question no longer be asked, "What has become of them?"

Paper Pulp from Wood.

The following is a description of the process of making wood pulp: The wood, four feet in length, and of any thickness, is brought in at the basement of the manufactory, placed in the barking jack (one stick at a time), where two men with draw-knives rapidly peel off the bark. It is then conveyed by an elevator to the first floor, sawed in two-foot lengths with crosscut saws, and passed on to the rip-saw, where it is slabbed (that is, a small portion of wood on opposite sides taken off), to permit it resting firmly in the grinding engine. It is then passed to the boring machine (an upright 1½ inch auger, with foot attachment, driven by power), where the knots are bored out. The wood is then placed in racks of the same size as the receptacle in the grinding engine, and carried out to be ground. The grinding engines are upright, and receive at a filling one-twentieth of a cord of wood. The wood is placed in a receptacle, and by a simple, variable, automatic feed process, is pressed flatwise between two outward revolving rolls, composed of solid emery, which are flooded with a spray of water, carrying off the fibrilized pulp in a stream through revolving screens to the tank or stuff-chest in the basement. It is then pumped up into a vat that forms part of the wet machine. In this vat is constantly revolving a large cylinder faced with fine brass wire-cloth, which picks up the particles of pulp out of the water and places them on the felt (an endless piece of woolen goods which makes between rolls, for different purposes, a continual circuit of the wet machine). On the cylinder is turned a heavy roll, called the "couch;" between the two, where they meet, the cylinder leaves the pulp, with most of the water pressed from it. The pulp now makes its appearance on the felt above the concha roll in a beautiful sheet, 38 inches in width, and is carried along in a steady flow a distance of about 8 feet, where it passes between (the water here again being pressed from it) but not beyond two heavy rollers, the upper one iron, the lower one wood; it adheres to the upper roll, which is constantly turning, wrapping it up, and when a sufficient thickness is attained, is cut off by a knife being pressed to the roll, which is attached to the machine for that purpose. It now leaves the roll in a thick white sheet, 36x38 inches, which is received by a boy in attendance on a table conveniently attached to the machine, and folded into a sheet 14x26 inches. It is then placed on scales until the weight is 100 pounds, when it is placed in a press and firmly tied into square, compact bundles. It is now ready for shipment to the paper mill.

Adventure in the Cave of Cacahuamilpa.

A serious but fortunately not fatal termination came to a recent excursion from the City of Mexico to the Cave of Cacahuamilpa, in honor of some American visitors. About fifty persons left Mexico, but the party received so many accessions by the way that when the cave was reached there were as many as 500 persons in the company, including the military guard.

It appears that Señor Carlos Quaglia, Governor of Morelos, had ordered a banquet to be prepared in that portion of the grotto which bears the name of "The Organ Salon," on account of the stalactites which have there assumed the form of an organ. The place was illuminated by electric lights, yet there were also many torches of resinous wood burning. The *élite*, who numbered perhaps ninety persons (there were also a great many servants), occupied the Organ Salon. In close proximity were placed several shelter tents for the ladies and children to sleep in. These were filled with sleepers, and along one side of the banqueting hall many gentlemen were lying on mattresses, mats, or blankets. A few of the more animated guests lingered over the table until 2 o'clock in the morning, and were chatting, when Governor Quaglia fainted. All efforts to restore him to consciousness seemed futile. While he remained in this condition some ladies complained of illness, others were asphyxiated, and a gentleman suggested that all this might be due to mephitic exhalations. Mothers at once hastened to their children, and, finding some in a stupor, comprehended the danger. A panic ensued. General Diaz ordered an instant retreat from the grotto. General Ord and others instructed the soldiers to carry out the ladies and children. Ex-Governor Romero Vargas aided Señor Mariscal, Minister of Foreign Relations, to scramble over the rocks. In fact, all who had strength assisted those who were asphyxiated, and every person was removed to a purer atmosphere. Some persevered until they reached the entrance of the cave (three miles distant) and threw themselves down on the bare ground, almost exhausted with fatigue, but safe.

George Stephenson.

