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PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

The present appearance of the work on the East River Bridge is shown in the accompanying engravings so clearly that any description, except of details, is quite unnecessary.

The point of view chosen by our artist is (for the larger engraving) on the high ground northeastward of the Brooklyn tower, so as to show not only the progress of the work, but the graceful structure of the tower, which from its great height appears to be very slender, notwithstanding its massive thickness and breadth of base.

Beneath the bridge is seen the harbor, looking southward, with Governor's Island and Castle William in the middle distance. Beyond is the lower bay, and beyond that the ocean. Only the southern point of New York is seen on the right. Across the mouth of the Hudson, which looks like a pointed bay, lie the Jersey shores and Staten Island. Across the bay, on the left, is the Long Island shore, with Bay Ridge and Brooklyn.

The smaller cut shows the underside of the bridge, without the timber flooring, as seen from the deck of a ferryboat passing beneath. The work of suspending the floor beams progresses with practical uniformity at both towers and on both sides of each tower, the design being to keep the strains on the masonry as equally balanced as possible. At this writing about twenty-five beams are in place on each side of the two towers, or something near a hundred in all. Suspender ropes are in place for more than twice as many additional beams, there being four suspenders to each beam.

From below the suspenders look like spider lines; they are, however, stout ropes of steel wire, from 1⅝ to 1¾ inches in diameter, and able to sustain a weight of 50 tons or more each, or five times the heaviest load likely ever to fall upon them. The bands by which the suspenders are attached to the cables above are of wrought iron, five-eighths inch thick by 5 inches wide. They were put on when the cables were being wound, and fit closely to the cables. On the outer side the ends of the bands terminate in two lugs, seven-eighths inch thick. An iron screw bolt, 1¾ inches in diameter, passes through the lugs to hold the suspender socket and to tighten the band around the cable. The bands were put on by the winders, who heated the backs of the bands in little forges until they could be opened far enough to let them go over the cable. The two ends of the band were then drawn together, a thin plate of iron being slipped between the cable and the hot band so as to protect the galvanizing of the wire of the wrapping until the band was cool. To these bands the suspender ropes are attached by means of wrought iron closed sockets. On the lower end of each suspender is a cast iron socket for the reception of the stirrup rods which hold the floor beam. The stirrup rods have long screw threads, by means of which the beam can be raised or lowered to regulate the floor grade, it being impossible to cut and fasten the suspenders to the exact length required.

The floor beams are made in halves at the steel works; are landed at the foot of the towers; are hoisted to the level of the bridge floor and run out upon a tramway to the point of suspension; and after being attached to the suspenders are securely riveted together, making a continuous beam the entire breadth of the bridge, or 85 feet. These floor beams are unlike any ever before used on a suspension bridge. They are 32 inches deep, 9⅜ inches wide, and weigh four tons. Each beam has two top and two bottom chords tied and braced together in the form of a triangular lattice girder. The chords are of steel channel bars. The main beams are suspended 7 feet 6 inches from centers, and between each pair of principal beams a lighter I beam is placed, resting on the truss chords, so that the floor planking will be supported and fastened every 3 feet 9 inches from centers. Wooden bridging will be inserted between the beams to resist the

[*Continued on page* 322.]

SUSPENDING THE FLOOR BEAMS OF THE EAST RIVER BRIDGE.

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HUMANITY VERSUS FANATICISM.

When the gentle Cowper declared he would not hold upon his list of friends him who would "needlessly set foot upon a worm," the poet's humanity touched high water mark, but stopped short of fanaticism. The fanatic would have left out the word *needlessly*.

The distinction between wanton cruelty and the infliction of pain for humanity's sake is an important one; and in refusing to make it the Society for the Prevention of Cruelty to Animals, more recently styled Humane Society, certainly do not ally themselves with the class of kindly and sensible people represented by the poet.

Good intentions cover a multitude of sins, and command respectful consideration even where they do not give proof of wisdom; nevertheless, it is difficult to be patient with those who persistently prostitute the word *humanity* to justify courses which do not tend to ameliorate the condition either of beasts or men, collectively or individually, but rather bar the way to such amelioration. The tender mercies of the foolish, like those of the wicked, are often cruel; and of such a nature are those displayed by the officers of the society referred to when they seek by exaggeration and misrepresentation to stop all use of living animals for the scientific advancement of physiology and medicine. And it shows a pitiful state of popular intelligence, feeling, and judgment when legislatures can be persuaded by fanatics to pass laws making it a crime to pursue a line of scientific investigation which has been more fruitful than any other in knowledge helpful for the prevention and cure of disease. Pasteur's recent brilliant and most promising discoveries in connection with chicken cholera were no doubt made at the cost of considerable discomfort to a small number of guinea pigs, rabbits, and barn-yard fowls; but the certain issue of those discoveries must be to prevent an incalculable amount of distressing and fatal disease among these animals, with a possible issue of infinite value to humanity in furnishing a clew to a right understanding and treatment of many of man's diseases.

If the anti-scientific spirit of those who assume to be the official advocates of "humanity" shall prevail, all such investigations must become crimes to be prevented by the strong arm of the law, and men and animals may go on for ever dying of diseases which knowledge might mitigate or entirely prevent. That this spirit has already largely perverted a movement for the prevention of cruelty to animals into one which arrests the labors of those who would do most for the alleviation of pain in animals and in human kind, is only too plainly shown in the recent letter from a committee of the Medical Society of this State to the officers and members of the Humane Society, begging them not to interfere in certain proposed investigations touching the origin and prevalence of diseases among animals.

The letter, which is signed by nine of the best known and most honorable physicians of New York, says, after referring to the diseases mentioned and their disastrous effects:

"So weighty are these interests that the Medical Society of the State of New York has appointed the undersigned a special committee on the subject of experimental medicine, charged with the duty of protecting such investigations from harmful interference.

"Such an interference is threatened by the efforts which have been made, in the name and with the implied sanction of your society, to prevent, by legal enactment, experiments on animals for medical and scientific purposes. Should these efforts succeed, they would have the effect to prohibit, within this State, a most useful means of investigation, and would be a lasting detriment to the cultivation and improvement of medicine. The committee can say, from their own knowledge, that the experiments in question are not performed in a spirit of wanton cruelty, nor in such a way as to inflict needless sufferings upon the animals employed; and that the information acquired by their means is often of the highest value for the protection of life and property.

"With you, we earnestly desire to prevent every form of unnecessary suffering. But we would most strongly draw your attention to the radical difference between the infliction of wanton cruelty and the serious and careful use of the lower animals for the benefit of humanity and of the brute creation; and we respectfully ask that the name and authority of your society may not be employed to the injury of the medical profession and of medical science."

The real friends of humanity and of the brute creation await the answer of the society named with no little interest. If, as there is reason to expect, the reply is not favorable to the work proposed by the Medical Society, the friends of humanity untainted by fanaticism will wisely refrain from giving aid or encouragement to the misguided society until a different set of officers give a more reasonable spirit to the administration of its affairs.

INTOLERANCE AMONG PHYSICIANS.

The unended, but we trust not endless question of professional recognition among the diverse schools of medical opinion and practice, has been brought once more into unseemly prominence in connection with the treatment of the late Earl of Beaconsfield.

Because the physician first in charge was nominally attached to a school of practice not accounted regular by those who arrogate to themselves the sole right to be so designated, the ordinary courtesies of the profession were refused him, and condemnation was urged against an associate who had the courage to be a trifle more courteous than the society rules allowed.

It is a pity that physicians cannot more generally rise above the traditional code of their craft in their professional consideration of this question, and look at the matter for a moment with the layman's unprejudiced eyes.

Were this done we are quite sure that there would be an end to the spirit of professional intolerance which so frequently comes in to embitter the intercourse or non-intercourse of physicians, to the hinderance of real progress in medicine and the lowering of the moral if not the professional standing of physicians in the estimation of intelligent laymen. Individually the majority of physicians recognize the present emptiness of the shibboleths of medical generations dead and gone. Years ago they meant a systematic abiding by this, that, or the other theory of medical practice; and A could not consistently consult with B or C, because they knew no common ground of theory or practice to agree upon. Their remedies being always different and their methods systematically opposed, there was at least a shadow of a reason for keeping professionally aloof. But knowledge comes though wisdom lingers, and sensible men in all the medical schools have learned the vital truths that all the schools possessed some truth and a great deal of error. The hard and fast lines of theory and practice have been abandoned by all; yet the medical codes are as intolerant as ever. In this, as in all cases, men in organized society prove to be more conservative, more bound by tradition and custom, than the individuals who make up the society.

In the Beaconsfield case the intensely conservative medical societies of London show, though unconsciously, the influence of the times. Formerly the reason for non-recognition would have been bold and clear: "The obnoxious physician is not of our school; therefore his practice is all wrong, and we can have nothing to do with the case so long as he is retained." That excuse could no longer be given, since it had practically lost all its original force. So the ground was shifted, and the reason for non-intercourse was said to be moral, not professional. "The offending physician's practice is eclectic, like our own," the regulars said, "but he is saling under false colors. In deference to the prejudices of the ignorant he professes to be a disciple of Hahnemann, when he is not. Hahnemann has no genuine followers nowadays. We cannot consult with a man who is a professional cheat, however reasonable his medical practice may be, or however admirable he may be in his private, non-professional character."

It will not take long, we fancy, for this flimsy pretext to wear itself out. And when that is gone the grounds for fence building between medical societies of different denominations will become shadowy indeed. It is high time they were lost sight of altogether. Intolerance is pretty nearly gone out of fashion. Men in all professions are learning that any pretense of monopolizing knowledge or wisdom or sincerity of purpose on the part of any clique or school is more likely to engender contempt than respect from the world at large. Men or sets of men in no way compromise their position mentally, socially, or professionally, by treating courteously those of different mental, social, or professional standing; while they do seriously compromise their claim to popular respect by courses which indicate on their part an overweening confidence that they are radically better or wiser than any one else. In this country, at least, men are free to do right in any way or under any name that may happen to fall to them; and it lies with no exclusive schools of thought or practice, but with the best judgment of all, to decide what in any case is within or without the bounds of right. The "regular" physicians, as they delight to style themselves, take an honorable pride in saying that they are hampered by none of the theoretical or practical "pathies;" that they are scientific and scientifically free to accept and use all knowledge and all methods of practice that promise to benefit their patients. Intelligent physicians, whom the regulars style "irregular," take precisely the same ground. There are reasonable differences of opinion as to what in any case is true or expedient. And neither the regular nor the irregular heightens our respect for his opinion or practice by refusing to confer with those whose opinions do not exactly coincide with his own. Still less do we respect those who would disfellowship each other for imaginary differences implied by accidental school names or outworn shibboleths of system or method handed down from days when toleration was regarded as a crime rather than a virtue. The scientific and practical advancement of the art of medicine is to be helped much more by the unrestricted conference, friendly criticism, and mutual respect of all the schools, than by mutual intolerance and partisan wrangling.

CORN AS FUEL.

Not a few good people, in parts where fuel is cheap and food dear, have been shocked by reports from the West of settlers resorting to corn for fuel. To the sentimentalist it seems dreadful, almost sinful, that grain which might feed thousands of hungry people should be "destroyed" in that way; and we have heard some speak as though it would be almost a virtue in the Iowa farmer to freeze to death and save the corn for its more legitimate use as food.

The *Iowa State Register* looks at the question in a more matter of fact and sensible way. It has tried corn as fuel, and finds that corn in the ear can be burned in stoves made for either soft or hard coal, and is an especially good fuel for cooking stoves. Moreover, the cost of growing corn in Iowa is so small that it is as economical to raise corn for

fuel on the prairies as it is to import coal or grow wood, certainly off the lines of railway.

An acre of corn can be raised for about $6, including the rent of the land. Fifty bushels of corn will weigh 3,500 pounds, or equal to a ton and three-quarters of soft coal. This, at 15 cents per bushel (which is as much as corn was worth on the farm away from railroads last winter), would be as cheap for fuel as soft coal at $4 per ton. Two bushels of corn will make a fire which will keep a family warm all day, even in very cold weather.

Some recommend raising sunflowers for firewood, but they are not as good as corn. Nor need the talk about burning corn create any reluctance to removing to regions where they have to burn corn for fuel. It can be raised in one-tenth of the time and at less expense than timber can be raised for the same purpose, and the farmer may as easily and as conscientiously plant corn for fuel as sunflowers or trees. The *Register* is of the opinion, however, that, though the prairie farmers will occasionally have to burn corn to keep warm, they are not likely to choose it as fuel when they can get coal or wood.

HOW TO GET RID OF FOUNDLINGS.

The methods adopted by the almshouse officials of Philadelphia for getting rid of unwelcome babies appear to be complete and efficient to a degree never before approached in a modern public institution. The death rate is precisely 100 per cent. As the president of the city board of Guardians of the Poor frankly put it, when he protested against sending any more unfortunates to the almshouse: "All of them die. None of them live; and never have we raised a child out there."

The assertion seemed incredible, but an examination of the records of the institution found it to be true. It was discovered that few if any foundlings survived the almshouse treatment more than four months, and none lived more than six months. During the year 1880 there were brought to the institution 66 foundlings, of whom 30—of course the prettiest and apparently healthiest—were taken out for adoption. Of the 36 which were left all but one died within four months, and that one lived four months and one week. Nearly all died within four weeks of the time of entry.

Charges have been preferred against the management of the children's department of the almshouse by the society to protect children from cruelty, and at this writing the matter is still before the grand jury.

At the request of the president of the Board of Guardians, the condition of the foundling ward was investigated by the obstetrical staff of the almshouse, who attributed the terrible mortality to bad food, impure quarters, bad air, and insufficient attendance. As given in the *Record* the report mentions that in former years there were twelve resident physicians in the institution, thus obviating the necessity for the frequent change to which the foundlings are now subjected in their medical attendance. Under the present rules of the almshouse the number of resident physicians is twenty-three, and these are young physicians, fresh from college. As these physicians are rotated every month, the infants, who should have a permanent medical officer over them, have a new physician every four weeks. The report is also understood to say that the infant ward is ventilated from a cellar room, which is used as a drying room at high temperature for the pauper clothing, so that the foundlings are compelled to breathe a vitiated atmosphere; also that they are seldom if ever taken out of this room except during the summer time. It is also said that the medical staff connected with the almshouse has from time to time protested in vain against the food supplied; that patients have actually suffered from scurvy brought on by the food, and that the milk supplied has often been not only unfit for use, but that no attention has been given to repeated warnings that this was the case.

No doubt the official baby killers will to a man testify that everything has been done by them to discourage the perverse habit of the foundlings; and that it is only by the most painstaking carefulness that the little wretches have been kept alive so long on the average. But there will remain with the people at large a distressing sense of dissatisfaction with the results of the official tender mercies of the City of Brotherly Love. As a rule foundlings are not the best possible material for making men and women out of; still a death rate of 100 per cent in six months is a little too comprehensive to be accepted with composure, even when we are assured that "the subject has been one of serious study with the doctors of the almshouse for sixteen years," during which time, it is admitted, they have been unable to rear a single foundling in the institution. Many of those who are taken away and adopted live, but none of those survive who remain in the institution.

EXTINGUISHING PETROLEUM WITH CHLOROFORM.

The following experiments made some time ago are again published, in the hope that some of our readers may be induced to study the subject further and develop useful results.

The doctrine of the inflammability of chloroform has been generally accepted by chemists up to the present time. M. Würtz, in his great dictionary, states that a cotton wick dipped in chloroform will burn. M. Moigno has been making experiments which seem to point to a completely opposite doctrine.

If chloroform—$CHCl_3$—be submitted to the action of heat, another chloride of hydrogen is formed, an equivalent of chlorine and an equivalent of carbon are set at liberty. This proceeds from the reaction indicated by the formula, $CHCl_3 = Cl_2H + Cl + C$.

M. Moigno has established that pure chloroform, free more particularly from any trace of alcohol, does not burn. He has established, besides, that pure chloroform, mixed with inflammable liquids, destroys their inflammability. His experiment was an easy one to perform, and began by mixing petroleum and chloroform in the proportion of five parts of the former and one of the latter. This mixture will not burn with a wick. It is both uninflammable and incombustible, that is, until the greater portion of the chloroform has been volatilized. To give the experiment greater effect, it may be varied in its operation as follows: Let a liter of petroleum be spread over a surface of 10 c.c., set the liquid alight, and when it has well taken, pour 50 cubic centimeters of chloroform into the mass. The petroleum is at once extinguished. If, now, an attempt be made to rekindle the petroleum by any inflamed body the latter goes out on touching the mixture.

The discoverer of this curious property of chloroform, extending the scale of his experiments, next poured 4 liters of petroleum upon this same surface—10 c.c. This liquid mass, having a depth four times that of the amount first experimented on, was well lit, and was then successfully extinguished by the same quantity of chloride of hydrogen as before—50 cubic centimeters.

M. Moigno then proceeded: 1. To raise the vapors of explosive gases. The greater number of these mixtures lost their inflammability. 2. To expose a wick saturated with chloroform to a strong flame of alcohol. The flame became smoky, and an intensely opaque vapor of hydrochloric acid —HCl—was formed. 3. To pass the vapor of boiling chloroform into a good flame of alcohol. The flame is extinguished.

Practically what can one make of these experiments? Less, perhaps can be made of them in the way of process than in that of principle. They point to the possibility of the extinction of the obstinate and dangerous flame of burning petroleum.

The principal difficulty in this application of chloroform will consist in its high price, chloroform costing from ten to fifteen francs the kilogramme. This difficulty will, doubtless, prevail against the adoption of the new principle for the extinction of petroleum fires in large towns, where less costly means are at hand, but it will not hinder its adoption in a case considered till now almost beyond the reach of help—fire on board ship. In this direction M. Moigno thinks there is fair room for experiment and reasonable ground to hope for satisfactory results. If the indications given by laboratory experiments lead to good practical results an important problem will have been solved. It is not impossible to conceive that a ship could be furnished with a supply of chloroform, so stored as to admit of projection to any point where fire broke out. However considerable its first cost, this, as the chloroform keeps good from voyage to voyage, would be small for each one; and in presence of the terrible disasters it is capable of preventing, the question of cost disappears altogether.

PLEA FOR A GOVERNMENT PERPETUAL MOTION.

We publish in another column an extract from the remarkable report of Chief Engineer Isherwood to the Secretary of the Navy, in which he strongly urges, in fact almost implores that functionary to order the construction, at government expense of an experimental motor on Gamgee's plan. It will be seen that the hallucination of perpetual motion has taken complete possession of the Chief Engineer's brilliant intellect, and made him for the time being the laughing stock of the engineering world. This is much to be regretted, for Mr. Isherwood is an individual of superior attainments, and high capabilities. That such a man should embrace so palpable a delusion, and run off into such a labyrinth of absurdities as the report shows, is very strange.

The very best thing that the Secretary of the Navy can do is to clear out from the Washington navy yard at once, the whole crowd of Gamgee followers, and allow no more of the public money to be wasted on such stupid and irrational schemes.

It is unfair to Keely to allow this thing to go on. His perpetual motion is kept going by supplies drawn from willing victims—the private contributions of New York speculators. But it appears that Gamgee, Isherwood & Co., have an eye to the resources of the national treasury, to drive their wheels. In both cases it is money that makes the motor go.

The Partial Eclipse of the Sun.

The sun will be partially eclipsed May 27. The greatest obscuration occurs in latitude 69° 4′ north and longitude 90° 24′ east of Washington, or in northern Siberia, where 0·737 of the sun's diameter will be obscured 8·84 digits.

The shadow (Penumbra) first touches the earth in latitude 39° 9′ north and longitude 178° 40′ west from Washington, in central China, and leaves the earth in latitude 46° 20′ north and 17° 18′ west from Washington, or in central Minnesota—Morrison county. In the United States the southern limit of the eclipse begins on the Pacific coast, a few miles south of Astoria in Oregon, passing through Portland, Salt Lake City, and just south of Pueblo, Col., taking in Leadville, Denver, Colorado Springs, etc., where the eclipse will be very slight, and occur very late in the afternoon; at Denver at 6:13 P.M.; at Jefferson City, Mo., the middle of the eclipse occurs at sunset, the sun setting partially eclipsed. The sun will set more or less eclipsed throughout Missouri, Illinois, Iowa, Wisconsin, Michigan, Indiana, and Ohio. From Cairo, Ill., the boundary line of the eclipse, where it begins at sunset, follows the general direction of the Ohio river to Zanesville, thence to Buffalo, N. Y. Thus none of the Southern Atlantic or New England States are favored, and the North Central States will only see the sun set with a very small eclipse upon it.

The Gamgee Zeromotor.

Some of our American contemporaries are speaking with considerable hopefulness of a new motor which has been designed by Professor Gamgee, and which has recently been reported upon favorably by Chief Engineer B. F. Isherwood. This "zeromotor," as it is called, is, it appears from Mr. Isherwood's report, an apparatus by means of which the heat in water or other objects at a natural temperature may be utilized to vaporize ammonia under very considerable pressure, the gas so obtained being used to move a piston in a cylinder, and being employed with the greatest practicable measure of expansion. The ammonia gas becomes "by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee to the ammonia boiler whence it came. The cycle is thus a closed one; no material is lost, and no heat is rejected in matter leaving the engine." It is not quite clear how the gas can be "diminished in bulk" by "very expansive use," but we may pass this point by for the present. Mr. Isherwood goes on to speak of the engine utilizing the heat in natural objects, and therefore costing nothing in money for fuel, while he enlarges on the great value for naval purposes of such a motor, particularly to the United States, which does not possess coaling stations in different parts of the world, and finally he recommends his department to spend money in assisting Professor Gamgee to prosecute his experiments.

We must own to considerable surprise at finding an engineer of Mr. Isherwood's experience give his support to such a scheme. We need scarcely say that it is utterly chimerical to attempt to obtain continuous motive power in the manner in which Professor Gamgee proposes, as it would be to attempt to continuously propel a vessel by utilizing the power derived from a turbine driven by water entering through a hole in the vessel below the external water line. For instance, if we suppose such an engine as Professor Gamgee proposes to be constructed, and to be in the first place cooled to a temperature below that of surrounding objects, so that there may be a flow of heat into it, then unless the whole of the heat so flowing into the machine be converted into *external* mechanical work, the temperature of the apparatus will rise more or less gradually until it attains the temperature of objects around it, when the inflow of heat from these objects will cease, and as a matter of course the development of work also. We have said *external* work because any work expended in overcoming the internal frictional resistances of the machine will, as a matter of course, only aid the rise in temperature. As a matter of fact, Professor Gamgee's proposed zeromotor is simply a perpetual motion in disguise, and the sooner this fact is recognized the better for those who are concerning themselves with it.—*Engineering.*

The *Art Interchange* instructs its readers how to color a pine floor which is to be partially covered with rugs, a fashion which prevails to a great extent just now. Obtain at any house-painter's store turpentine and linseed oil (not boiled). Ask the clerk to put a little Japanese drier in the turpentine. Buy either burnt sienna or Vandyke brown, or both, according to the color of the rugs and the tint on the walls. These colors come put up in tin cans, smaller but otherwise similar to tomato or fruit cans. After the floor has been washed thoroughly clean, and dry, begin by mixing in another receptacle the oil, turpentine, and paint. The mixture should be so thin that it will run with liquid readiness. Lay it on with a brush, stroking the brush the way of the grain of the wood. Protect your hands with old gloves, and go over the floor with a rag. In fact, you will need two rags, one pretty well charged with paint, to rub in every crevice, and another rag to rub off any superfluous paint. Do not stop in a straight line across the grain of the wood, but carry the brush irregularly down, taking a hint from nature's lines in the wood. By mixing the burnt sienna and Vandyke brown a rich color will be produced without using the paint thick. The mixture should be so thin that the grain of the wood will show through. If too much turpentine is used the paint will rub off. If too little, your room will need more days to dry. Use twice as much oil as turpentine. Do not economize the oil, and be as prodigal in rubbing as your strength will permit.

AT a Berlin feather-dyeing establishment an ostrich feather dyed in shades with methyl-violet was laid upon a paper upon which some ammonia had been poured but had dried up again. After a time the feather became partially green, the green passing gradually into violet, and producing an extraordinary effect. This reaction is being utilized in feather-dyeing, and will probably be applied in the manufacture of artificial flowers.