At an influential meeting lately held in the Town Hall, Newcastle-on-Tyne, the following resolutions were carried unanimously:

"That this meeting is of opinion that it is desirable to commemorate the centenary of the birth of the late George Stephenson on the 9th of June next, and expresses the view that Newcastle-on-Tyne, being practically the place of his nativity, and where his first and most important engineering triumphs were won, is the most fitting center where such celebrations should be held.

"That this meeting is of opinion that there is no better way of doing honor to the name of Stephenson and perpetuating his memory in this district than by erecting a building for the use of the University of Durham College of Physical Science, to be called the Stephenson College."

A Yellow Crow Lost in the Mails.

A white crow is a rare bird, but a yellow one is rarer still, and yet a bird of this color has been lost in the United States mails, that general receptacle for all sorts of merchandise to be transported over the country. One of Uncle Sam's officers in this far Western country, while perambulating the Rocky Mountain region (in the southern part of Colorado) came upon a rare bird, a yellow crow, which he succeeded in capturing. The bird was carefully skinned, the skin thoroughly cured and prepared for shipment to the Smithsonian Institution, at Washington. There being no way save the mails for shipping such articles from the wilds of La Plata County, this rare and valuable specimen of ornithology was intrusted to the care of the Post Office Department, and there the story ends for the present. The yellow crow still remains unknown, except to the very few who saw the bird before shipment, but earnest and determined efforts are being made to find the lost specimen, and Gen. Cameron, the Post Office Inspector for this division, to whom the case has been intrusted, expresses a determination to find the missing bird, unless the same has been stolen outright by some dishonest official.—*Denver News.*

Automatic Recording of Telephone Messages.

In a book on the application of the telephone and microphone to physiological and chemical uses, Dr. Boudet describes his method of automatic recording of telephone messages. To do this he removes the diaphragm of the Bell telephone, screws to the wood one end of a steel spring, the other end being opposite the pole of the magnet. To the free end he solders a small piece of soft iron, weighing one-tenth of a gramme. Attached to this piece, and in the prolongation of the axis of the spring, he fixes a light bamboo arm, ten centimeters long, and terminated by a needle of whalebone. In fact, the diaphragm is replaced by a movable armature resembling the interrupter of an induction coil. The tracings are made on smoked paper, and transferred to glass. There are some points of difference, as well as resemblance, which make it probable that tracings of this kind may be deciphered, but the matter is in embryo yet.

Imperfect Eyes among School Children.

Three years ago the Philadelphia Medical Society appointed a committee to investigate the condition of the eyes of the children in the city schools. The report of the committee was read by the chairman, Dr. Risley, at a recent meeting of the society. The committee had examined about 2,000 pairs of eyes. The condition of those examined, Dr. Risley said, had proved better than had been expected by the committee. The cases of impaired sight ranged from 25 per cent among the smaller children to 40 per cent among the older scholars. The average of diseased eyes ranged correspondingly from 30 to 60 per cent. The instances where any blame attached to the Board of Education or their sectional boards for want of care for the eyes of the children were only two, one of which was the case of the primary practicing class in the Normal School. The room is lighted by one large western window, which, owing to the position of the desks and the master's table, the children are obliged to face.

Fusion of Metals by Electricity.

M. Imbert describes Siemens' method of fusing large metallic masses by means of electricity. He uses a plumbago crucible, surrounded by a thick refractory wall, the cover being traversed by a carbon rod of 20 millimeters (0·79 inch) diameter. This rod is suspended by one of the arms of a balance beam, the other arm carrying a cylinder of soft iron sliding freely in a solenoid and plunging into a liquid, in order to moderate the oscillations which might arise from sudden variations of current. In one experiment 500 grammes (1·102 pounds) were melted into a compact ingot in four and one-half minutes. In melting large quantities the electrical method is rather more than twice as costly as the ordinary furnace, but for the fusion of precious or refractory metals, for chemical purposes, and for other applications where the question of economy is secondary, the new method is very convenient and practical. In melting small quantities it may even prove economical.—*Ann. du Gen. Civ.*

Excess of Fat.

Dr. George Johnson's diet for excess of fat: The patient *may eat:* lean mutton and beef; veal; lamb; tongue; sweetbread; soups, not thickened; beef tea and broths; poultry; game; fish; cheese; eggs; bread, *in moderation;* greens; spinach; watercress; mustard and cress; lettuce; asparagus; celery; radishes; French beans; green peas; Brussels sprouts; cabbage; cauliflower; onions; broccoli; sea-kale; jellies, flavored but no sweetened; fresh fruit in moderation, without sugar or cream; pickles.

May not eat: Fat bacon and ham; fat of meat; butter; cream; sugar; potatoes; carrots; parsnips; beet root; rice; arrowroot; sago; tapioca; macaroni; vermicelli; semolina; custard; pastry and pudding of all kinds; sweet cakes.

May drink: Tea; coffee; cocoa from nibs, with milk, but without cream or sugar; dry wines of any kind, in moderation; brandy, whisky, or gin, in moderation, without sugar; light bitter beer; Apollinaris water; soda water; seltzer water.

May not drink: Milk, except sparingly; porter and stout; sweet ales; sweet wines. As a rule, alcoholic liquors should be taken very sparingly, and never without food.

Express Atlantic Steamers.

A company is being formed, with a nominal capital of two and a half millions, to work a line of express steamers between Milford Haven and New York. Although certain statements have been made concerning the proposed dimensions of these ships, we may say at once that nothing has been settled concerning this point; the size of the company's steamers is still an open question. The idea is that they will be about 550 feet long, 45 feet beam, and that they will draw about 25 feet when loaded; but these figures must be taken as approximate, as well as the statement that they will carry 5,000 tons of goods and 400 first-class passengers.

Only one point has really been settled, or can at present be settled, but it forms the pivot round which all or nearly all other questions connected with the new ships and their construction must turn. This is their speed, which is to be 20 knots, or about 23 miles an hour. No such speed has ever been attained by any screw steamer of large size; and it has only been reached by a very few paddlewheel yachts on rare occasions. The first ship driven at this speed across the Atlantic will have performed a feat without, for the time, a parallel; and when we bear in mind in what a rapid ratio the resistance of a ship increases with each augmentation of speed, it will be seen that the construction of the proposed express Atlantic steamers presents a tremendous problem for solution to naval architects and engineers.

Calculations have been made, which appear to be accurate, and they go to show that 16,000 indicated horse power, and probably more, will be required to drive a ship of the stated dimensions at 20 knots an hour across the Atlantic. It is very doubtful if the required velocity could be got at all with a vessel with much less than 7,000 or 8,000 tons displacement.

It will be understood that the conditions of the problem are very different from those affecting the design of a torpedo boat. The latter can only attain a high velocity in comparatively still water; but these great Atlantic liners must be driven at full speed through head seas; and sheer dead weight and great length must be present in them to enable them to preserve their way steadily, instead of being constantly checked and beaten off their course by the waves. If large dead weight and great length are necessary, it follows that the engine power must be in proportion; and for these reasons the idea that a small steamer of little power may be made to attain a high speed in a sea like the Atlantic, is well understood by all naval architects and engineers to be futile.

We may thus consider it as certain that engines exerting 16,000 horse power at least will be a necessity in the proposed ships. We have said that these vessels will draw only about 25 feet. They cannot be fitted with propellers of more than about 22 feet or 23 feet in diameter; and it is a very grave question if anything like 16,000 horse power can be sent through such a propeller without great loss. The shallow draught has been adopted no doubt for good reasons, and it may be taken that a propeller of greater diameter than we have stated cannot be used.

Let us suppose, however, for the moment that 16,000 horse power can be sent with economy through a single propeller, and we are face to face at once with the question, Where is a crank shaft to be had which can transmit this power when revolving at a moderate speed?