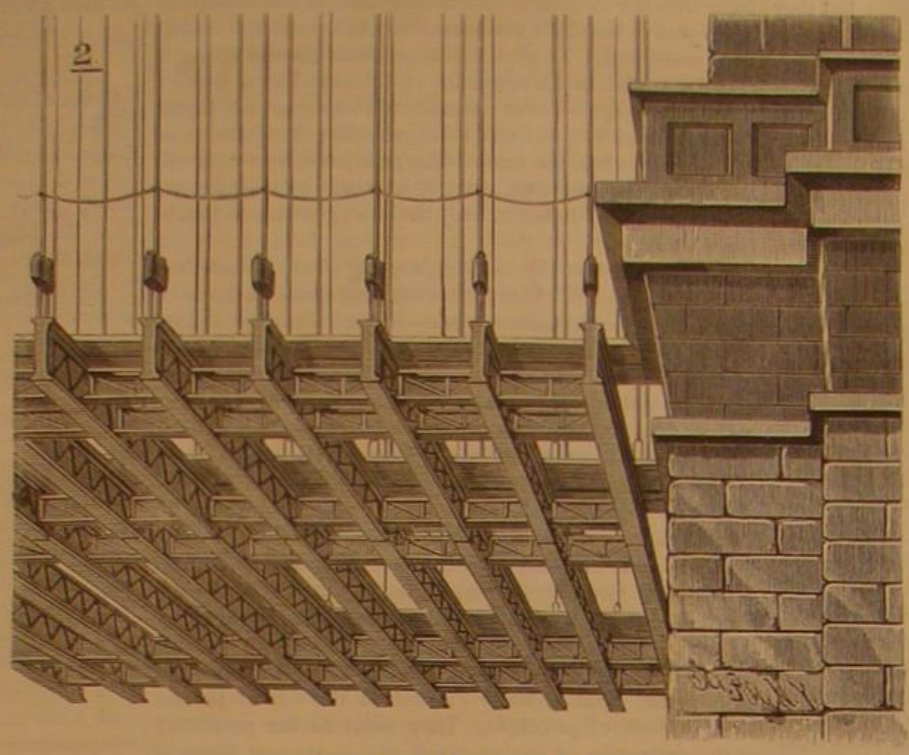
PROGRESS OF THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

[*Continued from first page.*]

strain of the over-floor stays. The longitudinal trusses are six in number, dividing the bridge floor into five sections. The two outside sections, 18 feet 6 inches in width, are for vehicles. A tramway will also be laid down in each, in case it may ever be desirable to run street cars across the bridge. Inside the carriageways will be two railways for cars to be propelled by an endless iron rope, operated by a stationary engine. Between the railways, and elevated 12 feet above them, will be a footwalk, 15 feet wide. This promenade will be the first part of the structure completed, since it will be needed for the workmen upon other parts of the superstructure. On both sides of the river the masonry of the approaches to the bridge is substantially finished.

An idea of the magnitude of the work already accomplished may be had from the following figures, which are furnished by Mr. E. E. Farrington, master mechanic of the bridge:

Length of the main span	1,595½	feet.
" " land spans, 930 ft. ea., total	1,860	"
" " New York approach	1,562½	"
" " Brooklyn approach	971	"
Height of main span above water	135½	"
Depth of N. Y. foundation below high water	78½	"
Depth of Brooklyn foundation below high water	44½	"
Size of N. Y. caisson (for foundation)	172x102	"
" " Brooklyn "	168x102	"
Cubic yards of masonry, N. Y. tower	46,945	
" " " " Brooklyn tower,	38,214	
Size of towers at high water mark	140x59	feet.
" " " " top	136x53	"
Total height of tower above high water	271½	"
Height of roadway at towers	119	"
" " arches above roadway	117	"
" " towers " "	159	"
Width of openings through towers	33¼	"
Size of anchorages at base	129x119	"
" " " " top	117x104	"
Height in front	85	feet.
" " rear	80	"
Width of flooring	85	"
Grade of roadway	3¼ ft. in 100	"
Number of cables	4	
Diameter of cables	15¾	in.
Length of each cable	3,578½	feet.
Wrapping wire on each cable	243 miles 943	"
Number of wires in each cable	5,434	
Total length of wire in each cable	3,515	miles.
Number of suspenders—		
Each cable, main span, 208; in all	832	
" " each land span, 86; in all	688	
Total	1,520	
Number of post bands—each land span, each cable, 35; in all	280	
Number of double floor beams supported by cables	450	
Strength of each suspender	140,000	lb.
Sustaining power of each cable	12,000	tons.
Greatest weight on a single suspender	20,000	lb.
" " " " " cable	3,000	tons.



THE FLOOR BEAMS FROM BELOW.

NOVEL OIL SEPARATOR.

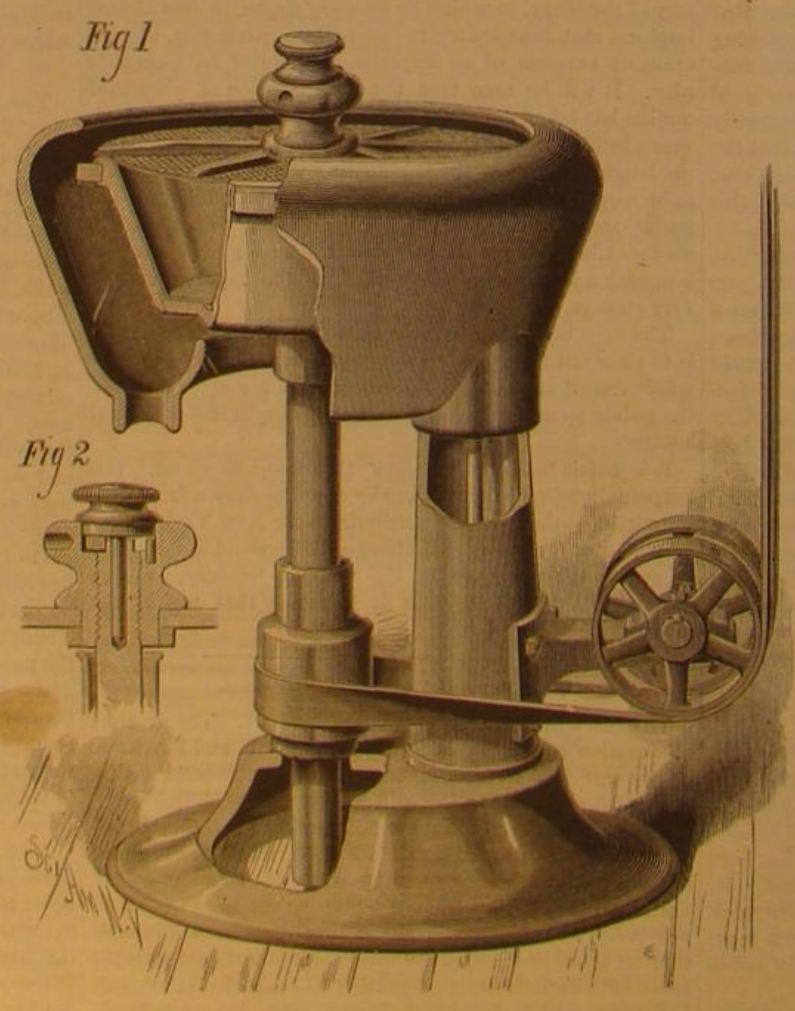
We give an engraving of a machine for separating oil from metal chips, such as turnings, drillings, chips from bolt and screw machines, and from small articles such as screws, bolts, and nuts, which in their manufacture are necessarily coated with oil, much of which is commonly lost. By the use of this machine the oil carried by the chips, crews, etc., is very quickly separated from the metal by centrifugal action, leaving only a slight film, which is beneficial rather than otherwise.

The article from which the oil is to be separated is placed in a removable conical pan in the revolving drum, and confined by a metal cover fastened securely over the top of the drum by the lock nut shown in Fig. 2. The machine shown in the illustration is about thirty inches high and requires a floor space about twenty inches square. It revolves at a speed of 2,000 revolutions a minute, and is noiseless and free from jar. The machine is well made, carefully finished, and is accompanied by a shaft and hangers. It is in use in several of our largest and best machine shops, giving complete satisfaction.

Further information in regard to this useful invention may be obtained by addressing Mr. C. F. Roper, P. O. Box 1211, Boston, Mass., or Hartford, Conn.

Making Old Rails into New.

But few people are aware, says the *Indianapolis Journal*, of the immense amount of handling that it requires to convert an old iron rail into a new one. From the time it arrives in the yard at the Indianapolis rolling mill until it is shipped out, a rail is handled thirty-one times. The process is as follows: It is first unloaded from the car, then picked up and run on a set of rolls to the shears, then cut up, when cut piled into fagots, then loaded on to a barrow and charged into furnace, heated to a welding heat, then hauled out and placed on iron buggies, run to weighing rolls, handled six times, until finished to a bloom, then returned to the buggy, carried to a repeating furnace, brought to a welding heat, then returned to the rolls on a buggy, passed through the rolls nine times, then run to saws where both ends are put off at once, then laid on the cooling bed; when cold, placed under the straightener, which takes out all minor crooks. The burr on the ends is then filed off, when the rail is inspected, then taken to the punching machine and fitted for splice bars, thence to the slotting machine, where it is slotted for the spikes; then the rail goes on the benches in the yards and from thence to the cars.



ROPER'S OIL SEPARATOR.

MISCELLANEOUS INVENTIONS.

Mr. Charles T. Sands, Jr., of Nassau, New Providence, West Indies, has patented a cheap, simple, and convenient device for enabling persons to escape with safety from burning buildings. It consists, in combination with a fire escape, of novel devices for arresting or regulating the descent of the basket or cage of the fire escape.

An improved holder for nuts and dies has been patented by Mr. Edward Squires, of Beaverton, Oregon. The invention consists of a frame or box for holding dies or nuts, and is provided with a sliding perforated bottom and an adjusting screw, and is held between the forked end of a rod or hand brace.

An improved means for preventing escape of sewer gas from waste pipes has been patented by Mr. Willis Knowlton, of New York city. Heretofore cocks have been applied to waste pipes for closing such pipes when not in use, but no provision has been made for preventing overflow, or else the arrangements have been complicated and liable to get out of order. The object of this invention is to provide the waste pipe with a valve whereby it can be closed, and to combine with this device valves in the water pipes and means for operating them, whereby the waste pipe shall be automatically closed, and the overflow pipe of the basin opened simultaneously with the water pipe.

Mr. James Corr, of Jamaica, N. Y., has patented an improved cigar holder, constructed to inclose the cigar entirely while it is being smoked, thus avoiding danger of fire and preventing the ashes from being an annoyance.

An improved metallic sole for boots and shoes has been patented by Mr. William T. Burrows, of East Dubuque, Ill. The object of this invention is to increase the durability of the boot or shoe sole, and it consists of a plate of metal of the shape of the sole, and designed to be secured thereon, made with parallel cuts or slits, that alternately begin at the opposite edges and extend nearly across the plate, thereby forming, in effect, a series of parallel end-connected crossbars.

A device whereby the driving reins will be securely held and can be easily and quickly inserted and detached, has been patented by Mr. Jonathan S. Pitcher, of San Diego, Cal. It consists in posts having one or more cams hinged to them, the cams being held forward by springs pressing against pins attached to the cams and prevented from being forced too far forward by stops attached to the clamp. The device is intended for attachment to the dashboard of the vehicle.

A cheap and strong ear for earthen pots and pans, attached so that it does not interfere with the cover, and so that the strain upon it will not break it loose from its fastening, has been patented by Mr. Milton T. Geren, of New Brighton, Pa.

An improved horse power for gins, etc., has been patented by Mr. Willis H. Harvey, of Somerville, Tenn. The invention relates to an apparatus for transmitting motion from a prime motive power to the machinery intended to be driven by it, the object being to reduce the cost of construction, to adapt it to any present gin house without interfering with or moving the gin stand or lint room, and to economize in space and in power.

An improved governor for vulcanizing apparatus has been patented by Mr. William E. Gwyer, of New York city. This governor is for regulating the flow of gas to the steam generators of vulcanizing apparatus, by which the temperature in the vulcanizing chamber is maintained at a uniform point, the object being to utilize an ordinary pressure diaphragm for that purpose, and also to allow escape from the steam space or steam generator of expanded air, which, when allowed to remain, interferes with the indication pressure.

An improved truss, which is simple, durable, convenient, and effective, has been patented by Mr. Henry E. Garst, of Cincinnati, Ohio. The truss is provided with two pads adjustably attached to a spring bar, which is pivoted to one end of the truss spring by a pin passing through a slot in the end of the truss spring, and the other end of the spring is attached in a like manner to the truss cushion, to which the belt is fastened.

An improved shovel handle has been patented by Mr. Wm. H. Johnson, of Industry, Maine. This invention relates to that class of wooden handles for shovels, and similar implements, which are bifurcated and the parts curved in opposite directions to receive the round or hand gripe between them at their ends. In the improved handle the round or hand gripe is firmly secured between the curved arms in such a manner that it cannot revolve.

An improvement in pool tables has been patented by Mr. John Jefferson, of Columbus, O. This invention relates to that class of billiard or pool tables which are provided with pockets; it is a device for conducting the balls from the pockets to a large pouch or pocket at the foot of the table. It can be attached to old tables, using the same pockets without changing the external appearance.

A simple, convenient, and efficient device for cleaning knives and forks has been patented by Mr. Benjamin J. Howe, of Sing Sing, N. Y. The invention consists of a scouring table mounted on a box which is open at both ends of the table, and of a sliding rubbing block guided by or in grooves for applying the polishing powder to the knives or forks.

Mr. Charles W. Stiff, of Foxborough, Mass., has patented an improved lamp extinguisher, by means of which a lamp can be extinguished immediately at any desired time, and which also operates automatically if the lamp is accidentally upset. The invention consists in a lamp burner having two extinguishing caps pivoted to the wick tube, or some other suitable part of the burner, in such a manner that they can close over the top of the wick tube and thus extinguish the flame.

Mr. Richard Kersey, of Lexington, Ky., has patented a simple and compact middlings purifier that will thoroughly separate the flour and bran from the middlings without creating dust in the mill, and that will enable the operator to grade the middlings at will.

An improved heating apparatus for sanitary purposes has been patented by Mr. William R. Macdonald, of Allegheny City, Pa. The object of this invention is to supply at small cost an effective apparatus of simple construction for the sanitary uses of heating, ventilation, and disinfection of buildings—public and private—sewers, drains, and vaults, isolated, sick, or other apartments, water closets, and mines, to be used either solely as a heater or as a heater, disinfector, and ventilator, or for outdoor use as a disinfecting ventilator alone.

A machine which will receive labels or other sheets or prints as they are delivered from a varnishing or enameling machine, and keep them in slow motion through the air for a sufficient length of time to dry the varnished surfaces, without smearing them or making contact between the varnished sheets till they are dry, has been patented by Mr. Joseph E. Hinds, of Brooklyn, N. Y.

An improved machine for grinding glassware, such as tumblers, goblets, and similar articles, has been patented by Mr. Emmanuel Hutter, of Rive de Gier, France. It is simple in construction and operation, and can conveniently be adjusted and regulated to suit the various forms and sizes of the articles and the grinding stones.

The Electricity of Atoms.

The most novel conclusion of Professor Helmholtz, in his recent Faraday lecture, is to the effect that the atom of every chemical element is always united with a definite unvarying quantity of electricity. This quantity stands in close connection with the combining power of the atom which modern chemistry has termed quantivalence. For if the amount of electricity belonging to the monad atom be taken as the unit, then that of the dyad is two, that of the triad three, and so on. "If," says Professor Helmholtz, "we conclude from the facts that every unit of affinity of every atom is charged always with one equivalent either of positive or of negative electricity, they can form compounds, being electrically neutral, only if every unit charged positively unite under the influence of a mighty electric attraction with another unit charged negatively. You will see that this ought to produce compounds in which every unit of affinity of every atom is connected with one—and only with one—other unit of another atom. This is, indeed, the modern chemical theory of quantivalence, comprising all the saturated compounds."

A Rare Japanese Medal.

At the late meeting of the Philadelphia Numismatic and Antiquarian Society, a member exhibited a very rare and valuable Japanese gold medal, termed "Shinroku Oban," 400 years old, which excited interest not only from the credentials accompanying it, but also from the manner in which it comes to this country. A few years ago the Japanese Ambassador at Washington asked the advice of Col. Thomas A. Scott in relation to the selection of an American engineer to superintend the construction of certain important works contemplated by the Japanese Government. Col. Scott suggested Mr. Joseph W. Crawford, of Pennsylvania, then engaged upon the Texas Pacific Railroad. Mr. Crawford sailed for Japan, and commenced the construction of an artillery road around the island of Yesso, the northernmost of the Japanese possessions, bordering on Russia. This road, although primarily constructed for the transportation of troops and cannon, was graded so that rails may be laid at any time.

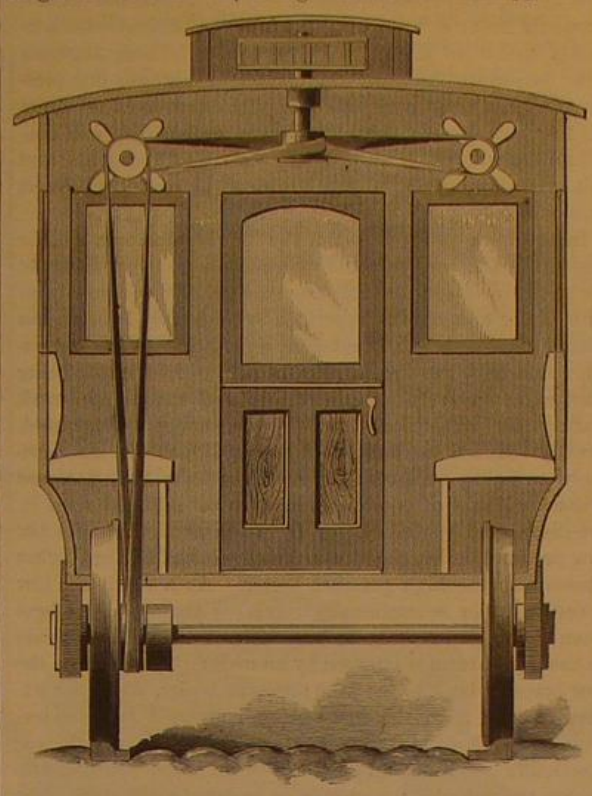
Owing to the precipitous rocky cliffs, the climate, and other causes, this undertaking was regarded as exceedingly difficult to accomplish. The manner, cost, and celerity with which this road was completed proved so acceptable to the Japanese Government that Mr. Crawford was sent to this country to purchase supplies, equipment, and assistants to construct the Polonai Railroad. The road was completed and opened with formal ceremonies last November, on which occasion Mr. Crawford was decorated with the Order of the Rising Sun, and as a particular mark of favor this "Shinroku Oban" was presented to him by the government, through Gen. Koroda, Colonial Secretary and member of the Privy Council of the Mikado. The medal is supposed to be one used at the time of Hiyashiyama (a Tycoon who reigned over the empire about 400 years ago), as a reward to any person of an extraordinary merit.

Sleigh Bells—How Made.

It has, no doubt, been a mystery to many how the iron ball inside of sleigh bells got there, and it is said to have taken considerable thought on the part of the discoverer before the idea struck him. In making sleigh bells the iron ball is put inside a sand core, just the shape of the inside of the bell. Then a mould is made just the shape of the outside of the bell. The sand core, with the jinglet inside, is placed in the mould of the outside, and the melted metal is poured in, which fills up the space between the core and mould. The hot metal burns the core so that it can be all shaken out, leaving the ball within the shell. Ball valves, swivel joints, and many other articles are cast in the same manner.

NOVEL CAR COOLER.

We give an engraving of a device lately patented by Mr. Isaac H. Fridenberg, of Philadelphia, Pa., for cooling passenger cars and for improving ventilation. The apparatus

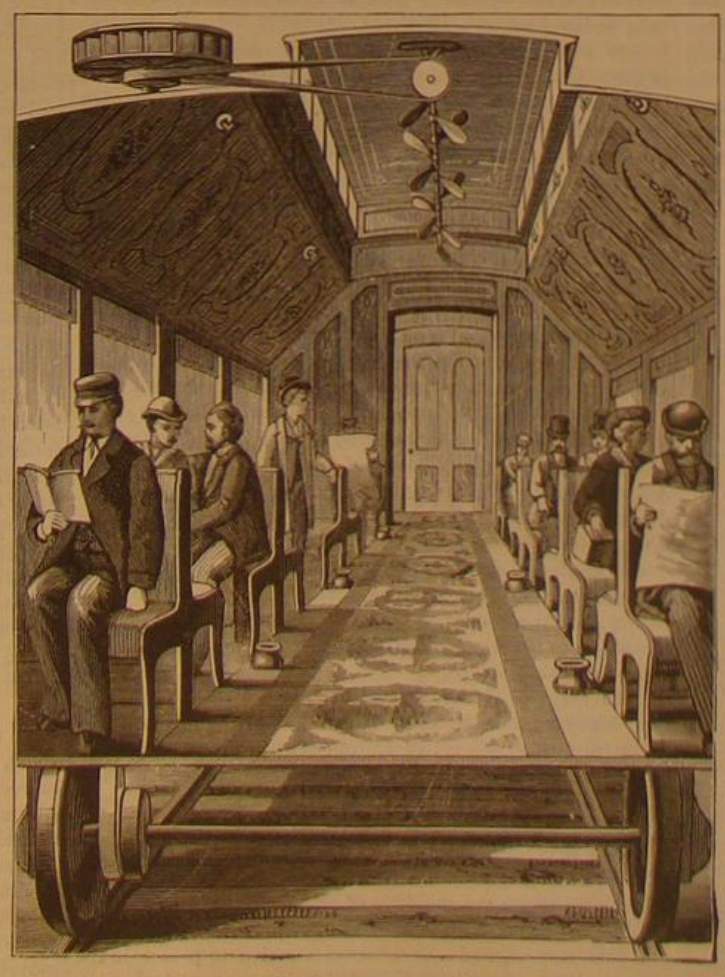


COOLER FOR HORSE CARS.

is very simple indeed, consisting of a shaft running lengthwise through the car, and carrying a number of wings like screw propeller blades, which, as they revolve, set the entire body of air in the upper part of the car in motion, and produce currents in the lower portion of the car which have a cooling effect similar to that produced by so many fans.

When the device is applied to steam cars motion is imparted to the propeller shaft by a wheel mounted on the roof of the car and driven by contact with the air as the car moves along. A belt or a shaft and miter gears may be employed to transmit the motion. When the device is applied to horse cars the power to drive the propeller shaft is taken by a belt from one of the axles.

The discomforts of summer travel will be greatly relieved wherever this invention is applied. It has a large field in



FRIDENBERG'S CAR COOLER.

sleeping cars, where a comfortable and wholesome atmosphere is usually wanting, and in ordinary passenger cars and street cars it will insure a degree of comfort which should warrant its general application.

Further information in regard to this useful invention may be obtained by addressing Mr. I. H. Fridenberg, S. W. corner 7th and Poplar streets, Philadelphia, Pa.

Industrial Secrets.

A century ago what a man discovered in the arts he concealed. Workmen were put upon an oath never to reveal the process used by their employers. Doors were kept closed, artisans going out were searched, visitors were rigorously excluded from admission, and false operations blinded the workmen themselves. The mysteries of every craft were hedged in by thick-set fences of empirical pretensions and judicial affirmation. The royal manufactories of porcelain, for example, were carried on in Europe with a spirit of jealous exclusiveness. His Majesty of Saxony was especially circumspect. Not content with the oath of secrecy imposed upon his workpeople, he would not abate his kingly suspicion in favor of a brother monarch. Neither king nor king's delegate might enter the tabooed walls of Meissen. What is erroneously called the Dresden porcelain—that exquisite pottery of which the world has never seen its like—was produced for two hundred years by a process so secret that neither the bribery of princes nor the garrulity of the operatives revealed it. Other discoveries have been less successfully guarded, fortunately for the world. The manufacture of tinware in England originated in a stolen secret. Few readers need be informed that tinware is simply thin iron plated with tin by being dipped into the molten metal. In theory it is an easy matter to clean the surface of iron, dip it into a bath of boiling tin, remove it enveloped with a silvery metal to a place of cooling. In practice, however, the process is one of the most difficult in the arts. It was discovered in Holland, and guarded from publicity with the utmost vigilance for more than half a century. England tried in vain to discover the secret, until James Sherman, a Cornish miner, insinuated himself master of the secret, and brought it home. The secret of manufacturing cast steel was also stealthily obtained, and is now within the reach of all artisans.

Facts about Sahara.

Recently Dr. Lenz, who has just returned from an expedition across the Sahara desert to Timbuctoo, gave a lecture before the Paris Geographical Society. Dr. Lenz decisively condemns as impracticable the project of flooding the Sahara. The fresh water fossils, which are met with in many parts, show that the Sahara is not the bottom of a dried-up sea. The temperature is not nearly so hot as might be expected; wild beasts are rare, and the most formidable enemies to be met with are the Touraeg tribes, who, according to report, have recently massacred the French Trans-Saharan Expedition. On the whole, the impression is conveyed that the Sahara is not half as black as it has been painted, and that it is entitled to an apology from the entire civilized world.

Wild Rice.