Making every allowance for the skill of modern smiths, we cannot help regarding it as somewhat doubtful that a trustworthy shaft of the kind can be made. Allowing that steel is to be used, and that the shaft will be built up on the most approved principles, we shall find that many portions of it cannot be less than 2 feet 6 inches in diameter by about 7 feet long. Sound forgings of these dimensions have never yet been produced. The weight of such a block would be when finished nearly 8 tons. It is true that heavier forgings have been made for years, but they have not been solid. We do not assert that a sound crank shaft, with a minimum diameter at any place of 2 feet 6 inches, cannot be made; but we do say that no such shaft has yet been made, and that it will not be easy to produce one. Such a shaft might, perhaps, be depended upon to transmit power safely at the rate of 250 horses indicated per revolution per minute. This means 64 turns per minute to provide for 16,000 horse power, and this velocity implies a great deal more than appears at first sight. If the engines are to be kept down to reasonable dimensions they cannot well have a stroke of less than 6 feet, corresponding to a piston speed of 768 feet per minute.

Considering the enormous dimensions of the masses to be moved at this velocity, it is evident that unusual precautions will have to be taken in arranging the lead and in balancing the engines. Apparently the only type of engine that can be used is that of the Britannic, repeated and modified for the better, either on the system designed by Mr. W. Allen, of Sunderland, for the City of New York; or by Mr. Humphries, of Barrow-in-Furness, for the City of Rome. That is to say, the engines must have at least six cylinders—the three high pressure above the three low pressure, and the main shaft fitted with cranks arranged at 120°.

But the engines of the City of Rome, to indicate 10,000 horse power as a maximum, are probably about as large as engines of the type can be conveniently made; and consequently, unless the builders of the engines of the new steamers are prepared to use cylinders of much greater diameter than those of the City of Rome—namely, 43 inch and 86 inch—eight cylinders, or four engines will be required. More would be necessary, but the velocity we have named, 64 revolutions per minute, is greater than that of the City of Rome's engines by some 14 or 15 per cent. With six cylinders of 55 inch and 110 inch we think the requisite power might be got, but the strain on the crank shaft would be proportionately augmented. The crank shaft of the City of Rome is built up of hollow forgings of fluid compressed steel; it is 25 inches in diameter, or but 5 inches smaller than the dimensions which we have named as the least possible for those of the proposed boats.

No matter what point of view we regard the problem from, it will be found fraught with doubt and trouble, and we still hesitate to say that a trustworthy shaft can be made to transmit 16,000 horse power at 64 revolutions per minute. It is questionable, however, if this speed will suffice. Making a small allowance for slip, the screw must have a pitch of at least 36 feet, which is fully sharp for a diameter of about 23 feet; a higher velocity would give a lighter engine, a smaller crank shaft, and a better screw. But on the other hand, is it certain that colossal machinery of this kind can be made to work at a much higher speed than 64 revolutions per minute with ease and safety for a week at a time? The experience to be had in men-of-war is of no use whatever in this connection. It is one thing for engines to make a six hours' full power trial, and another to run at full power for a week at a time in all weathers, and to do this month after month without accident or heavy repairs.

All that we have said seems to indicate the use of twin screws instead of a single screw. In this way we should have two 8,000 horse power engines instead of one of 16,000 horse power; but, tempting as the advantages are thus held out by the twin screw system, we hesitate to say they are worth having at the price to be paid for them. Indeed, it is more than doubtful if it be possible to obtain under any circumstances 20 knots with twin screws. They give handiness, no doubt, and they render the use of comparatively light machinery compatible with the development of great power; but none of the great ocean companies have adopted them, and there are objections to their use which are, we think, insuperable.

All things considered, we think engineers will find it more easy to get a sound crank shaft of the required size, than to drive a ship at 20 knots with twin screws. Whether 16,000 horse power can or cannot be used up by single four-bladed propellers, 23 feet in diameter and 35 feet or 36 feet pitch, remains to be seen. Assuming that 50 per cent of the whole power developed is, as is usual in screw ships, wasted, the screw would still exert a thrust of not less than 130,000 pounds, or over 58 tons. It is not easy to see how so enormous a thrust can be got out of so small a propeller. It would be very mortifying if, after the ships were finished, it was found that their screws were quite inadequate to utilize the power of the gigantic machinery which turned them round.—*The Engineer.*

The Coming Bleach.