At a recent meeting of the Academy of Sciences, San Francisco, Capt. R. W. Simpson made an interesting statement detailing his efforts to acclimatize the *Zizania aquatica*, or wild rice, which grows so plentiful in some ponds, lakes, and rivers of Canada, extending north to Mackenzie River, nearly to within the Arctic circle. It grows annually from seed, and induces the presence of enormous flocks of wild fowl in the autumn, who visit these rice lakes and extensive beds for food. At Lake Erie it grows in water six to eight feet deep, and millions of reed birds, as well as bucks and other water fowl, resort there, and afford very fine shooting. Sportsmen's clubs East are taking means to extend its growth, as it attracts game of all kinds. In Rice Lake, where it grows prolifically, it has been cut before seed time by manufacturers, who find its fiber, taken from the under surface of the water to a depth of six or seven feet, to be very valuable. It affords the strongest kind of fiber known for making bank note parchment paper. The Canadian Government are now trying to cultivate and stimulate its growth all over the inland waters of the Dominion. Two friends of Capt. Simpson have each sown thirty bushels of this rice seed, in Wales' Pond, Maine, and he desires to call attention to it, as an element likely to prove very useful in improving the shooting in our State, and as such capable of contributing largely to increase our food supply. Different varieties of it are known, but they all belong to one single species, varying according to climate and location. Capt Simpson had tried to make it grow in Oregon and California, but had failed. He now learned that the seed needed first to be soaked in lukewarm water.

EARTH FUNGUS AS FOOD.

Dr. Harkness exhibited colored drawings of a new species of earth fungus, first discovered in Golden Gate Park by Mrs. Dr. Mary Curran, which, if to be had in quantity, would prove a valuable article of food. He called it the *Octaviana*. Its spores are distributed underground, in the same manner as those of the famous luxury called truffles. He said he had hunted annually for fifteen years under the small oak groves of California, hoping to discover truffles, which in Paris are eagerly sought after as a great delicacy, and sell readily there at $4 a pound. French scientists with whom he has conversed assure him that our State has conditions which convince them that they will undoubtedly be found here, when a large number of observers are trained to hunt for them systematically. In Europe they are often rooted up

by hogs, who are very fond of them, and have a remarkable faculty of finding them. They grow just under the surface, within four or five feet of oak trees, in fields, and are highly esteemed by epicures the world over. Mr. Clayton, now in Sonoma, once found some red truffles, not the genuine variety, but a very good article of food, and a fair substitute, among the foothills around Santa Clara, and off a little from San José. He had himself dug up some interesting earth puff-balls at Roseburg, and found them edible and quite good for a fungus. Feeling confident that truffles exist on our coast, he recommended farmers engaged in grubbing around oaks to hunt for them especially, and try and recognize them, for thus they could add a new industry to our State, and increase the value of their farms. Capt. Simpson recommended hunting among the heavy oak forests of Oregon and Willamette valley.

THE GAMGEE PERPETUAL MOTION.*

Chief Engineer Isherwood goes on to say in his report to the Secretary of the Navy, which is dated New York, March 19, 1881:

From observations made by Professor Gamgee in the experimental working of this machine, he deduced the possibility of what he terms a zeromotor, in which, by means of properly adapted apparatus invented by himself, the heat in water or other objects at ordinary atmospheric temperatures may be utilized to vaporize liquid ammonia under very considerable pressures, but within the control of known means of retention. The high pressure gas thus obtained being used with the greatest practicable measure of expansion on a working piston generates power, becoming by that very expansive use greatly refrigerated and diminished in bulk, and partially liquefied at the end of the stroke of the piston, when it is exhausted and then returned by a method invented by Professor Gamgee to the ammonia boiler whence it came. The cycle is thus a closed one; no material is lost, and no heat is rejected in matter leaving the engine. The work done by the engine is due to the difference in bulk of the material when it enters and when it leaves the boiler, that difference being caused by the heat derived from water or other natural objects in the ammonia boiler and from the refrigeration resulting from the transmutation of a portion of this heat by the engine into the mechanical work performed by the latter. That this difference of bulk exists is indisputable, and if the proper mechanism can be contrived to utilize it, the idea of the zeromotor becomes realized. It will be observed that this power has not been obtained from artificial heat produced by the combustion of fuels, but from the heat of natural objects at ordinary atmospheric temperatures, and therefore costing nothing in money. This is made possible by the fact that liquid ammonia gasifies under considerable pressure at ordinary atmospheric temperatures, the sole difficulty in constructing the zeromotor being to find the means of economically condensing the gas after it has been used on a piston. Were it not for the refrigeration due to the expansive working of the gas, the condensation would have to be obtained by the application, externally to the condenser, of artificially produced cold, and the zeromotor could not be made a commercial success. It is only by obtaining the lower limit of temperature from the action of the engine itself, while the higher limit is furnished without money cost by natural objects at atmospheric temperatures, that commercial success becomes possible.

A MOTOR TO SUPERSEDE THE STEAM ENGINE.

The purpose of the Department in ordering an examination of Professor Gamgee's ice making machine was not to obtain an opinion on its ice making merits, but one as to whether his observations on the behavior of ammonia in the process were sufficiently accurate to warrant his inference of the practicability of constructing a successful zeromotor for industrial uses—a motor, in short, destined to supersede the steam engine. Accordingly the undersigned closely investigated the working of the apparatus. The facts of liquid ammonia gasifying at ordinary atmospheric temperature under very high pressures, and of that gas undergoing very great refrigeration when used expansively in doing work, are not called in question by any one. Both are well known phenomena. The special fact to be observed was whether any part of the ammonia which entered the cylinder as a gas left it as a liquid, and so far as the form of the apparatus allowed any observation to be made, such appeared to be the case. The possibility of the invention of a new motor of incalculable utility would seem to be established, and in view of the immense importance of the subject to the Navy and to mankind at large, I strongly recommend it to the serious attention of the Department, suggesting further that whatever facilities the Department can, in its opinion, consistently extend, be allowed to Professor Gamgee for the continuance of his important experimental inquiries in the Washington Navy Yard. He is most anxious to bring his invention, with the least possible delay, to a crucial test by the completion of the necessary mechanism, and its submission to any board of experts which may be ordered to experimentally ascertain its merits. For this purpose he proposes to use such parts of his present ice making machine as can be recombined in his zeromotor, adding the other necessary parts, and thus producing, with but little loss of time, an embodiment of his idea that will by simple trial show whether an unquestionably correct theory has been successfully reduced to practice.

Professor Gamgee has perfected the calculations and drawings for the mechanism required to give practical effect to his invention, and there remains only to execute the mechanical work. He proposes to use the steam cylinder of his ice-making machine as the ammonia cylinder of the new motor, the present ammonia condenser, and the present ammonia boiler as a low pressure boiler, adding another ammonia boiler as a high pressure boiler. These, together with the ejector between the condenser and the low pressure boiler, a small pump for pumping liquid ammonia from the low pressure to the high pressure boiler, etc., will constitute the zeromotor—a machine, as will be apparent from this brief description, of the simplest, cheapest, and most manageable kind.

In the high pressure boiler the liquid ammonia will be gasified by the heat in water of atmospheric temperature to the pressure normal to that temperature. In the low pressure boiler ammonia is kept at a considerably less tension than in the high pressure boiler, and with this lower pressure ammonia gas the engine is operated, the gas being used as expansively as practicable and made to do work during its expansion, thereby becoming refrigerated, greatly reduced in bulk, and partly liquefied. Immediately on being exhausted the cooled and shrunken gas, and whatever liquid of condensation may be mingled with it, are discharged by the ejector from the condenser into the low pressure boiler, the ejector being worked by the higher pressure in the high pressure boiler. As a result the low pressure boiler is continually receiving ammonia and heat from the high pressure boiler. This excess of ammonia in the liquid form is pumped by an ordinary pump from the low pressure back to the high pressure boiler, while the excess of heat is continuously being converted into the mechanical work done by the engine. There is also the extinction of such part of the heat in the high pressure ammonia gas working the ejector as is due to the work done by it in forcing the contents of the condenser into the low pressure boiler. Of course the cylinder, heat condenser, the low pressure boiler, and their connections are protected from receiving heat from the atmosphere and surrounding objects by a non-conducting substance.

NO FURTHER USE FOR COAL.

The plan proposed is far from chimerical. It is based on well demonstrated thermodynamical principles. The whole is definite and precise, both in theory and mechanical detail, nor can it be shown, *a priori*, that there is not a fair prospect for success. There can be no doubt that the product of the pressure and volume of the contents of the condenser which are to be forced into the low pressure boiler, is less than the product of the pressure and volume of the ammonia gas which leaves that boiler to operate the engine, and that this difference which has not been produced by the external application of artificial cold, but by the working of the machine itself, is available for the production of power for industrial purposes. All that remains is to give the system a practical test in order to ascertain whether the mechanism proposed will act efficiently enough to realize the expected result. Should this prove to be the case, the steam engine will, within the near future, be certainly superseded by the zeromotor, for the great item of coal, whose cost is the principal expense of operating the former, will be wholly eliminated with the latter. If it can once be practically shown that a very much cheaper, lighter, and a far less bulky mechanism than the steamengine, including for the latter its boilers and, in case of steam vessels, the coal bunker and its contents, can be employed for the production of power to any amount without the use of fuel, nothing can prevent its introduction into general use for all industrial purposes, with the vast result of a great cheapening to mankind of every article of manufacture, from the daily bread of the poor to the luxurious textures which robe the rich. The whole world is concerned in the solution of this problem, and the poorer the person the greater is his interest in it. The source of heat for the steam engine is the continually diminishing supply of coal—a diminution that will be severely felt some centuries hence; but the source of heat for the zeromotor is as inexhaustible as the sun himself, and will last undiminished as long as he shines.

The success of the zeromotor is of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe with which it may come in collision, because those powers have colonies and coaling stations on the farthest shores, while the United States possesses neither, and would consequently, in naval warfare, be at great disadvantage for want of coal—its navy, as a rule, having to render service within a reasonable distance of its own coasts the sole base of supplies. If coal, however, can be dispensed with, we are at once placed on an equality in this respect, and our cruisers enabled to penetrate the remotest seas as easily as those belonging to countries having possessions there.

VALUE OF THE ZEROMOTOR TO OUR NAVY.

The enormous importance of a motor capable of superseding the steam engine and furnishing power without the combustion of coal can be estimated from the fact that it would produce an industrial and consequently social and political revolution equal to what was effected by the introduction of the steam engine. The whole of modern society is based on the steam engine which mainly has made the difference between the ancient and the present world, for our civilization would be impossible without it. It is the inanimate slave which performs the labor of mankind, freeing them from the greater part of their drudgery and giving them the time and means for culture.

I have ventured these few remarks to show the nature and scope of Prof. Gamgee's invention, which is not that of a machine for the application of power, but for the immensely more important purpose of generating power itself, so that, strictly speaking, it includes as a basis all other machines. I have wished to show this in order to make clear how different is his invention from those of others who may ask to have their apparatus tested in a Navy Yard, and to bespeak for it the most favorable consideration of the Department.

Professor Gamgee and able assistants—among whom is Mr. W. E. Sudlow, an accomplished mechanical engineer, thoroughly versed in the theory and practice of his profession—are well acquainted with the difficulties to be overcome. They are quite aware of all the objections that can be raised, and have well considered the means of obviating them. The subject has been carefully studied, and there are brought to bear upon it the requisite scientific and engineering information necessary to give it an exhaustive treatment. His engine, like the steam engine, is a heat engine, and produces power by the conversion of heat into mechanical work, the same quantity of work consuming in both cases the same quantity of heat, but with this immense practical difference, that the heat for his zeromotor is freely furnished to hand by nature, while for the steam engine it has to be excavated from the depth of earth and afterwards handled and transported by expensive manual labor.

What is now mainly desired is that Professor Gamgee may be permitted to prosecute his experiments at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the Department be able to grant this, the favor will be well and properly bestowed in the interest of the Navy and of the world. Submitted with great respect by,

Sir, your obedient servant,

B. F. ISHERWOOD, Chief Engineer.

* From the Report of Chief Engineer Isherwood, U. S. A., on the Gamgee Zeromotor.

Bitter Substances Developed during Fermentation.

We have on several occasions drawn attention to this subject, and have expressed an opinion that peculiar bitter substances are occasionally developed during the fermentation of saccharine fluids. As a rule the bitter flavor imparted by the hop is sufficiently strong to mark this extraneous bitter even if it be produced at all, but it must be within the experience of almost every brewer that beers do sometimes acquire an intense and peculiarly bitter flavor quite beyond anything that can reasonably be expected from the hops used. Some experiments by Mr. W. H. Langbeck recorded some time since, point to the occasional existence in fermented liquids of a bitter principle allied to colchicine. He prepared two samples of a fermented liquor from solution of glucose with small quantities of tartar, tartaric acid, kino, and a few drops of a mixture of formic and œnanthic ether. Fermentation was set up by means of sound pressed yeast, and was maintained at a temperature of 64° to 68° Fah. One sample, filtered through flannel after four days and allowed to stand for three weeks in a stoppered cask at 47° Fah., yielded a pleasantly vinous liquid. The second sample, not filtered till after five days, tasted intensely bitter, and grew worse on standing. The newly-formed yeast, at first of a whitish yellow, had taken a brownish color, died off, was precipitated by the more alcoholic character of the fluid, and formed with the alcohol in nascent state that substance which betrays itself by its bitterness in unhopped fermented liquors when the fermentation has been neglected. The compound in question is by no means innocuous. It was isolated by treating the liquor according to Dragendorff's methods I. and II. Langbeck succeeded in obtaining it in a crystalline form, and described its reactions. There is but little doubt that other products besides alcohol, carbonic acid, glycerine, and succinic acid are produced during the fermentation of worts, and some of these may materially modify and injure the flavor of the resulting beer; the use of chemically prepared sugars may tend to the production of these mysterious compounds, but at present our knowledge of the subject is very meager.—*Brewers' Guardian.*

A French Safety Lamp.

At the usual annual meeting of the Académie des Sciences, just held, the yearly prizes bestowed by the society in recompense of services to science have been awarded. Among others, M. Birckel, a civil engineer employed at the Pechelbronn mines, has received the Montyon prize—which is restricted to improvements in dangerous industries—for a modification of the Davy safety lamp. M. Birckel's improvement is very simple, consisting in providing the wire gauze cylinder with a double iron casing. The top case is movable, and slides over the under one, which is fixed, when a concentric movement is given to it by turning the hanging handle. These casings have corresponding openings of equal section, so that it is possible to more or less restrict the supply of air, or to shut it off altogether, and so instantly extinguish the gas burning inside the lamp when there is much light carbureted hydrogen in the atmosphere. It is not generally necessary to go so far as to extinguish the lamp by hand, because if the air supply be carefully regulated, any addition of combustible gas to the atmosphere will of itself cause extinction through lack of oxygen. M.

Birckel's lamp has been used for nearly a year in the Pechelbronn mines, which are very fiery, without any accident having happened.

A Good Suggestion to Housekeepers.

No one knows until she has tried it, says an experienced housewife to one of our contemporaries, how much she may change the aspect of things about the house by using a little varnish. On a sunshiny day take the old chairs and tables out on the porch or by an open door, and, after thoroughly dusting and wiping off with a damp cloth, apply a thin coat of varnish, and so cover up scratches and marred spots of all kinds. It will dry in a very short time, and you will be surprised to see how much good you have done. A flannel cloth, with a very little linseed oil, is good to rub furniture with, but the greatest care must be exercised to prevent any oil being left on the wood to attract dust. It must be rubbed until you would not know, except by the improved appearance, that any oil had been used.

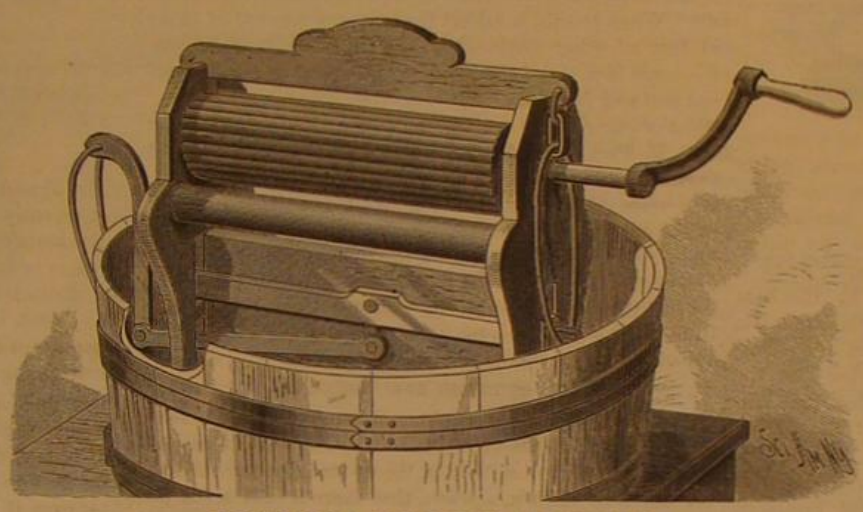
NOVEL WASHING MACHINE.

The washing machine shown in the annexed engraving employs a system of rods and levers by which the vessel and water in which the clothes are washed are made to produce the pressure necessary to cause sufficient friction for cleansing the goods, and insure a uniform pressure upon all thicknesses of material without the use of springs or complicated devices.

In machines of this class it has been the general practice to employ springs to produce the necessary pressure, and this is the principal reason why clothes washers have not come into more general use. Where springs are used the thicker the goods the greater the pressure and the more difficult it is to use the machine, but where the weight of the tub, water, and washing apparatus is employed the pressure is uniform on all thicknesses, and the work of washing with the machine becomes easy.

The washing machine, consists of three rollers mounted in a frame fixed to the bottom of the tub, two of the rollers having stationary bearings, while the third or upper one has movable bearings connected by straps with a cross bar beneath the lower rollers. This cross bar is connected by a link with a lever fulcrumed in the frame of the machine; the longer arm of the lever being connected with a standard rising from the bench.

The side of the tub opposite the standard is pivoted or hinged to admit of the oscillation of the tub as the rollers adapt themselves to clothes of different thicknesses. This invention was lately patented by Mr. J. K. Dugdale, of Richmond, Ind.



DUGDALE'S WASHING MACHINE.

Effects of Optical Slits.

M. Trève has lately described some curious effects. Looking through a fine slit at a vertical object (a post or a mast for, instance), he finds the perception much more distinct when the slit is horizontal than when it is vertical. On the other hand, to distinguish horizontal lines more clearly, the slit must be held vertically. But if, in general, one look at a house or a landscape through a fine slit, it is found that the maximum of brightness of the horizon is when the slit is horizontal. This effect, it is said, is also produced with the solar and lunar disks; they are seen much more distinctly with the horizontal slit. M. Trève has reproduced the effect by photography, and the negatives taken with the horizontal slit were more distinct. The light appears to be propagated with more intensity through the latter than the former, the vertical bands of solar photographs showing well the interferences and passage of light through a vertical slit. Again, if a cross-slitted disk be held between the sun and white screen, the horizontal part of the cross on the screen is brighter than the vertical. The practical application of these experiments of M. Trève to photography would appear to be the relation which they bear to the shape of the apertures of diaphragms and to instantaneous shutters. Is it a fact with regard to the latter that the uncovering of the lens horizontally admits more light, and therefore produces a picture more quickly than a shutter which opens vertically? There may be no difference, but the point, at any rate, is worth deciding.—*Photographic News.*

Seaweed Jelly.

The seaweed, *Arachnoidiscus japonicus*, which is used by the Japanese and Chinese to pack porcelain and other articles for exportation, is said, by the *Journal of Applied Science*, to be made use of in France for the purpose of making a spurious fruit jelly. When placed in a tumbler of water it absorbs the water in a few minutes; then a number of shoots grow, and constitute a jelly nearly as transparent as the water from which it is made. The jelly is easily sweetened with glucose, and cochineal or other coloring matter is added with equal facility to imitate the color of the fruit. The perfume and the taste were the only real difficulties that remained to be overcome. After considerable study it was discovered that by using a mixture of certain ethers with tartaric acid, glycerine, etc., a perfect imitation of the odor of raspberries was produced. By putting a little of this essence to the seaweed which has been allowed to develop itself in water, a substance is obtained which has the consistency of fruit jelly, though no fruit has been used, which is sweet, though no sugar has been employed, and which has the color and fragrance of raspberries, though altogether destitute of that fruit. When this ceases to please, another very good fruit flavor is produced by treating castor oil with nitric acid. The jelly still retains a little of the fibrous nature of the plant, and has a tendency to split and fall to pieces, instead of forming adhesive lumps. Examined by the microscope, it has no resemblance to the jelly made from fruit. Then, as the jelly must be colored, it is easy enough to discover the presence of an artificial dye. Without resorting to the laboratory, it suffices to dissolve a little of the suspected jelly in some tepid water, and dip a white silk ribbon in the solution. If it is a natural jelly the ribbon will only be a little soiled; but if the jelly has been artificially colored the ribbon will also be colored.

ENGINEERING INVENTIONS.

Mr. William H. Birge, of Franklin, Pa., has patented an improved storage tank for petroleum, so constructed that the floating cover can never sink to the bottom of the tank, and so braced that it will stand all weather and wind storms without the necessity of an external roof or other inclosure. The floating cover is so constructed that it will serve the purpose of a roof and afford ready access to the interior of the tank, and also a partial roofing made in sections whereby the body of oil is protected from rain and from fire.

An improvement in connecting rods has been patented by Mr. Jacob J. Anthony, of Sharon Springs, N. Y. The object of this invention is to provide a lubricating connecting rod for cranks, crank pins, slides, or other parts of mechanism where connecting rods are used. It is composed of a straight tube forming an oil chamber, having a journal box secured on each end and communicating interiorly. The caps of the journal boxes are held in position by straps extending parallel with said tube and on either side of it.

Mr. Daniel Gallafent, of Woolwich, County of Kent, England, has patented an improved rotary engine, which may be driven by steam, compressed air, water, or gas, and which may be adapted for use as a pump, a water meter, a blower or exhauster, or as a hydraulic buffer for absorbing or destroying the recoil of heavy guns, or other purposes.

Mr. Robert H. Elsworth, of Bayonne, N. J., has patented an improved boat for transporting city sweepings and offal to sea and safely and quickly discharging them. The invention consists of a barge covered amidship for nearly its entire length with a peaked roof or deck that slopes downward on both sides from a central longitudinal line at an angle of about forty-five degrees to the side-rails of the boat; and it consists, further, of hollow or box guards extending along each side of the boat or barge above the water line, open at the top and provided at the bottom with doors that swing open downward, these doors being simultaneously operated by ropes or chains that are made fast to winches or other suitable devices, the intention being that the sweepings and garbage loaded on the sloping deck and in the guards shall be quickly discharged on either side of the barge by opening the guard doors, so that even in very shoal water the barge load may be discharged clear from the barge and without interfering with her movements.

It is stated that the Bank of France has almost entirely abandoned chemical tests in favor of the camera for detecting forgeries. The sensitive plate not only proclaims forthwith the doing of the eraser or penknife, but frequently shows, under the bold figures of the forger, the sum originally borne by the check. So ready is the camera to detect ink marks that a *carte-de-visite* inclosed in a letter may to the eye appear without blemish, while a copy of it in the camera will probably exhibit traces of writing across the face, where it has merely been in contact with the written page.

In a letter to *La Nature*, M. Cornillon states that when observing the sun lately with a telescope, he was struck with certain undulatory movements on the disk. On inquiry into their cause he is led to connect them with the wind blowing on the earth's surface at the time. They vary in intensity with this, and they have generally (but not always) the same direction as the wind. Where they have a different direction they indicate a change of weather, or at least the direction of the wind next day.

The Timber Line of Mountains.

Some very interesting facts were brought out at a meeting of the Academy of Natural Science of Philadelphia, concerning the timber line of mountains. The highest Alpine vegetation consists for the most part of short stemmed perennials. Lower down are found dwarfed trees of species, which, still further down the mountain sides, form forests of considerable height, and which, as trees suited to merchantable purposes, make what is known to mountain travelers as the timber lines. In the mountains of Colorado the forests commence at about 7,000 feet above sea level, and continue up to about 11,000 feet, when they suddenly cease. At this point the coniferous trees are from thirty to forty feet high, and above the same species exist as stunted shrubs, seldom exceeding three or four feet in height, and often but a foot, though trailing widely over the ground. In this dwarfed condition they are often found some 1,500 feet higher up, or half way from the recognized timber line to the top of the mountain. On Mount Washington, in New Hampshire, which is a little over 6,000 feet high, the timber runs up to about 4,000 feet, while Mount Webster, a mountain forming the southern peak of the same chain, and about 4,000 feet high, has little timber above 3,000 feet. Roan Mountain, in North Carolina, is about 6,300 feet above the level of the sea, and on some parts of it timber extends to its summit. At a height of 6,000 feet a black oak was measured that was five feet in circumference at three feet from the ground, and forty feet high.

The question as to the peculiar course of the timber line is a mooted one. Until recently it has been referred wholly to climatic conditions, of which temperature and moisture have been regarded as the chief elements in producing the result. The objection urged to this theory is that the dwarfed and gnarled cone-bearing species, extending so many hundred feet up the mountain sides, never produce seed, which leads to the alternative of believing that the seeds have been carried up the mountain sides in enormous quantities and to great distances from the fruiting trees below by winds, or else that there were seed-bearing progenitors of these scrubby trees, beneath the tall protecting branches of which they had their earliest stages of growth. The result of an examination of different parts of Mount Washington favors the latter supposition. As is generally known, there is a railway running straight up the mountain side from the base to the summit. Near the timber line a cut about ten feet deep had to be made through an area covered by mature balsam firs. Under the trees moss and dead roots and old fir leaves had made an earthy strata of a foot in depth. The moss was still green from the rains, melting snows, and fogs of this elevated region, and sustaining the various kinds of low vegetation common to such heights. Young firs were springing up in great abundance, but all the larger trees were dead, though here and there might be seen a branch with a few lingering green leaves. This mass of dead, standing timber occupied several acres, and the reasor of the death of the trees was evident. The cut showed that the forest stood on a mass of large but loose rock, through which the water from the mountain above rushed, carrying with it all the earthy matter on which the larger trees had subsisted, but leaving the tough, turfy matter at the surface, on which the smaller trees of the same sort may live for many years. With the death of the larger trees there is an increase of light, and then the grasses and sedges speedily take possession, holding together the loose soil and permitting, in many cases, an increase of the earthy layer by holding much of the disintegrated rock which washes down from above.

A careful examination of the patches of scrubby spruces above the timber line not infrequently shows dark patches of vegetable mould, evidently the remains of larger trees that have been growing, where now only the masses of small scrubby plants exist. In some places a sharp stick may be pushed down among the dwarf firs and spruces, and the mass of roots intermixed with earth found to be but a foot or so deep over the loose rock from which the earth has been wholly washed away. Again, there are some places, often nearly an acre in extent, where the scrubby firs are still standing, dead, from the earth having been washed away, not leaving enough for even the moderate demands of these small bushes.

It is evident that many of these dwarfed specimens are of a great age. Some that were examined were certainly fifty years old, though the stems at the ground were no thicker than a man's wrist, and, trailing on the ground, occupied but sixteen or twenty square feet of space.—*N. W. Lumberman.*

Large Locomotives.

The working of the experimental locomotive, "No. 10," lately tried, of the Pennsylvania Railroad, has been so satisfactory that ten more of the giants are to be built at the Altoona shops this summer. The driving wheels of the "No. 10" stand 6 feet 6 inches above the rails. It is said that ever since it was put upon the fast train between New York and Philadelphia, this engine has been making a mile in fifty-seven seconds on up grade with a long train in tow without getting heated. It makes more than a mile a min-

ute and "keeps cool." Of course there is a great consumption of fuel. In 180 miles 12,000 pounds of coal are used up. The water tank contains 3,000 gallons, 400 more than is usually carried. Everything else is on a proportionately large scale. Only the delay in getting boilers sufficiently large has prevented the completion of two others of nearly the same pattern.

NOVEL CANDLESTICK.

The engraving shows a candlestick which has a candle receptacle formed of elastic fingers capable of fitting candles of different diameters, and it has a case for matches contained within a hollow pillar supporting the candle receptacle.

NOVEL CANDLESTICK.

The hollow pillar bearing the candle receptacle is permanently fixed to a base plate, and the match case, which is entirely separate from the other parts, is introduced into the pillar through an opening in the base plate, and kept there by spring catches. It is readily removed to expose the matches.

This invention has been patented by Mr. M. Brassill, of Hartford, Conn.

NEW TELEPHONE TRANSMITTER.

We give an engraving of a new transmitting telephone, patented by Mr. E. Berliner, of Boston, Mass., and owned and made by the American Bell Telephone Company, of that city. Fig. 1 is a front view and Fig. 2 a perspective view showing internal parts.

The instrument is very simple and compact, and has the all important advantage of not being liable to disarrangement.

The principal feature of the invention is the disposition of the carbon contact surfaces, one being attached to the diaphragm, the other being supported by a metal socket attached to a hinged plate secured to an arm that projects from the back of the mouthpiece downward over the diaphragm. This arm serves the double purpose of supporting the free carbon electrode and clamping the diaphragm in its place against the back of the iron mouthpiece. The diaphragm is bound around the edges with soft rubber, and is separated from the mouthpiece by a ring of pasteboard. The iron mouthpiece is hinged to a casting fastened to the circular box which contains the induction coil and supports the binding screws for the battery, line, and ground wires. To the front of the induction coil is attached a plate connected with the battery wire, and carrying a spring having in its free end a screw which bears against a spring connected with the center of the diaphragm and acts as a dampener as well as a conductor, through which the current passes to the carbon electrode at the center of the diaphragm. The battery current enters at one of the binding screws, passes through the primary wire of the induction coil, through the spring and carbon electrode at the center of the diaphragm, through the hinged electrode, metallic mouthpiece and its hinge, and back through a binding screw to the battery.

Fig. 1

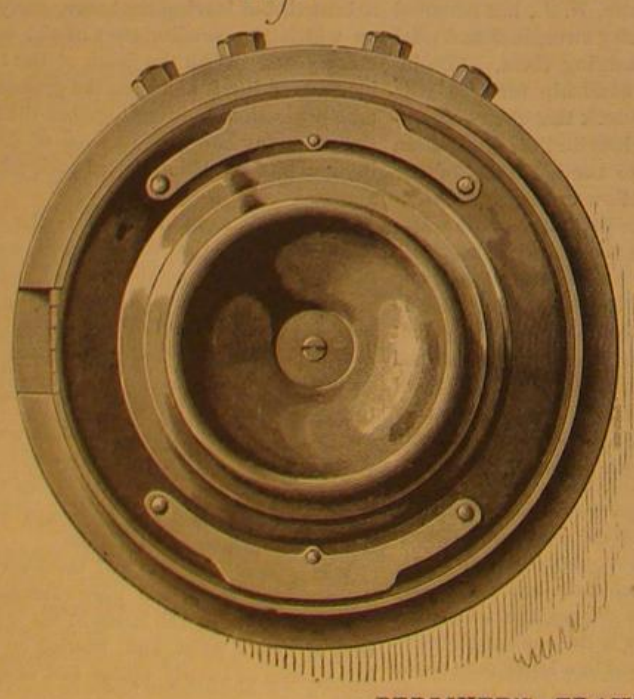
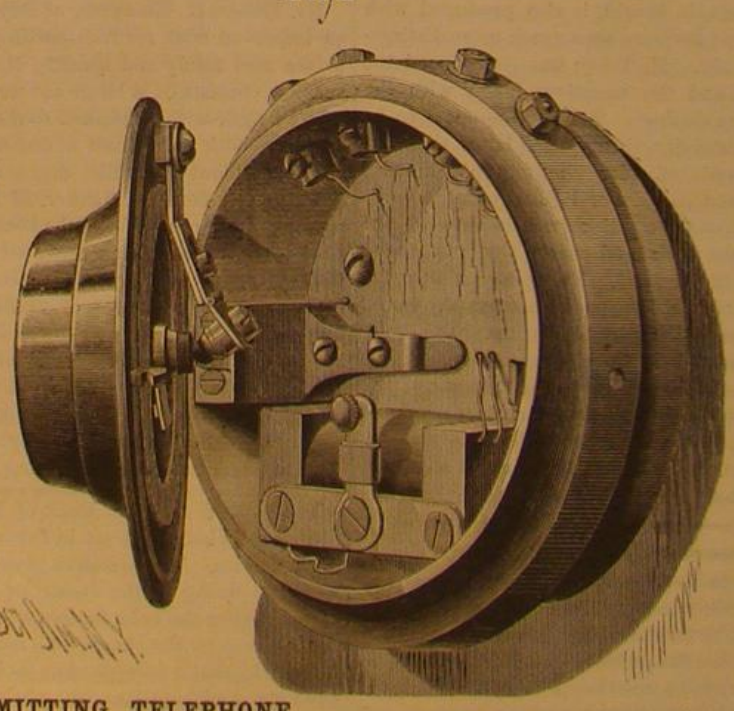


Fig. 2



BERLINER'S TRANSMITTING TELEPHONE.

The variation of the current in the primary circuit occurs at the contact of the two carbon electrodes, the contact being varied by the vibration of the electrode attached to the diaphragm.

When the transmitter is used for long distance telephony, the pendent carbon electrode is made heavier, to reduce resistance in the local current and to amplify the electrical undulations.

The terminals of the secondary wire of the induction coil are connected with the two remaining binding screws, which are connected, one with the ground and the other with the line, in the usual way.

The accessory devices connected with this transmitter may be of the usual character. It will operate well with any of the well known forms of receiver, and is easily managed and thoroughly efficient. This transmitter has been well introduced, and large numbers of them are being used in Europe. They have been adopted on several of the leading German railways, and are extensively used in the German postal service.

100,000 Buffalo Killed Last Winter.

It is estimated by competent authorities that 100,000 buffalo hides will be shipped out of the Yellowstone country this season. Two firms alone, says the *Sioux City Journal*, are negotiating for the transportation of 25,000 hides each. When to this is added the immense amount of skins and furs of other kinds—deer, elk, antelope, bear, beaver, etc.—some idea may be formed of the extent of the Yellowstone pelt and fur trade.

Most of our citizens saw the big load of buffalo hides that the C. K. Peck brought down last season, a load that hid everything about the boat below the hurricane deck roof. There were 10,000 hides in that load, and they were all brought out of the Yellowstone on one trip, and transferred to the C. K. Peck. How such a load could have been piled on the little Terry not even the men on the boat appear to know. It hid every part of the boat, barring only the pilot house and the smokestacks. But such a load will not be attempted again. For such boats as ply the Yellowstone there are at least fifteen full loads of buffalo hides and other pelts. Reckoning 1,000 hides to three car loads, and adding to this fifty cars for the other pelts, it will take at least three hundred and fifty box cars to carry this stupendous bulk of peltry East to market. These figures are not guesses, but estimates made by men whose business it is to know about the amount of hides and furs awaiting shipment.

Nothing like it has ever been known in the history of the fur trade. Last season the output of buffalo hides was above the average, and last year only about 30,000 hides came out of the Yellowstone country, or less than a third of what is there now awaiting shipment.

The past severe winter caused the buffalo to bunch themselves in a few valleys where there was pasturage, and there the slaughter went on all winter. There was no sport about it, simply shooting down the famine-tamed animals as cattle might be shot down in a barnyard.

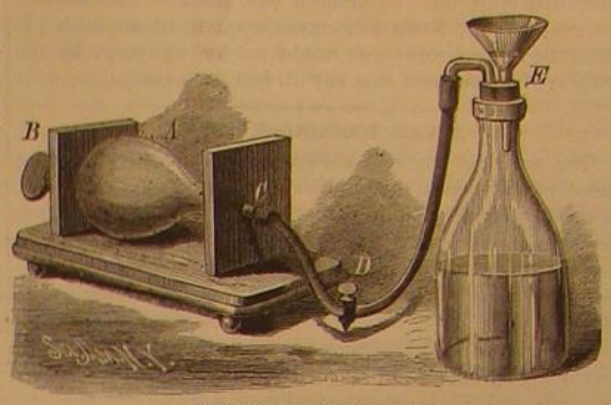
To the credit of the Indians it can be said that they killed no more than they could save the meat from. The greater part of the slaughter was done by white hunters, or butchers, rather, who followed the business of killing and skinning buffalo by the month, leaving the carcasses to rot. When the buffalo are all killed off, as they bid fair to be in a very few years at this rate, then everybody will wonder that the government did not do something to preserve this, the noblest of animal game, or at least prevent the killing of the buffalo for the hides alone.

A SIMPLE FILTER PUMP.

BY JOHN EITEL.

The engraving shows a simple device for accelerating the operation of filtering. It is intended to replace the Bunsen filter pump in many instances, and it consists of a collapsible rubber bulb, A, mounted between two standards and capable of being compressed by the thumbscrew, B. The mouth of the rubber bulb is connected with the filtering bottle by means of a flexible tube provided with a pinch cock, D. The filtering funnel is provided with a small platinum cone which prevents the filtering paper from being drawn downward with such force as to rupture it.

The exhaustion is effected by first expelling the air by turning the screw, B; the flexible tube is then connected and the screw retracted, to produce a partial vacuum. To render the operation continuous the cock, D, is closed when it becomes necessary to again expel the air from the bulb.



A SIMPLE FILTER PUMP.

The Uses of Mica.

The *Tradesman*, referring to the mica beds which have been recently discovered in East Tennessee, adds:

The mica chiefly met with in commerce is of that variety which is proof against acids and intense heat. Its toughness, elasticity, and close approach to transparency naturally led, at first, to its use for windows, and especially to its employment in lanterns. It is found in large quantities in North Carolina, where there are unmistakable evidences that some of the beds were worked a great many years ago. The finer sheets of tough mica are now used for such purposes as the dials of compasses, the lettering of fancy signs, covering photographs, constructing lamp shades, reflectors, etc. Of late, mica has been used in the soles of boots and shoes, as a protection against dampness. The invention consists of a sheet of mica embedded in thin coatings of cement and placed in the boot or shoe between the outer and inner sole, the upper leather lapping over its edges, and covering the upper space from the toe to the instep.

There are many other uses to which mica is put, and it is becoming more and more valuable as the arts and trades progress.

A Monster Cylinder.

There was cast at the Morgan Iron Works, in this city, the other day, what is said to be the largest steam cylinder ever cast. It is 16 feet 1¼ inches long, 110 inches in diameter, and required for its casting 45 tons, or 90,000 pounds, of gun metal. It is intended to accommodate a piston stroke of 14 feet. The metal in the thinnest part is 1¾ inches thick, and the flanges at the top and bottom are 2⅝ inches thick by 5¾ inches wide. Under the top flange the cylinder has a belt 16 inches wide, another 6 inches wide above the bottom flange, and between these two, three more belts, each 6 inches in width. The thickness of the metal at the belts is 2⅛ inches. A nozzle for the upper steam chest is cast on the cylinder, with an opening 14⅛ by 63 inches, the metal on the top of this nozzle being 1¾ inches in thickness, and on the sides and bottom 1⅛ inches.

The casting of this massive piece of work was done in a mould constructed of brick, and lined with loam, the outside being covered with heavy iron plates to prevent the matrix from bursting when the molten metal was poured in. The mould is constructed of one cylinder of brick and loam within another, the space between them being the required thickness of the casting, the flanges, belts, and other parts

of the work being accurately delineated in the matrix. Over half the mould was sunk in the solid earth which forms the flooring of the iron works. It required the metal three hours and twenty minutes to melt, and the 90,000 pounds were then transferred by the labor of 100 men to two huge tank ladles, each having a capacity of about 15 tons, and two large crane ladles. The tanks were connected with the mould by pipes, and the crane ladles were attached to huge cranes.

At 1 o'clock John Roach, who personally supervised the casting, gave the order to begin the pouring. The molten metal was turned into the mould from the two tanks on either side, and at the same time the two crane ladles were swung over, and from all four a red stream of liquid metal began to flow into the matrix. It took precisely two and a half minutes to complete the pouring and fill the mould. The operation was watched very attentively by Mr. Roach and his foreman, and when it was completed both pronounced the casting to have been successful.

The cylinder is intended for a new iron side-wheel steamer building for the Old Colony Steamboat Company, for the Long Island Sound.

THE LEMUR VARI.

Lemur is the name applied to many animals of the order *Quadrumana*, or monkeys, of the families *Galeopithecidæ* and *Lemuridæ*.

The fingers are not all provided with flat nails, some of them terminate in claws. They stand with difficulty, and their gait is generally like that of a quadruped. They have no pouches; their nostrils terminate in folded elastic sides, which permits of opening and closing them at pleasure. The incisor teeth are separated by vacant spaces, and the molars provided with sharp conical points adapted to tearing. The lemurs live principally upon fruits and roots, and are fond of insects; if they eat flesh at all it is in very small quantities. If the physical conformation of the lemur is similar to that of the carnivorous animals, their habits place them among the monkeys, and like them they live habitually upon the trees in the midst of the foliage. There, concealed and suspended by their lower members, they watch for their prey. If an insect comes within reach it is the work of an instant to catch and devour it.

The lemurs comprise five principal genera, almost all natives of the island of Madagascar or the adjacent countries. The *indri*, one of the largest species, are tamed by the natives of Madagascar, and being very agile are trained like dogs for the chase. The *loris* have no tails, a characteristic which distinguishes the other species. There are also *ga'agos*, *tarsiers*, and *makis;* these last are subdivided into many species: the *macoco*, the *mongoux*, and the *vari*. The animals represented in our engraving belong to the species *vari* of the genus *maki*. They are remarkable for their lank forms, their long bushy tails, the ruff around their faces, and their peculiar eyes, large and round, which give them the ghostly appearance to which they owe their name.

It is known that the Romans believed that lemurs were malevolent spirits who returned at night to the earth to torment the living, and that they instituted special ceremonies with the design of removing them. "Lemurs, gods of the infernal regions, come out of this abode." But one has never been tempted to address this objurgation to the lemur vari, notwithstanding his name and astonishing appearance, because he is gentle, sociable, fawning, and attaches himself quickly to persons who care for him and treat him well.—*L'Illustration.*

A New Species of Aphis Affecting the Pine.

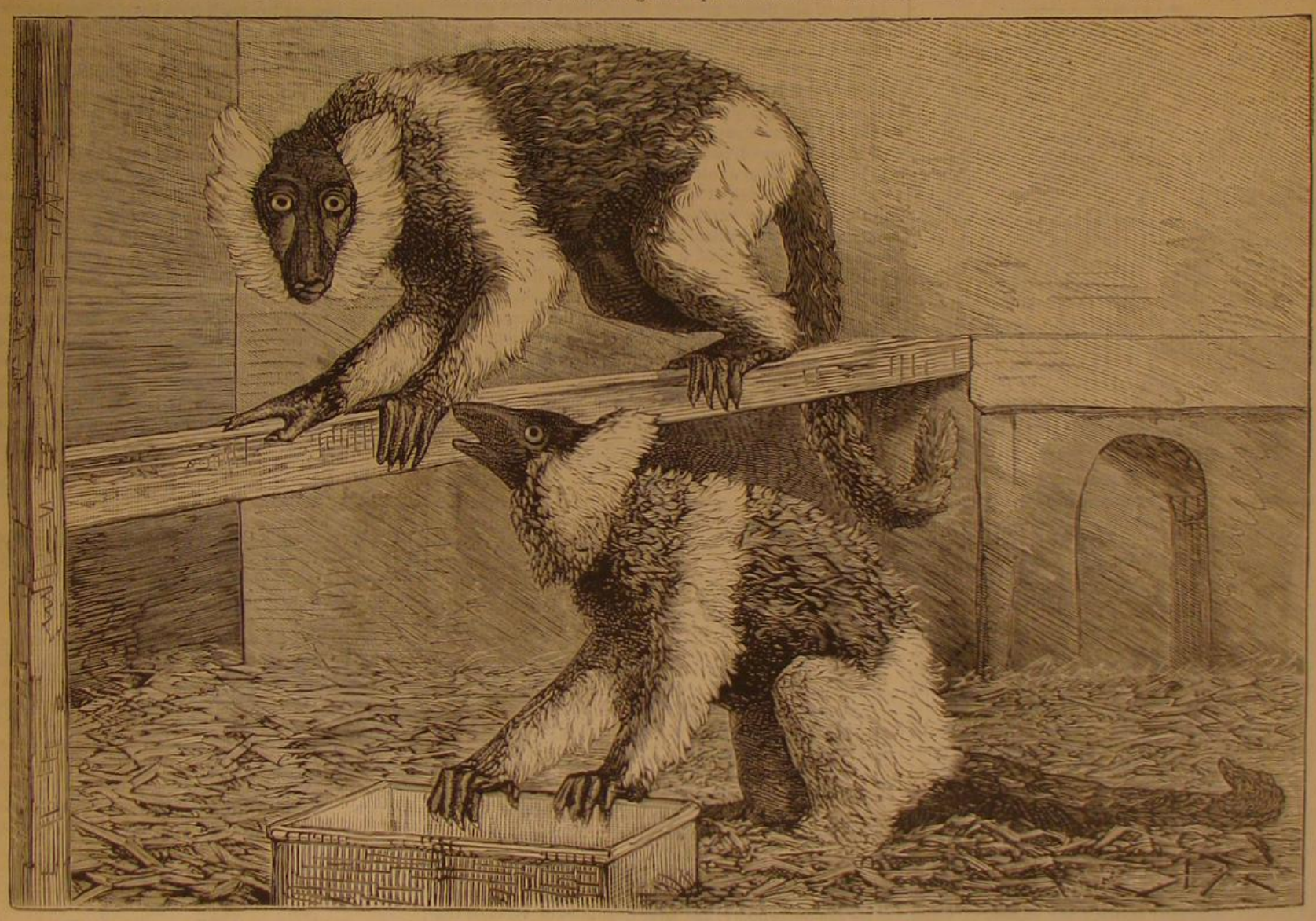
Among our native forest trees, none, unless it is the oak, suffer more from the depredations of insect enemies than the pine. Distributed as it is—from the Arctic to the tropics—climatologically speaking, it becomes a prey to every conceivable form of insect life.

Already its enemies may be reckoned by hundreds; but notwithstanding this, hardly a year goes by without some careful investigator adding others to the list. It is not the intention of the writer to enter into full details or enumerate all of its foes, but to call the attention of entomologists to a new aphis affecting a pine in Florida, that has evidently been overlooked by others.

For the past two years we have detected numerous large brown plant lice upon the common pine of this region (*Pinus australis*), which for want of time we have left unmolested. They cluster together upon the new and tender branches, which they puncture with their remarkably long beaks, causing the sap to exude and the branch upon which they exist to become gummy and sticky. In their habits they are suprisingly shy and timid. On disturbing them they invariably seek safety by hiding between the needles of the pine; indeed, even on hearing approaching footsteps, we have observed them cling closer to the limb, while a few skelter off where the needles are denser.

In looking up literature on the subject, we find several species of aphides described and mentioned as existing upon pines, but none on *Pinus australis*, nor will any of the descriptions agree with the species under consideration. It belongs to the section *Lachnini*, as defined by Thomas, and we therefore propose for it the name of *Lachnus australi*.

* By Wm. H. Ashmead, of Jacksonville, Fla., in *Canadian Entomologist.*



THE LEMUR VARI.

The Spring Flower Trade.

The *Sunday News* has been making inquiries with respect to the spring flower trade of this city, and finds that it opened the second week in April, and will last until the beginning of June. A prominent florist estimates that three hundred wagon loads of flowering plants are brought to the city during the period of the spring trade, and that as much as $2,000,000 is spent every spring in New York and Brooklyn for plants and flowers.

The flowers come from all around New York. In New Jersey, Staten Island, Long Island, and the adjoining counties of this State are vast flower and plant farms, each of which represents a fortune to its owner. Over in Astoria one floriculturist has over two acres of ground under glass, and there are several others like him and many less extensive, but still very large growers. These raisers have each their special varieties and graftings of plants, and in addition to their New York trade, ship all over the country. San Francisco, Montreal, and Savannah are profitable markets to them, and in every town and city of the United States they have customers. In addition to these extensive culturists, who raise the rarest and costliest exotic plants, as well as the commonplace market flowers, there are many smaller ones, who raise flowers for the spring trade and the winter supply of the bouquet makers almost exclusively.

In addition to the big flower and plant farms at Flatbush, Astoria, Union Hill, and Orange, there are many minor ones scattered all over the suburbs, and even in the city itself. One popular one is in Fourteenth street near Third avenue, and another occupies the corner of Houston and Hudson streets. Within a radius of thirty miles from the City Hall, there is at least $10,000,000 invested in the business.

To enumerate the varieties of plants and flowers sold in the spring trade this year would require a census of the globe in that line. The gardeners are constantly adding foreign varieties to their stocks, and the gardens of India, China, and the Sandwich Islands contribute to the store New Yorkers select from. The heaviest sales are, of course, in the cheaper varieties of plants. The familiar roses, geraniums, fuchsias, heliotropes, pansies, daisies, hydrangeas, laburnums, verbenas, petunias, violets, carnations, and mignonettes are sold by the hundreds of thousands. Ivies, passion flowers, and other vines have an immense sale too. Ferns, native and tropical; strange grasses from the sun-smitten natural gardens of South America, and orchids from the mysterious forests of the Equator swell the list. The catalogues the flower men publish would put those of many a library to shame, for size at least.

A dealer said that the largest profit is made on cheap plants, the number of them sold is so great. The heavier gains are made by the owners of city greenhouses, who raise fine plants, and are able to sell them without the intervention of middlemen.