When Thenard succeeded in adding another equivalent of oxygen to water, converting H_2O into H_2O_2, he had made one of the most brilliant of modern discoveries. Sixty-three years have passed since that event, yet oxygenated water, peroxide of hydrogen, hydrogen dioxide, as the compound has been successively called, is still regarded as one of the most remarkable products of chemistry. Resembling water in its freedom from color and odor, and mingling with it in all proportions, it is distinguished from that liquid by its sirupy consistency and by its higher specific gravity (1·452). When pure it begins to undergo decomposition at 70° Fah., giving off bubbles of oxygen and being converted into water. This change is quickened by the addition of an alkali, and retarded by that of an acid. When dissolved in water it is much more stable, and its aqueous solutions are prepared and sold for medicinal and photographic purposes.

For the preparation of hydrogen dioxide, baryta is still found indispensable, and a clearer conception of the process and its probable cost will be gained if we remember what is the source and what are the properties of baryta. This substance occurs as the sulphate, called heavy spar, in various parts of the United States, notably at Hopewell, New Jersey, on the line of the Bound Brook Railroad, about 30 miles from Philadelphia. When pulverized, mingled with powdered charcoal, and strongly heated, the sulphate of barium becomes the sulphide, and if this be treated with hydrochloric acid and water added, we have a solution of barium chloride. By decanting this and adding a solution of an alkaline carbonate, barium carbonate is precipitated, and if we collect the precipitate and calcine it in a crucible, the oxide of barium—baryta—BaO, results. Now this oxide, when placed in a tube, heated to dull redness, and subjected to a current of atmospheric air, takes up another portion of oxygen, becoming that interesting substance, barium dioxide or peroxide of barium, BaO_2, which, as some of our readers will recall, was brought into use by Tessie du Motay for bleaching silk, feathers, etc., and which is rapidly growing in practical importance.

Powdered barium dioxide, made into a paste with water and put by portions at a time into cold and dilute hydrochloric acid, dissolves without disengagement of gas, yielding barium chloride and hydrogen dioxide. The changes may be thus expres ed:

Barium dioxide.		Hydrochloric acid.		Barium chloride.		Hydrogen dioxide.
BaO_2	+	2HCl.	=	$BaCl_2$	+	H_2O_2

The barium chloride and hydrogen dioxide both remain in solution, and to separate the barium it is precipitated in the form of the sulphate by the careful addition of dilute sulphuric acid, agreeably to the following equation:

Barium chloride.		Sulphuric acid.		Barium sulphate.		Hydrochloric acid.
$BaCl_2$	+	H_2SO_4	=	$BaSO_4$	+	2HCl.

The hydrochloric acid thus reproduced now admits of more barium dioxide being added, and the operation may be many times repeated if the vessels are kept cool. If the hydrogen dioxide be required pure and concentrated, the remaining barium chloride is precipitated by sulphate of silver, the solution poured off, and evaporated *in vacuo*. The concentrated hydrogen dioxide is not demanded for industrial purposes. Solutions containing 3·04 per cent by weight suffice for the English market. They are called ten-volume solutions, because 1 cubic inch evolves 10 cubic inches of oxygen when fully decomposed. Twenty-volume and thirty-volume solutions are made in England to order.

It is said that when the Empress Eugenie, who was a blonde, led the fashion, certain dark-haired belles of Paris, anxious to emulate her even in the color of her hair, had theirs bleached to the "golden" tint, by a hairdresser of that city, who employed for the purpose hydrogen dioxide. In London it is used for a like object on dark false hair, which is saturated with a ten-volume solution and then exposed for two or three days, when the oxygen is liberated and the lighter shades are obtained. Hydrogen dioxide effectually bleaches blood serum in one of the processes for obtaining colorless blood albumen. It is also used for cleaning and bleaching oil paintings and engravings, and for bleaching oil, wax, and ivory, especially the last. Of this, the inferior qualities used in Sheffield for knife handles are put first into a solution of sodic carbonate to remove the grease and open the pores; then washed and immersed in a solution of crude hydrogen dioxide containing about 2·9 per cent, to which one-eighth part of strong aqua ammoniæ had been added. This is kept in a warm place for two or three days, when the handles are removed and slowly dried in the air. The deep color is thus removed, and a beautiful pearly-white ivory, when polished, is the result.