The trade in flower and vegetable seeds at this season almost rivals that in plants and flowers. The flower seeds are largely imported from France and Germany, a few coming from England and Holland. The vegetable seeds, on the contrary, are grown in the New England States, New York, Canada, and other sections of the continent, and are exported so as to almost balance the imports of flower seeds. American vegetable seeds are much better than those grown in Europe and produce better results. They are popular abroad in consequence.

Silk Culture in Louisiana.

Efforts are being made in Louisiana to attract to that State the silk growers of Provence, whose prospects in France have been blighted by plagues affecting grape vines and silk

worms. Specially promising are the opportunities held out in connection with silk growing. One of the better known silk growers of Louisiana, Mr. L. S. Crozier, says that not only are the silk worms of that State entirely free from disease, but the mulberry grows so rapidly that, instead of waiting five years for the first crop of cocoons, the careful planter can begin to feed worms the first year after planting.

The prospects for this spring's hatching are said to be very encouraging. The frosts of the past winter did not hurt the trees, and the worms are doing nicely. Some are nearing the last moult, and others are yet not hatched. All are healthy. One good tree will feed enough worms to produce seven pounds of silk, and ten pounds of leaves will produce one pound of silk. One ounce of good eggs will produce enough worms to eat 1,200 pounds of leaves. They cost from 50 cents to $6 per ounce. Thus, at $5 per pound for silk, the allowance for labor and expense is very large. The secrets of silk culture are pure air, warmth, dryness, and proper food. That the climate is warm enough in Louisiana is proved by the fact that a lot of 1,500 silk worm eggs were wintered at the outside temperature by Mrs. Leywaud, and are now hatched. The mulberry tree flourishes and the workers are careful. When it is wet they keep a fire in the house of the silk worms, and dry the leaves on the branches cut from the tree before they spread them on the worms. They avoid the dew, and it is a rule to have two meals of leaves in advance. The State, it is believed, has great advantages over European countries in the matter of raising the mulberry.

Silk Culture in Pennsylvania.

The Pennsylvania House of Representatives lately gave a hearing to the Women's Silk Culture Association touching the aims of the association. Mrs. John Lucas, president of the association, said that its main object was to instruct the women and children of the working classes in the management of silk worms and the proper treatment of the cocoons for the production of silk, by means of which they would be provided with light, agreeable, and remunerative employment. The advantages presented by this country for silk culture were enlarged upon, as well as the great benefit that would accrue to all classes of society by the proper encouragement and development of the silk industry. Several other lady officers of the association discussed the purposes, methods, and prospects of silk culture, hoping to give the legislators such a favorable impression of the operations of the society as to secure a small appropriation for the enlargement of the work. At the conclusion of the addresses the members examined the specimens of cocoons which the ladies had with them, one case of which was raised by Mrs. Taylor, mother of the late Bayard Taylor, who is eighty years of age.

Photometry by the Photographic Method.

It is announced that M. Janssen has made a promising advance in the application of photometrical methods to the precise measurement of the intensity of light, the process adopted being equally applicable to strong or feeble light, and needing only the presence of one light source at the time of measurement. M. Janssen's photometer consists essentially of a frame with a sensitized plate, before which, and in the path of the light rays to be measured, a perforated screen is caused to pass with a known rate of uniform motion. If the perforations were rectangular, in the form of slits, a uniform shade would be produced on the plate; but, by making them triangular, a variation of shade is obtained, decreasing in depth from the side corresponding to the base of the triangles to that corresponding to the apex. To compare two luminous sources with each other, each source is made to act successively on two similarly prepared plates in the instrument, when the points of equal shade in the two plates indicate the ratio of intensity. There is no difficulty in obtaining and testing by the same instrument the exact ratio of sensibility between any number of plates, so that absolute reliability may be placed upon the equality of the conditions under which the tests are made. It is stated that this photometer is so delicate, and at the same time capable of such universal application, that M. Janssen has succeeded in comparing the light of the sun with that of various stars, and has compiled a table to express the illuminating power of the latter in terms of the former. In this way it is expected that a definite solar scale might be constructed, to which all artificial lights might be referred.

A New Process of Decorative Printing.

In a recent letter from Italy to the *Times* Mr. James Jackson Jarves says that a good deal of interest is being shown in Florence in regard to a new process of printing on satin for decorative screens, panels, hangings, etc. The process is the invention of a Signor Gutman, whose subjects are chiefly the brightest-hued birds and flowers, amid tropical foliage, ferns, and other graceful plants. They are skillfully done, Mr. Jarves says, and very striking on first appearance, but altogether too gaudy in general effect and lacking harmonious combination of colors. They would be painful to the eye to look at long, and would kill everything else in the room as to tints, producing intensely disagreeable discords of coloring. Yet, judging from the remarks of the press, it would seem as if this new system of decorative work would soon become all the fashion in Florence. The Orientals, and especially the Japanese, understand how to combine brilliancy with harmony in ornamentation, giving variety and animation to objects without violating those principles of æsthetic repose which are the alpha and omega of decorative art. Instead of this, in these works we have exaggerated garish compounds and contrasts, irritating to the senses and destructive to good taste. As the process is patented, no doubt cheap reproductions, done in a mechanical way, will soon be seen in America.

The Coarser Varieties of Timber.

An eminent philosopher, passing through a low attic upon one occasion, carried his head so loftily as to strike the collar beams which strengthened the rafters, whereupon a friend, who was with him, remarked that he who looked too high would not only run the risk of breaking his head, but would lose sight of a vast amount of beauty, which could be found only upon a lower level. That this truth applies to the experiences of every-day life is shown in the tendency of human nature to search for gold and diamonds because of a supposed superior reputation and value, leaving to the plodder and economist the task of looking for the baser metals of greater economic value. This truth applies with equal force to the searchers after wealth in the forest productions of the United States. The pine and the oak, together with black walnut and maple, have been the gold toward which the lumberman has turned his eager eyes, and they have turned his vision away from the humbler, yet not less valuable, sources of forest wealth which exist in the hemlock, black ash, and beech, with which our forests abound.

In one of the timber growing States, there is now an estimated wealth of $87,500,000 in the growing pine timber, estimated at an average value of $2.50 per thousand feet for the standing tree. This is a vast source of wealth to the State in which it is growing, yet in the same State, unhonored and most lightly esteemed, even to such extent that its wanton destruction passes unnoticed, are to be found fully 7,000,000,000 feet of hemlock, which, in the near future, will be sought for at a price scarcely below the present value of the pine, for which it will be utilized as a most excellent substitute in many of the coarser uses of lumber. This hemlock is to-day utilized only in the production of bark for tanning purposes, and it bears to the timber wealth of the State only about the same relation that the hordes of buffalo upon our Western plains bear to the meat supply of our nation, as they are slaughtered by the thousand and stripped of their pelts for the use of the civilized world, while the carcass is left to the vulture, regardless of the fact that a race is being exterminated which can never again be propagated. The hemlock tree of the Northwest, like the buffalo of the plains, possesses a value, the extent of which will be realized only after the process of wasteful extermination has done its worst and no more remains to be utilized. The hemlock in one State, if placed at a value which it will bear before the expiration of five years from this date, would bring to its owners not less than $14,000,000; at the value which is placed upon it to-day it is worth not less than $2,000,000, and, in the endeavor to utilize the bark, the trunk of the tree, which might also add to the wealth of its owner, is left to rot upon the ground or to feed the insatiate forest fires which sweep away so much of our forest wealth every year.

But another despised factor presents yet more astounding revelations of timber wealth. Thousands upon thousands of acres of hardwood timber are yearly destroyed in the clearing of land for farms and the burning up of the forest growths which they contain. The hardwood of the State in question, if valued at but 25 cents per cord, is of the value of $175,000,000, or twice as much as the value of the pine timber. And yet but little account, comparatively, is made of this vast source of wealth. The furniture factories of a mighty nation, the vast commercial industries of the world, are ready and willing to pay the gold for this timber, which, to a great extent, is suited to their needs: yet its owners fail to see the opportunity, and large quantities of valuable timber are consigned to the flames. The time is near at hand when a wiser policy must and will prevail, and the modest yet valuable timber growths now neglected for the more pretentious and popular pine, will receive the attention which they merit; and those who now esteem the gold mines more highly than they do the iron, will discover that in the latter is a more enduring source of wealth, toward which they will gladly turn while seeking the high road to prosperity.

The proneness of the human mind toward entering those avenues which give promise of sudden wealth is too well known to need comment. The land of gold will attract thousands; the discovery of iron excites hardly the slightest comment. Yet the iron is actually the more valuable in its adaptation to the wants of man, and in its ulterior effect in adding to his wealth. The careful, earnest, saving plodder of 25 years ago is the rich man of to-day, while the sons of his millionaire employer of the former time are his clerks, his porters, and his draymen. That which is common in every-day experience is neglected by the multitude in the mad rush after wealth, but the sons of the rag-picker and scavenger of to-day will perhaps be the merchant princes of the next generation, the foundation for their immense wealth being based upon the humble and despised occupation which by the multitude is neglected. These truths of every-day experience apply to the now neglected timber wealth of this country, and a wise conservation of the despised hemlock and hardwood growths of our forests will result in the accumulations of wealth far greater in extent than are the colossal fortunes which have been made by the operators in pine timber and lumber.—*Northwestern Lumberman.*

The Drawing Out of Glass Tubes.

The Bunsen blast lamp is generally used in the accomplishment of this object, although in case of necessity the common Bunsen burner, or a round compound burner, may be employed, taking care, however, to observe the previously mentioned precautions. The tube should be held between the first three fingers of each hand, in the flame, and continually turned until it becomes sufficiently soft as to bend easily; it is then quickly taken out of the flame and drawn out, the rotary motion being kept up. The axes of the two drawn out portions must be held in a straight line, otherwise sharp points will be obtained. Very much depends on the care with which the tube has been softened; when thick tubes are used, they should be turned with great regularity. The object of this turning is to avoid uneven softening; the lower portion of the flame is, of course, hotter than the upper portion, and so when the tube is drawn out, the lower portion being softer, would yield first, and the result would be an uneven drawing out. When the tube has completely cooled, the drawn out portion is cut at the desired point with a sharp glass knife. Then taking a file, the projecting points are filed off, and the opening may be narrowed as desired by melting the cut in the flame. Here, also, we must carefully and regularly rotate the tube in the flame, or else the end will bend of its own weight. If the orifice has become too small from having been held too long in the flame, or if it has closed altogether, it may be opened by carefully touching the cut with the flat side of a file; of course only after the tube has been completely cooled. In fact, for many purposes this latter method is considered desirable, especially when a gas, such as hydrogen, is to be burned from the end.

The advantage of this process is that the thin sides of the tube are thickened by the fusing, and so are better able to resist the heat produced by the burning gas. The fusing of the point of the tube is sometimes prevented by platinizing it. This is effected by dipping it into a solution of platinum chloride, so that a drop or two of the fluid adheres to the tube. The point, in heating, acquires a fine metallic luster. By repeating this operation several times, a good coating of metallic platinum will be produced both on the exterior and the interior of the tube. This method is recommended in connection with the development of arseniureted hydrogen gas in the Marsh test for arsenic. When a point is desired having a very small opening, it is considered advisable to first fuse the ends and then open them with a file to the required size.—*M. B., in Journal of Education.*

Annual Meeting of the Women's Silk Culture Association.

The Women's Silk Culture Association lately celebrated in Philadelphia its first anniversary, and was able to give an encouraging report of its first year's operations. Touching the financial aspects of the industry the report was decidedly hopeful.

"The demand for the raw material, its constant increase, its value to our country, has already been proven. There is another valuable item of wealth. The ready market is at our doors; a price has been offered for all pierced cocoons, formerly waste, to be used with approved machinery in the manufacture of spun silk. As soon as the American people prove that they are ready to raise cocoons the filatures of the country will be put into operation. Cocoons are worth a price ranging from $1.50 to $2.50 per pound, pierced cocoons at $1.80 per pound, and eggs from $4 to $5 per ounce."

Further on the report said: "Up to this date trees and cuttings, in quantities from five to hundreds, have been sent into fifteen different States, and eggs, to the amount of many ounces, sent into twenty different States. This is a beginning at least, and these experiments will lead to others, until the hope is all our States and counties will soon present at their annual fairs, among other agricultural products, their quota of *cocoons and silk*. This year has gained for us new hopes, new ideas, fresh knowledge, familiarity with the need of the people and the needs of the association, and last, but not least, we hope, new friends."

After the reading of the reports the following important communication was received:

"*Mrs. John Lucas, President Silk Culture Association.*

"MADAM: In order to encourage the culture of silk among the people directly tributary to Philadelphia, we will offer through your society a series of prizes for the best four pounds of silk cocoons raised in the States of Pennsylvania, New Jersey, Delaware, and Maryland, the awards to be made according to the judgment of a person or persons selected by the society.

"We propose to give $500 in premiums, as follows: $200 for the best pound of cocoons, $150 for the next best, $100 for the third in quality, and $50 for the fourth. We desire the society to arrange all the preliminaries, and the only active part we wish to take would be to pay over the money to the winners of the prizes.

"Yours respectfully,

"STRAWBRIDGE & CLOTHIER."

The Silk Culture Association is to select the judges, who will decide upon the cocoons when they are offered in competition.

The Dark Day in Canada.

In some interesting and graphic reminiscences of Montreal sixty years ago, Mr. J. H. Dorwin writes to the Montreal *Star* as follows:

"What was the strangest occurrence of that time, or rather the strangest thing that ever happened in the history of this country, was what has been always known as the 'Phenomenon of 1819.' On the morning of Sunday, November 8, 1819, the sun rose upon a cloudy sky, which assumed, as the light grew upon it, a strange greenish tint, varying in places to an inky blackness. After a short time the whole sky became terribly dark, dense black clouds filling the atmosphere, and there followed a heavy shower of rain, which appeared to be something of the nature of soapsuds, and was found to have deposited after settling a substance in all its qualities resembling soot. Late in the afternoon the sky cleared to its natural aspect, and the next day was fine and frosty. On the morning of Tuesday, the 10th, heavy clouds again covered the sky, and changed rapidly from a deep green to a pitchy black, and the sun, when occasionally seen through them, was sometimes of a dark brown or an unearthly yellow color, and again bright orange, and even blood red. The clouds constantly deepened in color and density, and later on a heavy vapor seemed to descend to the earth, and the day became almost as dark as night, the gloom increasing and diminishing most fitfully. At noon lights had to be burned in the court-house, the banks, and public offices of the city. Everybody was more or less alarmed, and many were the conjectures as to the cause of the remarkable occurrence. The more sensible thought that immense woods or prairies were on fire somewhere to the west; others said that a great volcano must have broken out in the Province; still others asserted that our mountain was an extinct crater about to resume operations and to make of the city a second Pompeii; the superstitious quoted an old Indian prophecy that one day the Island of Montreal was to be destroyed by an earthquake, and some even cried that the world was about to come to an end.

"About the middle of the afternoon a great body of clouds seemed to rush suddenly over the city, and the darkness became that of night. A pause and hush for a moment or two succeeded, and then one of the most glaring flashes of lightning ever beheld flamed over the country, accompanied by a clap of thunder which seemed to shake the city to its foundations. Another pause followed, and then came a light shower of rain of the same soapy and sooty nature as that of two days before. After that it appeared to grow brighter, but an hour later it was as dark as ever. Another rush of clouds came, and another vivid flash of lightning, which was seen to strike the spire of the old French parish church and to play curiously about the large iron cross at its summit before descending to the ground. A moment later came the climax of the day. Every bell in the city suddenly rang out the alarm of fire, and the affrighted citizens rushed out from their houses into the streets and made their way in the gloom toward the church, until Place d'Armes was crowded with people, their nerves all unstrung by the awful events of the day, gazing at, but scarcely daring to approach the strange sight before them. The sky above and around was as black as ink, but right in one spot in mid-air above them was the summit of the spire, with the lightning playing about it shining like a sun. Directly the great iron cross, together with the ball at its foot, fell to the ground with a crash, and was shivered to pieces. But the darkest hour comes just before the dawn. The glow above gradually subsided and died out, the people grew less fearful and returned to their homes, the real night came on, and when next morning dawned everything was bright and clear, and the world was as natural as before. The phenomenon was noticed in a greater or less degree from Quebec to Kingston, and far into the States, but Montreal seemed its center. It has never yet been explained."

Wandering Needles.

The London *Lancet* observes that the vagaries of needles which have been introduced in the body, and have escaped immediate removal, have in all ages attracted the attention of collectors of the marvelous in medicine. Hildanus related an instance of a woman who swallowed several pins and passed them six years afterward; but a more remarkable instance of prolonged detention was recorded by Stephenson, of Detroit—that of a lady, aged seventy-five, who last year passed by the urethra, after some months' symptoms of vesical irritation, a pin which she had swallowed while picking her teeth with it in the year 1835—forty two years previously. Occasional pain in the throat was the immediate symptom, but in 1845 she was seized with severe gastric pain, which passed away, and she had no symptoms until hæmaturia in 1876. This curious tolerance of such foreign bodies exhibited by the tissues is often observed in lunatic asylums. M. Silvy recorded some years ago the case of a woman who had a penchant for pins and needles so strong that she made them, in effect, part of her daily diet, and after her death 1,400 or 1,500 were removed from various parts of the body.

Another case almost as striking has been recorded by Dr. Gillette—that of a girl in whom, from time to time, needles were found beneath the skin, which they perforated, and were removed by the fingers or forceps. Concerning the way in which they had got into her system no information could be extracted from her. She was carefully watched, and in the course of eighteen months no less than 320 needles were extracted, all being of the same size. Most were black and oxidized, but some had retained their polish. The majority were unbroken. They passed out of various parts of the body above the diaphragm at regular intervals, but in a sort of series and always in the same direction. The largest number which escaped in a single day was 61. A curious phenomenon preceded the escape of each needle. For some hours the pain was severe, and there was considerable fever. She then felt a sharp pain, like lightning in the tissues, and on looking at the place at which this pain had been felt, the head of the needle was generally found projecting. The needles invariably came out head foremost. No bleeding was occasioned, and not the least trace of inflammation followed. The doctor in attendance extracted 318. They were sometimes held firmly, and seemed to be contained in a sort of indurated canal. It was conjectured that they had been swallowed with suicidal intentions; but, on the other hand, the way in which the needles escaped in series, and their direction with the head outwards, suggested that they had been introduced through the skin.

That little weight is to be attached to the pace at which the needles escape as proof of their mode of introduction is evident from a case recorded by Villars, of a girl who swallowed a large number of pins and needles, and two years afterward, during a period of nine months, 200 passed out of the hand, arm, axilla, side of thorax, abdomen, and thigh, all on the left side. The pins, curiously, escaped more readily and with less pain than the needles. Many years ago a case was recorded by Dr. Otto, of Copenhagen, in which 495 needles passed through the skin of a hysterical girl, who had probably swallowed them during a hysterical paroxysm; but these all emerged in the regions below the level of the diaphragm, and were collected in groups, which gave rise to inflammatory swellings of some size. One of these contained 100 needles. Quite recently Dr. Bigger described before the Society of Surgery of Dublin a case in which more than 300 needles were removed from the body of a woman who died in consequence of their presence. It is very remarkable in how few cases the needles were the cause of death, and how slight an interference with function their presence and movement cause. From time to time their detection by a magnetic needle is proposed as a novelty; but, as Dr. Gillette reminds us, this method was employed by Smee nearly forty years ago, and has often been adopted since.

Coca (*Erythroxylon coca*).

In Mr. Markham's "Peruvian Barks," recently published, he has given the results of his own observations, and collated that of other travelers, respecting this substance, and to this account we are chiefly indebted for the following facts:

"Coca," the "beloved narcotic of the Peruvian Indian," was first named botanically through the labors of Joseph de Jussieu. The history of this noted botanist is a melancholy one. He left France in 1735, in the ever memorable expedition of La Condamine, and after M. La Condamine left South America, M. Jussieu continued his botanical researches, making numerous journeys on foot, notably those to the cinchona regions. The results of fifteen years' labors were contained in certain cases of dried plants, etc., and a native servant at Buenos Ayres, thinking these cases contained money, stole them, and this loss had such an effect on poor Jussieu that he returned to France in 1771 deprived of reason.

The coca is the great source of comfort and enjoyment to the Peruvian Indian. It is to him what the kava-kava is to the South Sea Islander, the betel to the Hindoo and Malay, and tobacco to the rest of mankind, but with this difference, it produces invigorating effects. The Peruvian Indian looks upon coca with veneration. In the palmy days of the Uncas or Yncas, coca was sacrificed to the sun, the high priest or Huillac Umu chewed it during the ceremony, and before the arrival of the Spaniards, coca was used in lieu of money. After the Spanish conquest, much was done to prescribe its use, because as a council of bishops held in 1569, said it was a "useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians, that the habit of chewing coca gave them strength, which is an illusion of the devil." Coca, indeed, from its popularity, being used by about eight millions of people, has always had a great commercial importance, and one viceroy, Don Francisco Toledo, issued no less than seventy ordinances concerning coca in the space of four years (1570–1574).

The coca plant is a shrub of four to six feet high, with straight and alternate branches and leaves like those of the tea plant, and is cultivated at elevations of from 5,000 to 6,000 feet above the level of the sea in the warm valleys of the eastern slopes of the Andes. Here the only alternations of climate is from wet to dry, frost is unknown, and it rains more or less every month of the year. The seeds are sown on the surface of the soil as soon as the rainy season commences, and begin to sprout in a fortnight, being carefully watered, and protected from the sun by a thatched roof. The following year the seedlings are transplanted in a soil carefully broken up and freed from weeds. The ancient custom was to raise the plants in terraces on the hillsides, but now plantations on the level ground are resorted to, although Indians aver that plants raised under the former conditions yield a much superior quality of leaf. At the end of eighteen months the first harvest is ready, and the picking of the leaves, performed by women and children, is very carefully proceeded with, so as not to injure the young and still tender shoots. As soon as one crop of leaves is removed, if well watered, and the ground carefully weeded, another crop is ready in about forty days. A plant continues to yield for about forty years, and Dr. Poeppig gives the profit of a coca plantation as about 45 per cent. Each picker carries a piece of cloth, in which the leaves, plucked one by one, are placed. These leaves are then taken to the drying yard, formed of slate flags. Here the leaves are spread out in thin layers, and carefully dried in the sun. Too much exposure to the sun spoils the flavor of the leaf, and if heaped too much together, the leaves ferment and become fetid. As soon as dried, the leaves are packed in bags made of banana leaves, with an outside covering of cloth, or packed tightly in larger parcels of about 50 lb. each.

In the Sandia district of Caravaya, two varieties of coca are recognized, the Ypara and the Hatun Yunca, the latter having a larger leaf than the former.

In Bolivia, coca is treated as a government monopoly, and the right is generally farmed out. In 1850, coca brought into that country's exchequer a sum of $200,000. The whole yield of coca in South America is estimated at thirty millions of pounds. Coca soon deteriorates in keeping, and Indians treat it as valueless if kept longer than seven months.

Such is the faith in coca, that it is believed if a dying man can but taste a coca leaf when placed on his tongue, his future bliss is assured. No Indian is without his *cuspa* or coca bag made of llama cloth, and three times a day, sitting down, he takes leaf by leaf and rolls them up in his mouth till he forms a ball. Then applying a small quantity of powder consisting of carbonate of potash, made by burning the stalks of the quinoa plant, mixed with lime and water, he goes on his way rejoicing. The use of coca is widely spread. The shepherd on the cold slopes of the Andes has but this and a little maize as his sole nourishment, and the runner messenger looks to it as his solace and support. As to the properties of coca, it seems very evident that it allows of a greater amount of fatigue, with a lesser amount of nourishment, and prevents difficulty of respiration in ascending steep mountain slopes. It has an agreeable and aromatic taste, accompanied by a slight irritation, which excites the flow of the saliva. When made into a tea, in taste it is like that of green tea, and effectually prevents drowsiness. Applied externally as a poultice, it moderates rheumatic pains, brought on by exposure to cold and wet, and also cures headache.

Mr. Markham chewed coca leaf very frequently, and states that he found it to produce an agreeable soothing feeling, that he could endure longer abstinence from food with less inconvenience, and that when using it, he could ascend precipitous mountain sides with a feeling of lightness and elasticity, and without losing breath. He also considers it the least injurious of all other like substances, even when taken in excess, and at the same time the most soothing and invigorating.

The Wax Palm in Pernambuco.

The Camanba palm (*Copernicia chifera*) seems to be a much more important plant in some parts of Brazil than is generally supposed. In Pernambuco the plant is very abundant, and the uses to which it is put very numerous. The wood, for instance, is used for roofing, both as beams or rafters, and as laths upon which to support the tiles; the fruits are used for feeding cattle, and the leaves are used for making hats and mats. A valuable medicine is obtained from the roots, which has recently been brought to notice in this country. From the shoots or leaves a wax is obtained; for this purpose they are cut before they unfold, dried in the sun, powdered, and boiled, the wax rising to the surface of the water. This wax, it is stated, is not produced in anything like the quantity that it might be. It is shown, in a recent report of Her Majesty's Consul at Pernambuco, that the export of this wax during 1875–76 amounted to 18,668 kilos, valued at £758; in 1876–77, to 171,980 kilos, valued at £6,957; in 1877–78 it fell to 89,482 kilos, of the value of £3,168; and in 1878–79, to 1,542 kilos, valued at only £61. By far the largest portion of this wax finds its way to this country. It is shown that the decrease during the last year was due to the famine and drought which so severely crippled all industry in the province. It is not a little remarkable that, at a time when roasted date stones are proposed as a substitute for coffee, we should also learn that the stones or seeds of the Camanba palm, when roasted, are used in Pernambuco as coffee.

Sleep and Sleeplessness.

Dr. J. M. Granville, in his work on this subject, says, with reference to the difficulty some persons find in getting to sleep: "Habit greatly helps the performance of the initial act, and the cultivation of a habit of going to sleep in a particular way, at a particular time, will do more to procure regular and healthy sleep than any other artifice. The formation of the habit is, in fact, the creation or development of a special center, or combination, in the nervous system, which will henceforward produce sleep as a natural rhythmical process. If this were more generally recognized, persons who suffer from sleeplessness of the sort which consists in simply being 'unable to go to sleep,' would set themselves resolutely to form such a habit. It is necessary that the training should be explicit and include attention to details. It is not very important what a person does with the intention of going to sleep, but he should do precisely the same thing, in the same way, at the same time, and under as nearly as possible the same conditions, night after night for a considerable period, say three or four weeks at least."

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.

NEW BOOKS AND PUBLICATIONS.

HENDERSON'S HAND BOOK OF PLANTS. By Peter Henderson. New York: Peter Henderson & Co.

Something between a florist's and gardener's manual and a botanical dictionary, paying special attention to such plants and flowers as may be cultivated in this country. A multitude of cross references, giving the common and local names of plants, are a valuable feature of the book, the scope of which embraces also the systematic names of all the leading genera of useful and ornamental plants, with their more important species and varieties, with brief instructions with regard to their propagation. The glossary of botanical and horticultural terms and methods of cultivation is full and useful.

THE WOOL CARDER'S VADE MECUM. By William Calvert Bramwell. Hyde Park, Mass. 1881. Published by the author.

The third and much enlarged edition of Mr. Bramwell's useful manual. Among the additions are three chapters on textile fibers used in connection with wool. The book is now, in general make up, perhaps the handsomest industrial handbook in the maket.

HOW WE FED THE BABY TO MAKE HER HEALTHY AND HAPPY, WITH HEALTH HINTS. By C. E. Page, M.D. New York: Fowler & Wells.

A useful little handbook for young mothers, containing much sensible and practical advice calculated to diminish materially the murderously excessive death rate of young children. Special stress is laid upon the bad effects of over-feeding and frequent dosing of infants.

HYDROPHOBIA. By Horatio R. Bigelow, M.D. Philadelphia: D. G. Brinton.

The author's aim has been to furnish in this monograph a critical digest of the literature of hydrophobia. Contrary to the theory commonly held Dr. Bigelow is strongly inclined to believe that this disease is not primarily one of the nervous system, but a blood disease, which must be treated by remedies acting directly upon the blood.

AMERICAN CHEMICAL JOURNAL. Baltimore Md.: Published by the Editor, Professor Ira Remsen, Johns Hopkins University 8vo, pp. 448. $3.

The second volume of this highly creditable periodical is completed with the February issue. The six numbers contain half a hundred original articles by American and foreign chemists, besides a considerable number of reports on progress in various departments of chemistry, reviews of books on chemical subjects, and many notes and items of general interest to chemists.

MODERN ARCHITECTURAL DESIGNS AND DETAILS New York: Bicknell & Comstock. Part 7. $1.

Includes plates 49 to 56, showing a number of large and small seaside or lake shore cottages, and southern houses, with front, back, and side elevations, floor plans, details, etc.

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) W. B. T. writes: 1. Having read a description of canoe in SCIENTIFIC AMERICAN SUPPLEMENT No. 219, I take the liberty of asking whether said canoe, when built, would be capable of carrying two persons? If not, will you be kind enough to inform me, through your valuable paper, what dimensions are required to carry two? A. For two persons we think it should have 26 inches or 28 inches beam. 2. Will 15 oz. duck be heavy enough to cover deck? A. Yes.

(2) J. D. W. asks how a perfectly transparent water size for gilding on glass is prepared—a preparation that may be easily worked. A. a. Isinglass, 1 oz.; dissolve in just enough water to cover it, and add 1 pint rectified wine spirit, then increase the quantity to a quart with water. Keep well corked when not in use. b. Dissolve ¼ oz. isinglass in ½ pint of rum, add ½ pint distilled water, and filter through a piece of linen.

(3) J. C. H. asks what the chemical constituents of fire clay are, and how it is prepared to manufacture into brick. A. Fire clay is a silicious aluminum silicate—silicate of aluminum mixed with more or less free silica and usually a little iron oxide, etc. The clay is elutriated to separate the coarser particles, the finer portion after settling, draining, and partly drying being well mixed together, pressed into form, dried slowly, but thoroughly, in the air, then fired in a kiln. 2. I am manufacturing hydraulic cement; have always presumed the bond was made by a chemical change. Yesterday I heard of some reported experiments in your city which showed by a powerful microscope that the particles of cement were fibers which, when wet, curled and twined together, thus making the bond. The theory appeared ridiculous to me. Is there anything in it? A. The bond is chiefly chemical. Consult Gillmore's "Treatise on Hydraulic Cements and Mortars."

(4) J. S. B. asks: 1. Will you please to inform me the supply, demand, and price per pound of corundum? A. You can best obtain this information by addressing the dealers who advertise in this paper. 2. Is it probable, should corundum be found in sufficient quantities, that it will supplant the use of emery? What is the relative value as between corundum and emery, both as regards abrasive qualities and value? A. In a measure, yes. The value is determined chiefly by the comparative abrasive qualities—the standard wears away four-fifths its weight of glass. In this respect corundum from different localities varies widely. See articles on corundum and emery, SUPPLEMENTS, Nos. 125 and 42; also papers by J. Lawrence Smith and C. T. Jackson, Silliman's *American Journal of Science* (3d series), vii., 283; ix., 289; x., 354; xxxix., 87; xl., 112 and 123. 3. Is corundum found anywhere in the world except in this State? A. Corundum has been extensively mined at Chester, Pa; it is found also in South Carolina and Alabama, Massachusetts, and on the Pacific coast, in Brazil, Germany, and in South Africa and China. 3. Is it probable that in any reasonable length of time the supply of corundum will exceed the demand? A. Probably not. For other references on corundum see SCIENTIFIC AMERICAN, 405, vol. xxxviii.; 193 and 276, vol. xxxix.; and 113 vol. xlii.

(5) D. K. H. asks how files are measured. I say, for instance, a file measuring ten inches from shoulder to point is a ten-inch file, while a friend claims it is an eight-inch. Which is right? A. The tang of a file is not included in the measurement.

(6) C. H. F. asks: What cheap solution of a gluy nature—ignitible, not explosive, can I get to cement fibrous matter together, such as hemp in our common ropes cut up fine; must also be waterproof? A. A solution of shellac in wood naphtha might answer your purpose. See cements, page 2510, SUPPLEMENT, No. 158.

(7) T. S. W. asks. How can I make a liquid stove polish to be applied with an ordinary paint brush, and afterward polished with a stove brush? A. See ans. to L. A., p. 202 (9). Diluted with a sufficient quantity of water the polish there described may be used either as a paste or paint; for the latter it must be ground very fine.

(8) W. L. T. asks: 1. Can mica be dissolved, and if so, to what use can it be put? A. There is no solvent for mica. 2. Do you know of a machine for cutting mica to proper sizes? I have the control of a large mica mine, and will soon commence working it. A. We know of no special machinery for this purpose. 3. Do you know of what use the waste can be used for? A. See "The Utilization of Mica," page 241, vol. xxxiv.

(9) E. H. asks what acid or acids to use for taking out ink spots from ledgers, etc. A. Shake up 2 oz. of good bleaching powder (calcium hypochlorite) with 3 oz. of cold water; let it stand to settle, decant the clear portion, add ½ oz. acetic acid, and bottle. Dry the paper as quickly as possible with clean blotting paper.

(10) F. Y. asks: Do you know of any preparation that will remove from paper instantaneously ink stains, blots, or writing, made by inks or writing fluids, without injuring the enamel or gloss of the paper, so that it can immediately be rewritten? A. See answer to E. H., above.

(11) O. F. N. writes: 1. I wish to draw negative pictures on glass by scratching with a needle through an opaque film. The finished plates are to be used for the same purpose, and to take the place of photographic negatives of line and dot subjects. Please tell me the best and simplest covering for the glass plates. A. As we understand you, melted beeswax colored with any opaque pigment, or thin asphaltum varnish, will answer very well. 2. Is there any better way to dispense with photography in producing gelatine relief plates? A. We know of nothing better.

(12) O. F. D. asks whether there is an ink made that nitric acid will not affect, or if there can be one made? A. India ink of good quality is not materially altered by cold nitric acid. A solution of good asphaltum in lavender oil, with a little lampblack added, also resists the acid to a considerable extent.

(13) L. M. asks for a receipt for making olive soap, costing not over two and a half or three cents per pound. A. See Cristiani's late work on soap and candles. Address the book dealers who advertise in this paper.

(14) R. H. asks: 1. What are water colors? A. Generally speaking, colors or pigments finely ground in gum water. 2. How are they prepared for coloring printed cards? A. Consult Penley's "System of Water Color Painting," Hatton's "Hints on Sketching in Water Colors," and Gullick and Tims' "Painting Popularly Explained."

(15) D. D. G. writes: I have suspected for two or three years that throwing salt on ice to melt it from stone sidewalks injured the stone, and this winter has convinced me of the fact. Our stone is a sand stone, and from the effects of the salt crumbles and scales off on the top. I account for it by the sudden and extreme cold made by the salt and ice, but find few to give any credence to my suggestions. A. It is quite probable that the use of salt injures the stone in the way you suggest.

(16) W. F. S. asks how to make the solution used in Town's weather glass. A. The materials are dilute alcohol, camphor, sal-ammoniac, and niter. See "Weather Glasses," page 230, vol. xxvi.

(17) G. D. asks for a receipt for a cement for cementing glass. I wish something to cement the joints of glass tanks, the glass to be supported by a light frame. The cement must stand acids and a cyanous solution of metals. A. Melt together equal parts of pitch and gutta percha. See that the glass is free from grease and dry.

(18) H. B. writes: I have two hundred gallons of white California wine, which has got pricked. Can you tell me of any compound that would bring it back to its natural state again without discoloring it? A. See answer to R. S., this page.

(19) R. S. asks if there is a possibility of removing a flavor of acetic acid from wines caused by excessive fermentation, and if so, would like to know a remedy. A. The common remedy recommended in books is to saturate the excess of acid, with chalk, or calcined oyster shells; but such additions made in sufficient quantity to effect the object are apt to destroy the character of the wine and render it sickly. The best and safest method is to mix it with a considerable portion of full-bodied new wine, adding at the same time a little brandy, and in two or three weeks to fine it down. If too acid to admit of this it is better to make vinegar of the wine.

(20) T. H. asks: What is the best material for the lining of an ice chest? A. Sheet zinc is commonly used for lining. The best non-conducting material for filling in the walls is powdered charcoal.

(21) J. A. C. asks how to make fish lines waterproof. A. Boiled oil, 2 parts; gold size, 1 part; shake together in a bottle, and it is ready for use. Apply to the line, thoroughly dried, with a piece of flannel, expose to the air, and dry. After using the line two or three times it should have another coat, the application being repeated when necessary.

(22) J. A. S. asks if there is any chemical solution that will remove the rough outside coating that is on sea shells. I wish to dress them for ornamental shells, but find it laborious and difficult, on account of the roughness, to remove this red coating by grinding. A. Grinding is about the only practical way of removing the red silicious coating. We know of no means of dissolving it without injuring the other portions.

(23) J. J. writes: I wish to make a small boiler suitable for running a small engine, 1⅛ inch bore 3 inches stroke: what size should it be, and what style would be best and cheapest? A. A vertical tubular boiler having about 6 square feet of heating surface.

(24) O. N. T. asks: How many screw propellers, 18 inches in diameter, 12 inches travel, would be required to exert the same power as two propellers, 4 feet in diameter, 24 inches travel—each propeller with four blades, and driven same speed? A. Seven; but we think six would do the work very well.

(25) W. H. S. asks: What is used to put platinum points on to brass—is it a cement? A. They are either riveted or soldered with silver solder.

(26) W. E. B. asks (1) for a receipt for making a yeast that will be as strong, and that can be used in place of brewer's ale yeast? We wish to use it in making small beer without malt. Or can you give us directions for making ale yeast, where we have not the convenience of an ale brewery? A. Mix up 1½ lb. of wheat flour to a thick paste with water, cover the vessel containing it with tissue paper, and set it aside in a moderately warm place for about a week. Soak a

bushel of barley in water, let it germinate, then dry it thoroughly. (See article on Lager Beer, page 192, current volume.) Mash this malt in about 8 gallons of water heated to 170° Fah., cover the vessel, and after an hour's standing pour off the liquid, and stir up the malt again with a like quantity of hot water. Let it soak as before, then draw off, mix the liquors, add ¾ lb. hops, and boil for an hour. Cool down to about 90° Fah., and stir in the decomposed dough thoroughly beaten up with tepid water. Keep in a warm place for a few hours, when active fermentation will take place, carbonic acid gas be disengaged, and when the action is complete and the liquid clear, a large quantity of yeast of excellent quality will be found at the bottom.

(27) T. H. C. writes: S. R. B. can remove his wart by using chloral hydrate. Get a little and rub it up with just enough water to make a thick sirup. Apply this to the wart with a match whittled to a wedge shape, carefully so as not to get the chloral on the well skin. It will burn without discoloring, and destroy the surface, which may be rubbed or scratched off and fresh chloral applied. This is infallible, and leaves no scar. If by accident a little gets on the well skin, no harm is done save a slight reddening and soreness.

(28) A. C. L. writes: I was told by one who professed to be a machinist, that a right hand thread could be cut in a lathe by running the carriage to the right. But I believe it to be impossible. A. It can be done. Reverse the motion of the lathe spindle and turn the cutting tool upside down, or place it behind the work.

(29) S. E. W. writes: I have heard that cold pressure upon a boiler, as when testing it with water, strains boiler more than having same number of pounds of steam. Is this so? A. Cold pressure does not strain the boiler more, if the pressure is increased gradually. If injury is done, it is by improper manipulation. The difference in strength, hot or cold, is so small as to be of no account.

(30) L. B. asks: 1. Will you please tell me, through the SCIENTIFIC AMERICAN, how to make a hole about three-quarters of an inch in diameter into the bottom of a glass bottle? A. A three-quarter brass or copper tube used as a drill and supplied with emery and water will cut the hole. You may guide your drill with a wooden guide. Great care should be taken as the work nears completion. 2. How is transparent paint for coloring the glass slides of a magic lantern prepared? A. Prussian blue, gamboge, carmine, verdigris, madder brown, indigo, crimson lake, ivory black, and the coal tar, or aniline dyes, are the principal pigments used. Raw sienna, burnt sienna, copper brown, and vandyke brown are also sometimes used. The coal tar or aniline dyes afford the richest colors, and tints are most transparent, but are unfortunately apt to fade on exposure to white light. The pigments may be ground in oil or water, but ordinary megilp (strong mastic varnish mixed with an equal quantity of pale drying oil) is preferred as the vehicle. Not a drop more than is necessary for properly working should be used, for if the colors are mixed too thin they will run into one another. A thin size of transparent gelatin in hot water may be laid on the glass when water colors are employed. The transparency of many of these colors is heightened by a thin coat of pure mastic varnish, after drying.

(31) H. E. asks (1) how to make the platinum point of a plated blowpipe remain on the instrument. A. It should be screwed on. 2. How can I make an aniline blue ink? A. Dissolve an ounce of good aniline blue in half a pint of hot water, cool and dilute with cold water until it flows properly from the pen. See Inks, SUPPLEMENT, No. 157.

(32) H. B. ask for a recipe for japanning tin covers, cheap. A. Give the ware a coat of good japan varnish and heat it in an oven at about 300° Fah. until properly hardened.

(33) H. J. N. L. asks how to supply himself with a calcium or magnesium light, or other very bright and strong light for a sign, to attract attention now and again, and the cheapest way of manufacturing the same. A. For the lime or calcium light use the jet described in answer to A. M. B. (28), page 123, current volume. The jet is supplied with oxygen and hydrogen (or illuminating gas) from India-rubber gas bags. It is cheaper to purchase the apparatus and bags. See our advertising columns for addresses of dealers in such things. The oxygen is prepared by heating in a copper retort pure chlorate of potash mixed with about one-fourth its weight of powdered peroxide of manganese. The gas given off is washed by passing it through water in a bottle similar to D., in answer to C. M., page 123 (26), current volume, and collected, is then put in the bag. Use a smooth cylinder of good quicklime three-quarters of an inch in diameter and 2 inches long, perforated to fit tightly on the spindle, or shaped with a knife to fit the lime cap. In the magnesium light a thin ribbon of the metal magnesium is placed between slender rollers operated by clockwork, so that the ribbon, when ignited, is fed forward as rapidly as consumed.

(34) J. H. W. asks: 1. Is there any publication existing that gives the names of the different kinds of vegetable, animal, and mineral oils, their gravity, their process of manufacture, their illuminating and lubricating qualities, formulas for compounding, to refine or clarify? Or can you suggest a way I can obtain the above information? A. We know of no single book that will afford all the information required. Consult Wagner's "Chemical Technology," Muspratt's "Chemistry," Ure's "Dictionary of Arts and Manufactures," Knight's "New Mechanical Dictionary," and the encyclopedias.

(35) R. W. H. writes: 1. At a meeting of farmers in Westchester County, the writer stated that the length of rope used for draught made no other difference than its extra weight if the angle of draught were the same, and proved it by the ordinary steel yard and weight close to yard and three feet distant, the cord being balanced. Then arose a discussion on the most effective angle of draught. I was under the impression that it was 18°, but diligent search has failed to give me any information, and I think it a subject of such general interest that I trouble you for an answer through the SCIENTIFIC AMERICAN. A. Gregory says 18½°; a French author 14° to 15°. 2. The parties in charge of portable engines that are left out-of-doors paint boilers once or twice a month with gas tar (that is the tar obtained from the works for making illuminating gas). Is this deleterious, and is there not something better? A. It is not deleterious, but would be better if first heated sufficiently to drive off the more volatile matters. This heating should be done with caution or the vapors will take fire.

(36) F. P. asks: 1. What proportion does the electrical resistance of one copper wire bear to another of half its diameter? A. It is inversely in proportion to its sectional area; that is, the smaller wire would have four times the resistance of the larger. 2. What treatise on electricity can I get which takes up the theory and practical construction of the most approved dynamo-electric machine, and also the induction coil, fully explaining the construction of each? A. Back numbers of the SUPPLEMENT, Prescott's "Electricity and the Electric Telegraph," the "Electric Light," by Higgs, also recent text books on physics. 3. Is an electric light worked direct from the dynamo-electric machine, or is an induction coil inserted? If the latter, is there a circuit breaker in the primary circuit? A. The machine works direct. 4. How much does an induction coil increase the force? A. It does not increase the dynamic force. The electromotive force of a secondary current is very high. 5. What is a condenser as used with induction coil? A. A condenser is a series of sheets of tin foil insulated from each other and connected in alternation with opposite electrodes of the primary circuit, its office being to neutralize the extra current of the primary circuit.

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

A. M. D.—It is a yellow ocher; ground and washed it will make a cheap red or brown pigment.—O. G. S.—An impure kaolin—used in making cheap pottery, tiles, drain pipes, etc.—G. J. H.—Crystallized quartz rock crystal.

COMMUNICATIONS RECEIVED.

On the Coming Treatment of Ores. By J. C. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

April 19, 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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By the present it is made public that the Imperial Government will receive proposals until the 4th of July, 1881, for the construction of the railroads from Bagé to Cacequy and from Cacequy to Uruguayana, in the Province of S. Pedro do Rio Grande do Sul, under the following conditions:

I. The proposals must be presented sealed at the Directory of Public Works of the Department of Agriculture, or at the Brazilian Legations in Washington, London, and Paris.

II. The railroads will have the following lengths:

First—From Bagé, present terminus of the railroad already contracted from Rio Grande to that city, as far as Cacequy, 213 kilometers and 505 meters;

Second—From Cacequy, place where the railroad of Porto Alegre, at present in construction, meets the Bagé railroad, as far as the city of Uruguayana, about 262 kilometers.

III. The surveys already made and approved by the Government for the said railroads will form the basis of the contract.

IV. These surveys, as well as all the documents referring to said railroads, can be examined by the proposers or their representatives at the Directory of Public Works of the Department of Agriculture.

V. The Government grants a guarantee of seven per cent. interest on the capital, which, after the revision of the surveys, will be fixed definitely between the Government and the contractor.

Before beginning the works the contractor must pay to the Government the expenses already incurred for these surveys.

VI. The concession for these railroads will be made in accordance with decree No. 7,957 of 28th December, 1880, in all that relates to the technical part of the construction, and with decrees No. 6,926 of 10th August, 1878, and No. 7,900 of 29th December, 1880, as to the manner of regulating the guarantee of interest on the capital.

The Government reserves the right to grant the construction of both railroads to one single enterprise or to make two distinct allotments.

VII. The time to be consumed in the work and the capabilities of the competing parties will be the main points to be considered.

The companies that have already built railroads, or organized for the construction of these railroads, or persons that from their position and antecedents will offer all the guarantees for the prompt completion of the works contracted, will be preferred for the contracts now contemplated.

VIII. The proposers will make a deposit of 10,000 milreis, or £1,000. Only on presentation of receipt or certificate of this deposit will the proposals be received.

The deposit must be made in the National Treasury, in the above-referred Legations or in the Delegacy of the Treasury in London.

As soon as a proposal is accepted the contractor must increase his deposit to 50,000 milreis, or £5,000, as guarantee of the execution of the contract.

The deposits will be in money or bonds of the public debt of the Empire, and will be forfeited to the Treasury, the first one if the contractor, after the acceptance of the proposal, refuses to sign the contract; the second, if the said contract is not fulfilled.

IX. The Government will impose no clause which is not contained in the Decrees above referred to.

X. It is understood that only after the revision of the surveys and the amount of the guaranteed capital being fixed definitely will the contract agreed upon be considered made and perfect.

DIRECTORY OF PUBLIC WORKS, 3d February, 1881.

ANTONIO ALVARES DOS SANTOS SOUZA,
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Further particulars can be had by application to the Brazilian Consulate-General, No. 71 Broadway, Room No. 62, New York City.

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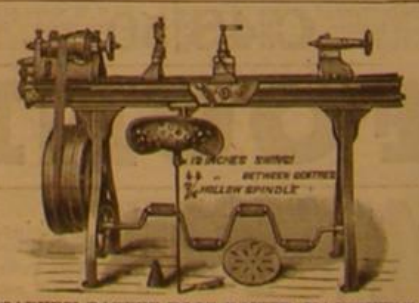

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THE SECOND BRIDGE BETWEEN NEW YORK AND BROOKLYN.

Mention was made a fortnight ago of the beginning of work on the pier foundations of the long-promised bridge across East River at Blackwell's Island. To-day we are able to set before our readers an engraved illustration showing the bridge as it will appear when completed, three years hence, if no mishap delays the expected progress of the work. The entire structure will consist of two spans across the two channels of East River, one elevated viaduct across the Island, and two approaches, the whole having together a length of nearly 9,000 feet, or almost 1¾ miles.

The New York approach will begin at the east side of Third Avenue, and traverses block between 76th and 77th streets to the river, a distance of about 3,000 feet. Connection will be made with the east side elevated railways, and with the New York Central and Hudson River Railroad traversing Fourth Avenue. The viaduct will be of similar construction to the high structure of the Metropolitan Elevated Railroad in Eighth Avenue, between the Park and 125th street, both onthe shore ends and on the Island. The bridge spans will be respectively 734 and 620 feet long, and will have a clear height above high water of 150 feet. The design of the spans is of the kind known as trussed chain suspension bridge.

The roadway will consist of two central railroad tracks each 14 feet wide; two carriageways each 9 feet, and two sidewalks each 5 feet wide, all on the same level. The bridge will be proportioned to carry two consolidation locomotives on each track followed by as many heavy freight cars as will cover the spans, and at the same time a general load on the highways and sidewalks of 40 lb. to the square foot. The floor will be designed to carry 100 pounds a square foot. The factors of safety will be three for dead load and eight for live load.