The action of hydrogen dioxide in bleaching is to destroy the color directly by oxidizing it, and this, without the introduction of any foreign body into the vat, an action altogether different from that of the principal bleaching agents, sulphurous acid and chlorine. The former does not destroy the coloring matter, it merely combines with it to form a colorless compound which is prone to undergo decomposition and therefore to return to the original color. Chlorine acts only in the presence of water, from which it takes the hydrogen to form hydrochloric acid, leaving the oxygen thus liberated to do the bleaching.

That hydrogen dioxide, either under a true or false name, is employed in the bleaching processes of print works, and that its cost alone prevents its general introduction, there is no doubt. Anticipating its extended use, and recognizing its unrivaled advantages, the *Société Industrielle de Rouen* offers a prize open to competition until the 1st of October, for a process of manufacturing a hydrogen dioxide which shall possess the power to decolorize indigo equal to that of chlorine, and which shall not cost more than ten times as much as that bleach. Left to itself, the perfecting of such an invention may linger for a generation. The prize offered is a gold medal, and the prize winner retains the exclusive right to his invention. This may be all that the Rouen Society can afford to offer, but in view of the great and general benefits to be anticipated from such an invention, the prize should be made international, and societies in Belgium, Austria, Germany, England, and America ought to co-operate with their French sister, and so swell the amount that experts in all nations shall feel the stimulus.—*Textile Record.*

A Remarkable Discovery of Natural Coal Tar.

The Titusville, Pa., *Herald* reports the discovery of a tar-like oil in sinking a well seven miles west of Foxburg, Pa. The oil is jet-black, and has a strong odor like that of "spirits of tar." In its natural state the oil emits on burning a dense black smoke carrying much soot, which suggests its use in the manufacture of lampblack. It is also thought that it may be available in the manufacture of aniline dyes. The *Herald* adds: The strike is certainly an extraordinary one, and as far as we can learn, nothing like it has ever before been known in the history of the oil trade. No other well in or near the vicinity has anything approaching to it. The oil seems to be found in the slate at a depth of 270 feet, and what is the more singular is that, although the drill passes through the same kind of slate and at the same depth in adjacent wells, no such yield as we have been describing has come from any other.

Florida Oranges in England.

London papers are noticing a new American product in the English markets, and, as it threatens no competition with anything raised at home, they seem disposed to give the new comer a hearty welcome. The *Pall Mall Gazette* says: A trial box of Florida oranges, dispatched from Jacksonville, Fla., to this city, arrived in prime condition after a journey of three weeks. Only three oranges were damaged *en route*. The experiment is likely to be repeated on a larger scale, and before long it is quite possible a thriving fruit trade may spring up between England and the Southern States. The supply of oranges in Florida is almost inexhaustible; their quality is said to be much finer than those from the Mediterranean, and if once the trade was established, the time of transit would be materially reduced.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) A. S. writes: One of your correspondents asks for a cure for warts. Some years since a corn doctor advised me to use coal oil. My hands were covered with them. Having little faith I tried it, putting a drop on each of common kerosene and letting it absorb; where there was a hard crust, scraping it to facilitate absorption. In a fortnight, after twice daily treating them thus, they began to lessen, and finally disappeared without scar. Then the right hand, in part, leaving one which remained after all others had passed away, and then that one. Have advised others to try it, with like effect, on persistent use. Simply softened the top, dropped the oil on, and let it be, for some minutes, to absorb. Let S. R. B. try it; it may relieve.