The eight towers which support the chains for the main spans will be made of Phœnix columns, well braced together in every direction. They will be 46 feet long on top, and 90 feet long on the base, and 260 feet high.

The long spans will be, as stated, "trussed chain suspension" bridges, somewhat similar in design to the "Point" bridge at Pittsburg, illustrated in SCIENTIFIC AMERICAN, vol. xliii., page 159.

Instead of there being one cable at a side, as at Pittsburg, there will be two, crossing each other in the center, on a pin joint, and flowing into each other in symmetrical curves, one above the other. The total load dead and live, is equally distributed between the two, and the resulting tension is always sufficient to more than counterbalance any compression resulting from unequal loading, the space between the two being thoroughly braced by diagonal bracing.

A somewhat similar arrangement has been suggested by an English engineer, Mr. Fidler, but in his designs he makes the upper chain straight. Besides the disagreeable appearance of this plan, it would be impracticable to draw the upper chain straight by any force that could be applied, and Fidler's bridge could only be erected by using false walls or staging, which are inadmissible across the East River.

By the plan proposed, however, the chains will be put in place by means of small temporary cables of wire, and will be allowed to take their own curves. The weight of the platform, being attached to the lower chains, half on each side, will draw the opposite upper chains nearly into position, and by temporarily loading the platforms, the chains can be made to take the curves designed for them. The intermediate bracing will then be put in, and the temporary loads removed.

This plan was designed by Messrs. T. C. Clarke and A. Bonzano, Members American Society of Civil Engineers, and, it is believed, overcomes all objection to trussed chain suspension bridges.

The principal contractor for the bridge is Thomas Rainey, Esq., of Ravenswood, L. I. The iron works will be constructed by Clarke, Reeves & Co., of Phœnixville, Pa., who have erected the West Broadway and Ninth and Eighth Avenue lines above the Park of the West Side Metropolitan Elevated system, and the Second Avenue line on the East side, besides many other bridges too numerous to specify.

The total cost of the bridge, including real estate, is estimated at five millions of dollars, and it is believed that it will be ready for traffic by December 31, 1883.

The Corwin's Cruise.

The U. S. revenue steamer Corwin sailed from San Francisco for a second cruise along the northern shore of Alaska, May 4, with the following assignment of officers: Captain, C. L. Hooper, Boston; First Lieutenant, W. J. Herring, New York; Second Lieutenant, E. Burke, Milwaukee; Third Lieutenant, O. B. Myrick, Boston; Third Lieutenant, George H. Doty, New York; Third Lieutenant, William E. Reynolds, Washington; Chief Engineer, James T. Wayson, Baltimore; First Assistant Engineer, Charles A. Laws, Philadelphia; Second Assistant Engineer, Frederick E. Owen, Owego, N. Y.; Surgeon, I. C. Rosse, Washington. There are thirty of a crew and a professional coal miner taken north with the view of working the crew in utilizing the coal ledge discovered during last year's cruise at Cape Thompson.

Captain Hooper's instructions give him great discretionary powers in his search for the Jeannette, and the expedition may winter in the Arctic regions.

A Filler for Porous Hard Woods.

Use boiled oil and corn starch stirred into a very thick paste. Add a little japan and reduce with turpentine. Add no color for light ash. For dark ash and chestnut, use a little raw sienna; for walnut, burnt umber and a slight amount of Venetian red; for bay wood, burnt sienna. In no case use more color than is required to overcome the white appearance of the starch unless you wish to stain the wood. This filler is worked with brush and rags in the usual manner.

Let it dry 48 hours, or until it is in condition to rub down with No. 0 sandpaper, without much gumming up, and if an extra fine finish is desired fill again with the same materials, using less oil, but more of japan and turpentine. The second coat will not shrink, it being supported by the first coat. When the second coat is hard, the wood is ready for finishing up in any desired style or to any degree of nicety by following up the usual methods. This formula is not intended for rosewood, and will not be satisfactory if used therefor.—*T. F. Page, in the Coach Painter.*

THE SECOND BRIDGE BETWEEN NEW YORK AND BROOKLYN.—OVER THE EAST RIVER AT BLACKWELL'S ISLAND.

Scientific American.

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COMET TELEGRAPHY.

In a special circular issued by the *Science Observer* the announcement is made of the receipt by cable of the elements and ephemeris of Swift's comet (*a* 1881), as computed by Drs. Copeland and Lohse at the Observatory of Dun Echt, in Scotland. The experience with Swift's periodical comet of last year, which was not seen at all in Europe for nearly a month after its discovery, owing to the moonlight and a total inability to determine its position after the moon had gone, was useful. It was an experience which involved the loss of many observations before perihelion passage, and caused the Boston Scientific Society to adapt a code to the telegraphic transmission of astronomical intelligence, and the first test of this code has just been made. The *Science Observer*, published by the society, has for the past three years issued special circulars by mail to American astronomers and observers, containing the elements and ephemeris of each new comet, when the date could be obtained, and Lord Crawford has made a similar distribution of circulars by mail from his observatory at Dun Echt to the English astronomers. It was, therefore, agreed that, as a test of the code, the elements and ephemeris computed at each place should be cabled to the other; the Boston data to Dun Echt, and *vice versa*.

The elements from Boston were sent across a few days ago, and those computed at Dun Echt have just been received at Boston, and form the subject of a special circular of the *Science Observer*. As a proof of the adaptability and utility of this astronomical code, both the original message and its translation are given. By the same code the announcement of a comet, which now requires a message of sixteen words, with a liability to error, can be condensed into seven words, five of which are necessary and two of which serve as check words to correct any possible error that might occur in the other five.

The elements and ephemeris computed at Dun Echt, on Monday, May 9, were transmitted by cable to Boston in the following message: "Decimosexto erective contextual bewitchery anticly demonstrative courageously sputter arithmancy stomachical auriferous suety bayou synecdochically bissextile eminently." The translation of this message is herewith given.

ELEMENTS OF SWIFT'S COMET, 1881 (*a*).

Per. Passage, 1881, May 20.67, Greenwich Mean Time.

	°	′	
Long. Perihelion	300	2	Eq. 1881.0.
Long. Node	124	54	
$\omega = \pi - \Omega$	175	8	
Inclination	78	48	

Log. $q = 9.7674$ ... $q = 5854$.

Motion direct.

EPHEMERIS.

Greenwich, midnight.	A.R. h.	m.	s.	Decl. °	′	Brightness.
May 10,	0	38	32	+26	46	1·69
14,		56	48	21	35	
18,	1	17	32	15	54	
22,		40	48	9	55	2·32

Computed by Dr. R. Copeland and J. G. Lohse, from observations made at Dun Echt Observatory. The light at discovery is taken as unity.

To astronomical people the translation will, of course, be of scientific value and interest; but a friend at our elbow says he is willing to wager a hat that the majority of readers will understand the telegraph message better and regard it with a deeper interest than the translation.

OPENING OF THE ELECTRIC RAILWAY IN BERLIN.

It is announced by telegraph that the electric street railway of Dr. Siemens, in Berlin, was opened for public travel on the 12th of May, with much success. A number of prominent officials and scientists were present. We have heretofore given accounts of the progress of the construction of this work. It is a narrow gauge elevated street railway, mounted on posts, placed on the street sidewalks, something like portions of the elevated railway in New York, but on a smaller scale. The new railway is located on the outskirts of Berlin, and extends from the suburb known as Lichterfeld to Yeltow, a distance of about two miles. The passenger cars are narrow and short, carrying only 14 passengers. There are two tracks. The cars are propelled by a dynamo-electric machine, which receives electricity through the track and a suspended cable, from an electric generator, one at each end of the line, each generator driven by a sixty horse engine. An average speed of twenty miles an hour was expected to be realized. We shall give further particulars in future numbers of our paper.

The original electric railways, which were tried as experiments at Berlin and Dusseldorf exhibitions in 1879 and 1880, were worked by locomotives whose mechanism resembled a fixed dynamo-electrical machine. The rails of the line and the wheels of the locomotive engines were made of use to conduct the current of electricity and produce the necessary motion. The second conductor conveying the current produced by the stationary machine to the locomotive was connected with a system of brushes attached to the locomotive. These brushes touched a high-edged rail running in the middle of two other rails and insulated from the ground by a longitudinal sleeper. In practice, however, it has been found that this arrangement is exposed to serious interruptions. The wet, snow, and mud which (according to the season) collects in the ordinary course of traffic upon the middle rail interfere very seriously at times with its conductive capacity. It has accordingly been determined on the Berlin electric line to conduct the current by means of a copper wire properly insulated, and attached to pillars erected alongside the line, the current being conducted from the copper wire to the locomotive by means of contact rollers.

IRIDIUM.

Several weeks ago we described the new process of John Holland, of Cincinnati, by which he is enabled successfully to work this refractory metal, thereby effecting some very remarkable and promisingly useful results. A patent has lately been granted for the invention. The process consists in bringing the iridium to a high heat, then adding phosphorus, then casting the metal into the desired form, and then eliminating the phosphorus by heating the metal again in a chalk bath. In a recent lecture before the Ohio Mechanics Institute, Cincinnati, Professor Dudley enlarged upon the value and importance of the discovery, reiterating the particulars given in the SCIENTIFIC AMERICAN of February 26, about the aid of the metal as an electrode in the electric lamp, its astonishing hardness, anti-corrosive nature, etc. He stated that the metal has the appearance of steel, but is much harder, being next in hardness to the ruby. It does not rust and cannot be injured by acids. Professor Dudley stated that a bar of it had been used with gratifying success, in place of the negative carbon in the electric light. It burned for sixty hours without any loss in weight or any perceptible change in form. Iridium cannot be fashioned by hammering while hot, nor can it be filed. It is moulded into convenient forms, and then sawed or ground by rapidly revolving copper disks, treated with emery and water. Many uses for the metal have been suggested. Besides its applicability to the electric lamp it has been found to be superior to platinum in telegraph instruments. Heretofore owing to the exceeding difficulty of working the metal its use has been much restricted, its most extensive employment, probably, being for pen points.

Faithful John.

JOHN W. JACKSON, for more than thirty years a faithful employe in this office, died on the 6th of May, of consumption, and was buried from the Colored Methodist Episcopal Church in Sullivan street the following Sunday.

"Old John," as he was familiarly called, had grown up with the SCIENTIFIC AMERICAN, and was as well known among business men down town as the paper itself.

John was faithful to his trusts and exacting in others. If he had business to transact with a business house or an official department and he discovered in the clerk a disposition to give another attention to the exclusion of himself he would have no argument with the clerk as to his rights, but would seek out the head of the firm or department and lay before him his complaint, which, he used to say, prevented delay and facilitated business next time.

A number of years ago, before the present system of making collections through our banks was general, John had a great many collections to make throughout the city. One day, in the absence of the member of our firm who was accustomed to indorse the drafts and checks for collection, a draft was received at the office for a considerable amount on the Sub-Treasury in this city. Another of the firm, who is no longer a member, indorsed the draft and John was sent to collect the money. He soon returned with his bag of gold, and laying it on the desk said: "Mr. W., your indorsement was not known to the cashier, and he at first refused to pay the draft, but on my assuring him it was all right, he said if I would add my indorsement he would pay the money, so I did it, and it was my signature that obtained it."

It is doubtful if Mr. W. ever fully understood why the colored porter's indorsement was necessary. And so wherever John's errands called him, his word or his signature was recognized authority.

Old John is very much missed about this office, and he will be missed by scores of business men about town, so identified had he become with the SCIENTIFIC AMERICAN and its thirty-five years' growth.

New Telephone Central Office System.

Mr. T. G. Ellsworth, manager of the John street office of the Metropolitan Telephone and Telegraph Company, of this city, has patented an improved telephone central office system, the principal object of which is to facilitate connection between wires of telephone lines in a telephone central office, and to afford means for making such connections rapidly and accurately.

Ordinarily in telephone central offices mistakes and delays in connecting and disconnecting the wires of communicating parties are of frequent occurrence, for the reason, among others, that the operator at the telephone cannot conveniently, or does not himself, connect and disconnect the wires, but gives directions to others to do so; hence results much noise and confusion, and consequent misunderstanding and forgetfulness or neglect of orders.

To avoid these difficulties Mr. Ellsworth has devised a system involving the use of novel switch connections and of novel telephone stands, and their peculiar arrangement relative to each other, whereby each telephone operator is enabled easily and without delay to connect and disconnect several communicating wires that are connected with his instrument.

American Medical Association.

The spring convention of the American Medical Association in Richmond, Va., the first week in May, opened with every promise of a successful and profitable meeting. Five hundred physicians were in attendance.

THE GAMGEE PERPETUAL MOTION.

One of our reporters called upon Mr. Edward N. Dickerson, the civil engineer and lawyer, to get his views with regard to the Gamgee "thermo-dynamic engine" and Chief Engineer Isherwood's report thereon. After reading the extract from Isherwood's report, as published in this paper last week, and after examining a copy of Gamgee's letters patent, Mr. Dickerson said that his attention had not been called to the matter before, and that he was somewhat astonished that Isherwood, who had published two or three books in years gone by, and expended millions of the public money in the attempt to prove that there was no power to be got out of expanding steam, should now be found advocating an engine whose entire merit is supposed to consist in the power that will result from the expanding of another liquid following the same laws as water in its operation; and that, in his opinion, the ignorance exhibited in the first publications is equaled by that exhibited in the last. In the first publications he denied the value of the dynamic effect due to expansion, and in the second one he converts that effect into the means of producing perpetual motion!

Mr. Dickerson then went on to say: The truth is, that any gas whatever which is produced by vaporizing a liquid will give out more or less of the value of the heat expended in the production of it, as it is expanded more or less. Isherwood, in the position of Chief Engineer of the Navy, prevented this simple truth from being made available for the United States for many years; and now he is going to the other extreme in assuming that if some other liquid beside water be used, not only an enormous amount of power can be obtained, sufficient to drive navy vessels without fuel, but that this enormous power, produced by means of expansion, has the faculty of restoring the liquid used to its normal condition by its own internal action, when it will be ready to perform the ceremony over again *ad infinitum*.

A simple way to illustrate this whole subject is to suppose a thoroughly exhausted vessel of any kind, into which some liquid ammonia or other low-boiling substance is introduced. If that liquid can derive from the environment heat enough to vaporize it, it will be thoroughly evaporated, and will fill that vessel under a tension corresponding to its volume and heat. When that is done the work of that amount of heat thus absorbed has been accomplished, and the gas will be very cold, if the volume into which it expands bears a large proportion to its normal liquid volume. Now, if in that condition, and by reason of this low temperature, this gas could suddenly reconvert itself into a liquid form, it could be very readily replaced in the original vessel, or a similar one, and again derive its heat from the environment and reproduce the original effect. The difficulty about it is that it will not reconvert itself into a liquid, and this is the fallacy of the whole assumption; and in order to reconvert it into a liquid form it must be compressed into its liquid dimensions, when it will again be as warm as it was in the beginning, and when the power expended in reproducing it will be equivalent to that it gave out in the expansion. This general truth may be confused by pictures of cylinders, condensers, and by jargon; but it is altogether probable that this law will assert itself notwithstanding the confusion that will result from such an organization as Mr. Gamgee exhibits in his patent. If not, there is, practically, a perpetual motion machine made.

In all engines operated by heat, whether atmosphere, steam, or the vapors of other liquids are used, a constant condition of disturbed equilibrium must be maintained between the opposite sides of the piston or diaphragm which is to exhibit the motion. One side of it may be made hotter than the ordinary temperature, while the other side need then only be of that temperature, or the ordinary temperature may exist on the one side and the opposite side may be made colder; and whenever that disturbance does occur a tendency of the gas to pass from the hotter to the colder space will exist, and power can be got. But, in order to make an engine operative, that tendency must be made chronic, or in other words, artificial heat must be added at one end, or the natural heat which has been expended at one end must be destroyed at the other by some refrigerating process. I have often said that if I were lecturing in a scientific school I would have a steam engine running in which the boiler should be filled with a mass of ice; and such an engine, which might easily be made, would illustrate the whole subject in a very striking way. Steam at the freezing point has a pressure of about one-tenth of a pound to a square inch; and, of course, if a pressure of about one hundredth of a pound to a square inch could be produced on the opposite side of a piston, ice steam would drive the engine; but it would require artificial refrigeration, and, of course, an expenditure of power at the lower side much more costly than to put an alcohol lamp under the little boiler at the upper side. It never occurred to me, however, that my ice machine would, by the expansion of this ice steam, destroy the heat and restore the ice to its normal condition in the boiler, so as to run in what Gamgee calls a closed circuit.

The best steam engine now existing (which consumes two pounds of coal an hour a horse power yields about one tenth of the power which the combustion of the coal would theoretically produce, measured by thermal units. This result is more than twice as great as in Isherwood's engines built upon the theory that there was no benefit in expansion. They required about five pounds of coal an hour a horse power, or more. By carrying expansion further an engine can be easily built that will make a horse power with one pound of coal an hour, or half the fuel now used; and it is undoubtedly true that after steam has been used to its greatest capacity, the remaining heat, which now is discharged overboard in the warm water of condensation, can be utilized in vaporizing low-boiling liquids, such as ammonia, out of which a very considerable further amount of power can be obtained. But it is not worth while to make those attempts until the power to be got from steam has come somewhere near to the practical limits to which it may be carried. At present it is not half way there. When that has been done, and when all the heat possible has been used in vaporizing low-boiling liquids, there is no present prospect that more than a hundred per cent of the power of combustion will be utilized; or, in other words, it is not probable that more heat units will be exhibited in the dynamic effect than are due to the perfect oxidation of the carbon or hydrocarbon of the fuel. In all cases, practically, the limit of fall of temperature must be the temperature of the thermal ocean in which we operate, which is a variable one, affected by geographical position and seasons of the year. When the sea water is 70° hot, there never will be a time in which power can be obtained upon the assumption that a greater degree of refrigeration than 7° is possible without expense; and it will always be cheaper to raise the temperature at the other end by fuel than to lower it at the minus end by artificial means.

There is only one other set of experiments that I know of analogous to these, and they are to be found in Isherwood's "Experimental Researches in Steam Engineering," between pages 2 and 55, in which he was trying to find out a method by which steam, after leaving the boiler, could superheat itself, and in which he concluded that, although it did not do so in the particular set of trials he made, yet, if the machinery had been bigger, he thought it would! The converse of the proposition is now involved, in which the analogue of steam is *cooling itself*, and in which it would require probably a larger machine than they will be likely to make in the Navy Yard to establish a successful result!

INSECTIVOROUS PLANTS.

In your issue for May 14, 1881, reference is made to the later experiments of Sig. Vayreda with some of the different species of *Silene* (catch-fly), in which he arrives at the conclusion that the plants do not digest the insects, or if they do, they are not benefited thereby any more than if they did not eat them.

During the summer of 1878, assisted by Mr. Wm. I. Tait, of Jersey City Heights, N. J., we made most careful and exhaustive experiments with the Carolina fly-trap (*Dionea muscicipula*), and arrived at exactly the same conclusion as Sig. Vayreda has done, that the so-called "feeding" of the plants in no way conduced to their health or vigor, being identical in all respects with those that had not been given the insects. One hundred healthy plants were used in each of the two experiments. The whole details of the experiment were given in the *Gardeners' Monthly*, of Philadelphia, in December, 1878, and brought out a very interesting discussion from those believing in the Darwinian theory and those who did not.

But why because the exudations from a plant are such as to cause an insect to adhere to it, or its mechanical formation entrap the insect, we should jump to the conclusion that it should then feed on its prey, it is hard to imagine.

On the "cruel plant" (*Physianthus albens*) hundreds of moths, butterflies, and other insects may be seen any day in August when the plant is in bloom—dead and dying, firmly held by their antennæ. Professor Geo. Thurber thus describes the trap contrivance by which the insect is caught: "The anthers are so placed that their spreading cells form a series of notches in their ring around the pistil. The insect in putting its proboscis down for the honey must pass it into one of these notches, and in attempting to withdraw it the end is sure to get caught in a notch, boot-jack fashion, as it were, and the more the insect pulls the more its trunk is caught." Thus caught, the insect starves to death, hence the well deserved name of "cruel plant." Now, here is a trap nearly as wonderful as that of the Carolina fly-trap, and far more so than that of the viscid exudations of the *Silene;* yet even Mr. Darwin would hardly say that the "cruel plant" feeds on these insects, any more than that the gnats caught by millions by the resinous exudations of the hemlock tend to augment their growth, or that the thistle or burdock of the wayside owe any part of their health and vigor to the scores of butterflies, moths, or bumble bees that are in their headlong flight impaled on their spines.

PETER HENDERSON.

Jersey City Heights, N. J., May 9, 1881.

SILK ADULTERATIONS.

[A simple test, showing quality and value of all silks.—Cracking, greasy, and dull wearing silks easily detected.]

Having proved by numerous experiments that all pure silk burned in a gas flame yields in ashes two-fifths of the original weight, and that all weighted silks, when burned in a gas flame, weigh less than two-fifths in proportion as they are weighted, and where there is much iron, "the chief adulterant," the color of the ash is a red brown. From pure silk the ash is always black, and the silk while burning seems to melt and run together, while the weighted silk keeps its form, shrinking equally from all parts. It is not necessary to burn any pure silk "unless comparisons are desirable," if you take the fact as established that the resulting ash is two-fifths of the original weight, and all silk not coming up to that standard is proportionately weighted.

The theory is: pure silk leaves a residue of two-fifths when burned to ash, and the weighted leaving very little ash from anything but the silk it contains, the adulterants being principally converted into vapor and gas, pass off, leaving no perceptible weight of residue.

The best method of burning the silk for testing is to lay it on a piece of wire gauze and let the gas flame pass through.

SCALE.

20	parts silk yielding	8	in ashes is	pure silk.			
20	"	"	"	7	"	"	⅞ "
20	"	"	"	6	"	"	¾ "
20	"	"	"	5	"	"	⅝ "
20	"	"	"	4	"	"	½ "
20	"	"	"	3	"	"	⅜ "
20	"	"	"	2	"	"	¼ "
20	"	"	"	1	"	"	⅛ "

A very good idea of the purity of silk is shown by comparison: taking a piece of ribbon—any pure color, white, blue, pink, gold, or any bright color—"one inch or two is sufficient," weigh carefully; then weigh exactly the same weight of silk to be tested, and as much as it falls short in measurement with the pure silk it is weighted. Endeavor when testing as above to get a piece of ribbon the same substance as that to be tested.

When it is considered that the weighting is a very expensive process, and that the additional weight does not in proportion add to the bulk, and that the strength, durability, softness, and luster are greatly impaired, 'tis strange that the fraud is persisted in; but it being so, and the consumer must necessarily pay the expense of the adulteration, it is for them to understand how to protect themselves.

There are many black silks that are valued by weight, manufacturers and dealers agreeing as to the dyed weight; such is what is termed French twist, often returned by the dyer three pounds for one. This silk twist is made from waste, and as it is cut up and carded there is a great amount of fine fiber on the surface, causing a dull and woolly appearance. In the process of dyeing the silk is rotted by the many baths of nitrate of iron and other chemicals; the fiber on the surface becoming very tender is beaten off, leaving a smooth hard twisted thread; but the processes are so detrimental to the strength, its use is confined to cutting up into fringes, but it soon shows its components, in becoming dull and cottony.

This French twist costs in the gray about four dollars per pound, and the dyeing heavy weight two dollars and fifty cents, so when finished there is returned three pounds for six dollars and fifty cents, or two dollars and sixteen and three-quarter cents per pound. If dyed in the regular way, sixteen ounces would return twenty and cost fifty cents for dyeing. So in that way the good silk would cost four dollars and fifty cents for twenty ounces, or three dollars and sixty cents for one pound, against two dollars and sixteen and three quarter cents for the heavy weighted. Let it be understood that the same number of yards and the same amount of good silk is in twenty ounces, costing four dollars and fifty cents, as in the forty-eight ounces heavy weighted, costing six dollars and fifty cents, and that the four fifty silk is clean and strong, while the six fifty is dirty and rotten. So the advantage is hard to be understood, and perhaps is only in the fact there are yet very many who can only understand a pound is a pound and a yard is a yard and silk is silk.

It is, however, gratifying to know many of our manufacturers depend on excellence. This, when understood by the consumer, will be found to mean the best economy.

New Haven, Ct. LEWIS LEIGH.

City Area and Sewerage.

Cities, Dec. 31, 1880.	Area in acres.	Population by census of 1880.	Density of population per acre.	Linear feet of sewers per head of population.
New York	26,401	1,206,577	45·70	1·69
Philadelphia	81,803	846,980	10·23	1·25
Brooklyn	13,338	566,689	42·49	2·81
Chicago	22,797	503,301	22·00	3·54
Boston	4,416	362,535	82·00	2·91
St. Louis	40,000	350,522	8·76	3·04
Cincinnati	15,360	255,707	16·64	0·98
San Francisco	26,880	233,965	8·70	2·82

Prints on Linen.