(2) S. L. J. asks (1) for a receipt for good black ink. A. For black inks see "Inks," SUPPLEMENT, No. 157. 2. For good black or blue black writing fluid. A. For blue-black writing and copying ink—Blue Aleppo galls, free from insect perforations, 5½ oz.; bruised cloves, 1 drachm; cold soft water, 3½ pints; purified sulphate of iron, 1½ oz; sulphuric acid by measure, 35 minims; sulphate of indigo in the form of a thin paste, and which should be neutral or nearly so, ¼ oz. Digest together in a closed vessel, with occasional agitation, for two weeks, the galls, cloves, and water. Then filter the liquid through a piece of cotton cloth, and press out as much of the liquid as possible from the sediment. Dissolve in this completely the powdered sulphate of iron, stir in briskly the acid, then the indigo, and filter the liquid through the paper (filter paper).

(3) E. H. R. asks: Can I clean silver ware—tea set, etc., in daily use, with receipt given in answer to W. H. P., page 251 (32), and how can I keep the silver clean? A. No. Cyanide of potassium cleans silver readily, but it is very poisonous and consequently dangerous to use for such purposes or to have about the house. Lacquer or varnish is never used on such articles. The best way to clean domestic silver ware is to lightly scour it with a little fine whiting or tripoli moistened with sweet oil (olive oil). This is washed off by dipping in a strong hot solution of washing soda, then in clean hot water, on removing from which it dries quickly without rubbing. 2. What is used to stiffen washed lace and make it look new? A. Very thin clear starch or gum water.

English Patents Issued to Americans.

From April 8 to April 12, 1881, inclusive.

Carding machinery, J. Pollitt, Philadelphia, Pa.
Design, process of producing, I. S. Hyatt, U. S. A.
Ivory, imitation of, I. S. Hyatt, U. S. A.
Lead pencils, B. A. Fiske, Naperville, Ill.
Locks and staples, G. M. Hathaway *et al.*, Jersey City, N.J.
Powdered substances, manufacture of articles from, I. S. Hyatt, U. S. A.
Shoe fastening, T. L. Jacobs, New York city.
Shoe machinery, D. C. Knowlton, Boston, Mass.
Spectacles, R. A. Carter, New York city.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 12, 1881.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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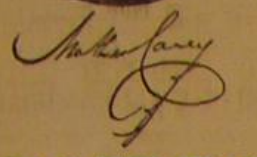

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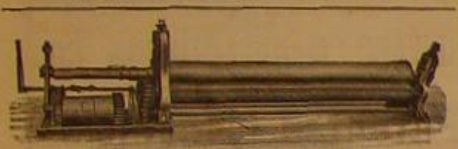

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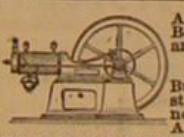

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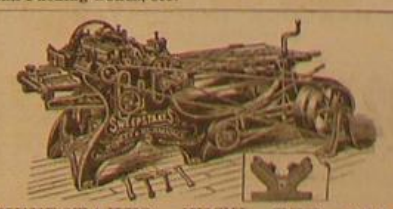

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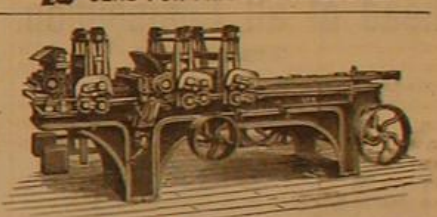

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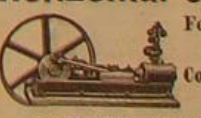

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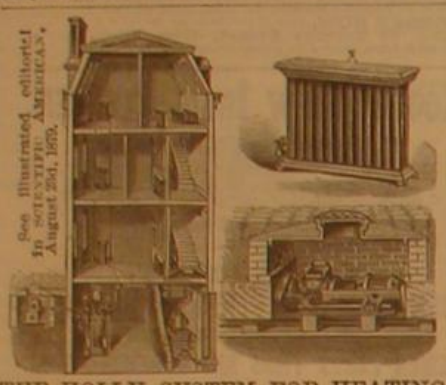

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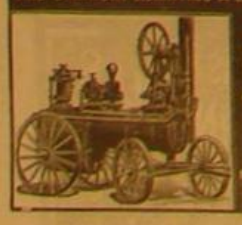
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