Copies of drawings or designs in black and white may be produced upon paper and linen by giving the surface of the latter two coatings of:

Gum arabic	7 to 10 grammes.
Citric acid	2 to 3 "
Iron chloride	4 to 6 "
Water	85 cub. centimeters.

The prepared material is printed under the drawing, and then immersed in a bath of yellow prussiate of potash, or of nitrate of silver, the picture thus developed being afterward put in water slightly acidified with sulphuric or hydrochloric acid.

A LARGE CRANK SHAFT.—The crank and crank shaft of the City of Rome, the new Ituman liner, are approaching completion at Messrs. Whitworth's. The crank has three throws, each piece weighing about 20 tons, and the whole about 61 tons, while the shaft of fluid compressed steel forged hollow will weigh 18½ tons when finished.

Society of Mechanical Engineers.

The American Society of Mechanical Engineers met in Hartford, Ct., May 4. Though but a year old, the society has acquired an honorable standing and a large membership. About fifty new members were received at the first session. Professor R. H. Thurston occupied the chair Papers were read by the president and by A. R. Wolff, of this city, on "Ratios of Expansion at Maximum Efficiency." At the second session Mr. Alex. L. Holly called attention to the dependence of this country upon foreign manufacturers for large steel forgings, owing to our lack of heavy steam hammers. Mr. Holly anticipated the supplanting of forgings in a great measure by steel castings, which are already made of high tensile strength.

Professor Thurston remarked upon the empirical character of the practice of depending upon familiar rules and formulas in the construction of steam engines. While standard tables, so called, like those of Regnault or Rankine, on pressures of steam due to temperature, might be accurate and very nearly exact, they were not absolutely so under all conditions, and he urged that engineers should depend upon observations derived from the actual conditions of the special case in hand.

Chas. E. Emery, Esq., in a brief paper pointed out the value of non-conductors as a means of preventing radiation in steam pipes, and from a series of experiments presented the following substances in the order of their mention as valuable: Hair felt, mineral, wool, sawdust, charcoal dust, wood, loam, slack lime, asbestos, ashes, brick dust, sand, air, and space.

Cold Air for Domestic Use.

The *Chronique Industrielle* gives an abstract of a paper by a French engineer, M. Mougey, of Bray-sur-Seine, wherein the author shows the benefits to be derived from a system proposed by him for distributing cold air through a line of pipes to private consumers. Some such system has been suggested before, but the one under consideration differs from it in the fact that the projector proposes to compress the air to a greater degree (5 or 6 atmospheres), and to *cool* it before sending it through the pipes to the various points of distribution. At these points the opening of a cock, by allowing the air to escape and expand, will distribute throughout cellars, living apartments, or wherever else it may be needed, a pure cold air capable of preventing fermentation or putrefaction of organic matters, and of rendering the atmosphere of stores, manufactures, or dwelling houses refreshing during the most sultry days of summer. The air thus compressed may also be used, like steam, as a motive power. As for the proposed mode of distribution, that is essentially the same as now employed for supplying steam heat to consumers in Lockport, N. Y.

NEW CAN AND BOTTLE OPENER.

The engraving shows an improved opener for cans and bottles, recently patented by Mr. I. N. Arment, of Dayton, Washington Ter. On the top of the main bar forming the handle of the several parts, is fixed a brush for cleaning off the top of the can or bottle. On one side, and near the center of the handle, there is a groove in which is pivoted a corkscrew which is held in either of its positions by a spring in the bottom of the groove. In one end of the handle is pivoted a short, stub knife blade, to be used for cleaning off wax, cutting wires, etc., and at the opposite end there is a sharp curved spur which is designed to be thrust into the center of the top of a can. This end of the handle is slotted and contains a follower which carries a pointed double-edged knife and a small roller. The knife is to be forced into the top of the can, and the roller presses the side of the can at the top, to guide the knife.

Novel Can and Bottle Opener.

A spiral spring is attached to the end of the handle and to the follower, and tends to draw the latter toward the end of the handle. This device insures a contact of the roller with the side of the can.

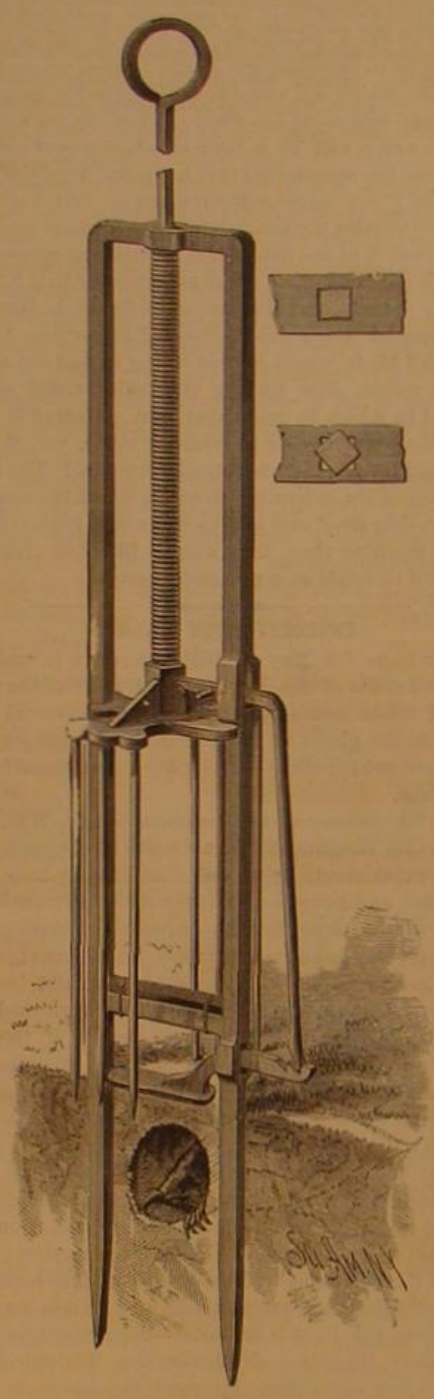
This tool, unlike many combination tools, is convenient and useful in all of its parts.

Conflicting Trade Marks.

The following decision indicates the way trade marks are sustained in England: A firm of brewers shipping to the colonies had put on their trade label the words "Bulldog Bottling." Another firm, also exporting to the colonies, had adopted, perhaps from want of originality, the words "Terrier Bottling." The users of the word "Bulldog" applied for an injunction against the use of the word "Terrier," and the Master of the Rolls, being of opinion that the labels could not be mistaken, declined to grant it. The Lords Justices, however, finding that the "Bulldog" beer had acquired the name of "Dog's head," reversed the decision of the Master of the Rolls, on the ground that the nature of the "Terrier" label would lead to its being described by the same name.

NEW MOLE TRAP.

We give an engraving of a simple and effective mole trap lately patented by Mr. Henry W. Hales, of Ridgewood, N. J. As will be seen from the engraving it may be set over the mole run without disturbing the ground in any way, or offering any obstruction to the free passage of the animal. The trap is so constructed that it may set very near to plants and flowers without injuring them, and it may be set close to a wall or fence without interfering with its working.



HALES' MOLE TRAP.

The trap consists of a vertical frame terminating in two pointed stakes at the bottom, which are wide enough apart to admit of pushing them into the ground on opposite sides of the run without disturbing the earth or changing the form of the run.

A follower fitted to slide in the vertical frame carries six long, pointed pins, three on each side of the frame. This follower is pushed downward by a strong spiral spring, and is retained in an elevated position by a lever extending through a mortise in the side of the frame and downward where it is engaged by a trigger. The trigger is furnished with a wide flat foot which rests upon the ridge of the mole run which is slightly depressed.

Now, when the animal attempts to go through the slightly contracted portion of the run the trigger is raised and the trap is sprung.

For convenience in setting and placing the trap, the square rod, extending upward from the follower through a square hole in the top of the frame, is rounded at a single point for a short distance, so that when the follower is raised until the round part of the rod is in the mortise in the frame and the rod turned as indicated in the detail view, the follower will be retained until the trigger and lever can be arranged, after which it may be again turned to bring it into position to operate. The trap is made entirely of metal, and is very simple and effective.

Statistics of Color Blindness.

The report of the committee appointed by the Ophthalmological Society of London, to collect statistics of cases of color blindness, presents many features of special interest. The secretary of the committee, Dr. Brailey, with the assistance of sixteen colleagues, has examined 18,088 persons of all classes, of whom 1,657 were females. It is at once curious and suggestive to find that while the average percentage of color defects among men is 4·76, and 3·5 for very pronounced defects, it falls in women to the low figure of 0·4. This, if true, remarks the London *Lancet*, would seem to suggest a new sphere of labor for women. If women are comparatively free from color blindness, they are so far specially indicated for many of the less laborious occupations in which good color perception is desirable or absolutely indispensable. It is satisfactory to find that these last statistics confirm, in the main, those collected by the late Dr. George Wilson, of Edinburgh, nearly thirty years ago. This is especially noticeable as regards the comparative frequency of color defects among members of the Society of Friends, particularly among the poorer section of them. Though the members of the Ophthalmological Society seem either not to have known the fact or to have forgotten it, Dr. Wilson found a considerable number of cases of color blindness among the members of the Society of Friends, and he was of opinion that this was not an accidental circumstance. He further believed that the largest proportion of cases of color blindness would, on extended examination, be found among the less accomplished male Friends in the larger cities.

A Japanese Bronze Worker.

The most skillful living bronze worker in Japan, and one of the most skillful of workers in metal that Japan has ever possessed, is said by the *Japan Mail* to be a Kiyoto artisan named Zoroku. His specialty is inlaying with silver and gold, an art which he carries to such perfection that his pieces are scarcely distinguishable from the *chefs-d'œuvre* of the Min period. What one sees on going into his *atelier* is a very old man—some 65 or 70—peering through a pair of huge horn spectacles at a tiny incense-burner or still tinier flower vase, from whose frets and diapers he is paring away, with marvelous patience, an almost imperceptible roughness or excrescence. Beside him, winter and summer alike, stands a brazier with a slow charcoal fire, over which an iron netting supports one or two bronze vessels similar to that he holds in his hand. Plainly these bronzes are being subjected to a slow process of baking, and if you watch for a moment, marveling at the purpose of a proceeding which seems only calculated to mar the fair surface of the metal, you shall presently see the old man dip a feather into a vessel filled with greenish liquor, and touch the heated bronze here and there with the most delicate and dexterous care. This liquid is acetate of copper, and this patient process, which you see repeated perhaps twenty or thirty times during a visit of twice as many minutes, will be continued in the same untiring fashion for half a year to come, after which a month's rubbing and polishing will turn out a bronze rich in green and russet tints that might, and indeed must, you would fancy, have been produced by centuries of slowly toiling time.

IMPROVED FRUIT JAR.

The engraving shows a fruit jar whose cover is retained by a wire bail carrying a roller, the wire being bent so as to retain the roller in its central position, and to form bows extending away from the pivots to increase the leverage in moving the bail. The cover has an arch across it, the surface of which is two arcs of circles of shorter radius than the bail, so that the movement of the bail across the arch causes the roller to press the arch and cover and bring the cover down tightly upon the packing of the bottle or fruit jar, and the roller remains in the slight depression formed in the surface of the arch.

Reilay's Fruit Jar.

This invention has been patented by Mr. Richard B. Reilay, of Wilkesbarre, Pa.

A New Cattle Car.

A "parlor" cattle car, with twenty head of cattle, arrived in this city the other day from Cincinnati, the cattle having come through without unloading. The cattle were fed and watered by a mechanical contrivance operated from the end of the car. With an ordinary car the cattle would have had to be unloaded for feeding three times, with considerable injury and delay. The superiority of the new car was shown not only in its increased capacity and the superior comfort of the animals, but also in the saving in weight by diminished loss, which is usually about ten per cent. With the "parlor" car the loss was under three per cent.

ASSAYING.

THE ASSAYING OF GOLD AND SILVER ORES.

A ton of rocks containing one thirty thousandth its weight of gold, or one fifteen hundredth its weight of silver, can in many instances be worked profitably; this is something like one fiftieth of a grain of gold or four grains of silver per pound of rock or ore. A quantity so small, even if in the metallic or free state when diffused through the rock, is difficult to detect with any degree of certainty by any physical examination or blowpipe test. Chemical analysis by the wet way is in this connection too slow and expensive, and without the greatest care and most expert manipulation the quantitative results in the case of poor ores are apt to be uncertain. The fire assay is by far the most expeditious, certain, and inexpensive method of testing such ores, as well as of quantitatively determining their value.

The apparatus and materials requisite in assaying are as follows:

A balance for weighing ore and fluxes, sensitive to a grain, with a weight of three ounces on each pan, with box of weights.

A finer balance, sensitive to one-tenth milligramme, with a weight of one gramme on each pan, with box of weights.

A small crucible or melting furnace, with hood to carry off the fumes produced in roasting ore.

A cupel or muffle furnace.

Crucible, scorifier, and cupel tongs, muffle cleaner, poker, and shovel, and stone hammer.

Brass moulds for making cupels.

Large iron mortar and pestle for breaking and grinding ores. Fine work with very hard ores also requires an agate mortar and pestle.

Brass wire gauze sieves—80, 100, and 120 mesh. Small spatulas, camel's-hair brush, and glazed paper.

Iron pans for roasting.

Tin samplers.

Moulds for pouring scorified charges.

Crucibles, scorifiers, annealing cups, parting flasks, and test tubes.

Silver foil, lead foil, granulated lead, litharge, floured charcoal, argol, niter, borax glass, boracic acid, bicarbonate of soda, salt, carbonate of ammonia, fine bone ash, and white silicious sand (silica), nitric acid (pure).

The first requisite in any assay is that the whole of the ore or rock to be tested be reduced to a uniformly fine powder or flour and separated from metallic scales or particles, if there be any. This is usually accomplished by breaking with the hammer, and then completing the reduction in the mortar or beneath a muller. The sample in process of reduction is from time to time thrown on the sieve to separate the finer portions and avoid the inconvenience and loss by dust. If any of the metallic particles or scales remain on the sieve these must be weighed and assayed separately, the results first proportioned to the weight of sample of ore taken being added to the results from the powdered ore assay.

The powdered ore should be well mixed together and weighed, then sampled. A handy sampler is made of three or four semi-cylindrical tin troughs cast six or eight inches long, about three-fourths of an inch in width, and one inch deep, placed parallel at a distance equal to their width, and soldered at the ends to a tin or wire frame or support. When powdered ore is sifted over this half falls through the openings, the other half being retained in the troughs, and the portion caught may in like manner be further divided, so that a large sample is reduced to one of suitable size for assay, the small sample correctly representing the large.*

The method of assaying depends much upon the character of the ore and gangue. If the ore contains any considerable quantity of sulphides, arsenic, or antimony it should be roasted. This is usually performed by spreading the weighed sample of ore on an iron pan, previously coated with oxide of iron or chalk, and gradually heated under a hood to low redness until all fumes cease. Carbonate of ammonia and powdered glass or sand is sometimes added to hasten or complete the action and prevent fusing or agglutination.

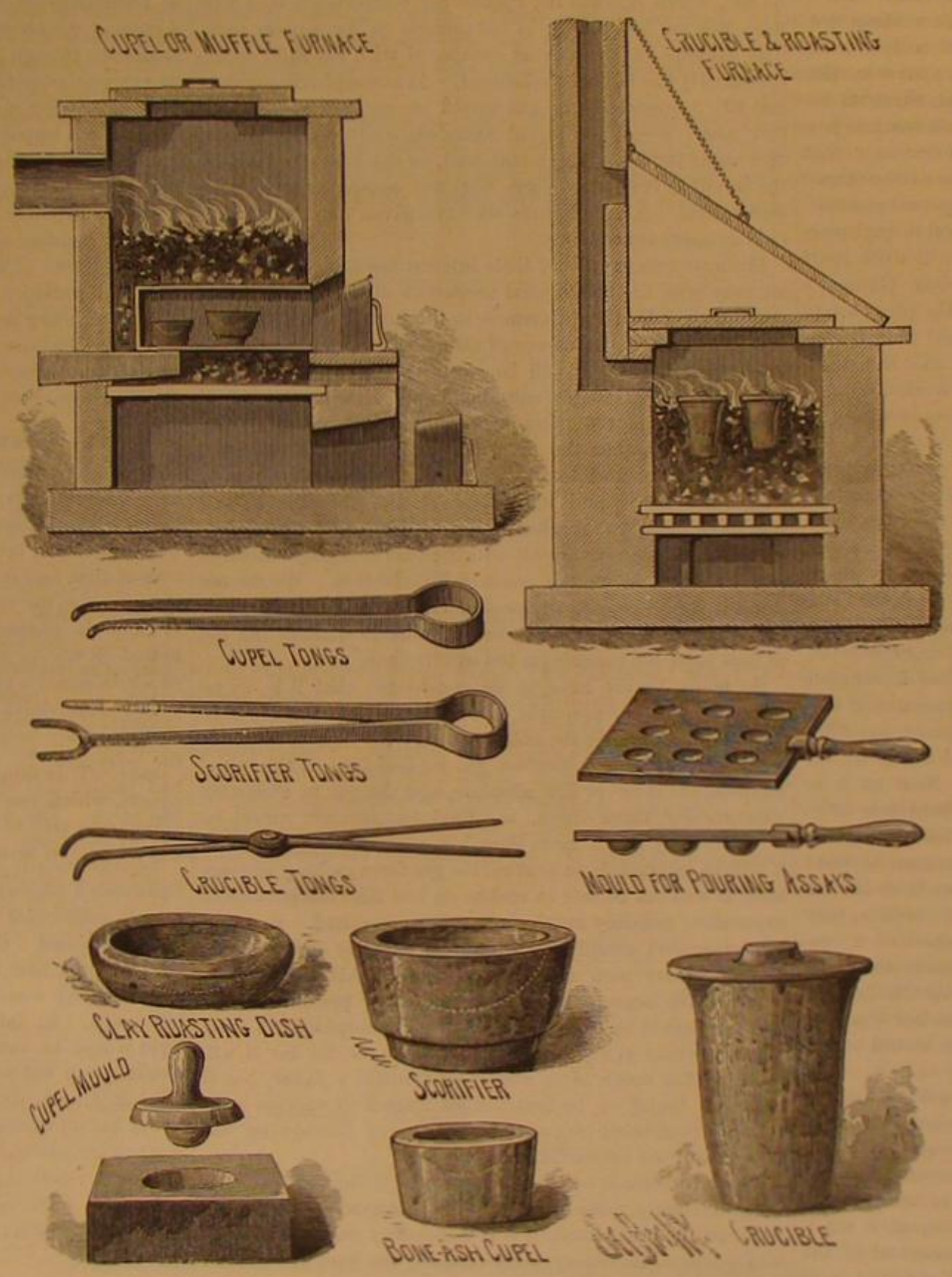
The scorification method is preferable in most cases where it can be applied, but owing to the limited quantity of ore that can be conveniently operated upon in this way its use is restricted to comparatively rich ores. Poor or presumably poor ores are best treated in the crucible which permits the working large samples.

With regard to fluxes, litharge (the yellow oxide of lead), carbonate of soda, and borax are the most important. Charcoal and argol as reducing agents, and niter as an oxidizing agent, are used in connection with them. Salt is used as a cover or wash in the crucible. Lead or its oxide, which is a powerful flux, plays a very important part in the gold and silver cupellation assay. In the crucible assay the oxide (litharge) is always used. The ore or the reducing agents mixed with the fluxes react upon it in such a manner that a portion of it is reduced to metallic lead, which, as the contents of the crucible becomes liquefied by heat, falls by reason of its greater gravity to the bottom of the vessel, washing down and alloying with the liberated particles of precious metal, so that when the crucible has been cooled and broken a button of lead is found at the bottom, and this button, if the assay has been properly conducted, contains all the precious metals.

In the scorification the metallic lead exposed to a current of highly heated air is partially converted into litharge, which, acting as a flux, liquefies the ore, the liberated gold or silver alloying themselves with the unchanged portion of lead at the bottom of the scorifier.

In the crucible assay the following proportions of flux will be found to work well with most quartzose ores:

Ore	1 A. T.
Litharge	2 "
Bicarbonate of soda	1 "
Argol	2½ grammes.



APPARATUS FOR ASSAYING.

Too much argol will produce too large a button of lead, and too small a quantity the reverse, or none at all. The ore itself acts as an oxidizing or reducing agent in many cases. The use of oxidizers, such as niter, in the crucible are objectionable, and careful attention to the preparatory treatment or roasting will, in most cases, dispense with the necessity of their use. Experience alone enables the assayer to judge of the oxidizing or reducing powers of the ores and the proper proportion of reducing material. Charcoal or flour or mixtures of these may be employed instead of the argol. These reducing agents should be in the finest state of division, and free from lumps and thoroughly dry. This applies equally to all the fluxes. Ores containing much limestone require a considerable addition of borax silica or borax acid (anhydrous); a similar addition to the charge is necessary if the ore be argillaceous—that is, slaty or earthy.

The ore and fluxes having been weighed out they are thoroughly mixed together and put into a dry and warm sand crucible, and covered with about one-quarter inch of dry salt loosely packed down. The crucible is then put into the melting furnace and covered with a good fire. Twenty minutes to half an hour is usually sufficient to accomplish the thorough decomposition and fusion of the ore, and the crucible is removed as soon as its contents are found to be in a state of complete fusion. It is allowed to cool thoroughly, then broken, and the button of lead at the bottom removed and cleaned by hammering it on an anvil. The appearance of the slag will indicate whether or not the decomposition and fusion were properly completed. The button of lead is put aside for cupellation (or scorification if necessary).

For the scorification assay the following charge will in most cases suffice:

Ore	½ A. T.
Granulated lead	3 "
Borax	q. s.

Two or three pieces the size of peas are usually sufficient. The ore is mixed with part of the lead in the bottom of the scorifier, the rest of the lead being poured over the top and the fragments of borax placed on top. The scorifier must be large enough to admit the charge without filling it. When placed in the muffle, properly heated, the lead and borax melt, the surface of the former by contact with the air becoming converted into liquid litharge, which with the aid of the borax fluxes the ore, forming a ring of liquid slag, which finally covers the whole surface of the lead. As soon as this takes place the vessel is removed from the muffle and its contents dexterously poured into the iron mould, where it quickly chills, and the lead button is removed and cleaned by hammering. If the buttons are too large to be admitted to the cupel (which should weigh at least as much as the button) they must be scorified down; that is, placed in a scorifying dish and exposed in the open muffle. The hot air oxidizes and slags off the lead, and on pouring and cooling this may be separated from the reduced button by pounding as before; in many cases it separates itself.

When the button is of proper size it is dropped into the bone ash cupel, thoroughly dried and heated to bright redness, where it melts, and as the hot air converts the lead by degrees into liquid litharge, and this latter is absorbed into the porous cupel, the button decreases in size until the last of the lead is slagged off and there remains in the bottom of the cupel only the fused bright button of gold or silver or any alloy of these. By too high a heat or overlong exposure in the crucible there is apt to be a loss of silver through volatilization. If too low a heat the litharge is imperfectly absorbed by the dish and the button solidifies ("freezes").*

Gold is nearly always found associated in ores with silver, and the button or bead obtained from an assay usually requires "parting;" that is, the separation of these metals. The button having been carefully weighed is treated with pure nitric acid diluted with half its volume of water, and heated to boiling in a test tube or small parting flask. If the proportion of silver is not less than three to one of gold all the silver dissolves in the hot acid, the gold remaining as a dark spongy mass. If less than this proportion of silver is present the gold protects it from the proper action of the acid, and the silver dissolves out slowly, or not at all. In this case—and a little experience enables the assayer to judge from the color of the button whether enough silver is present or not—silver must be added. Enough silver is cut from the silver foil, wrapped about the button, and this in turn placed in a small cornet of lead foil and placed in a clean hot cupel, where it melts and alloys; the lead soon slags out and the button is ready for the parting in acid as described.

The gold sponge or particles of gold powder obtained in parting is washed by decantation with hot water in a test tube. While the tube is filled with water a small annealing cup or porcelain crucible is placed with its mouth over the tube or flask, which is then quickly inverted, so that the fine gold falls to the bottom of the cup or crucible. By immersing this and the mouth of the flask the latter may be removed without disturbing the gold, which after decanting as much of the water as possible is dried at a gentle heat, then heated to redness to give it coherence, cooled, and weighed.

The greatest care is necessary in weighing assay beads of gold and silver, as, owing to the value of the substances weighed, a very small error may make a great difference in the results.

The decimal or French system of weights are commonly employed in assaying. The *assay ton* is intended to simplify and facilitate the final calculations; the ratio which an A. T. bears to a milligramme is the same as that between a ton (2,000 lb. avoir.) and a troy ounce, so that if one A. T. sample of ore is assayed and found to contain one milligramme of

* All assays should be made in duplicate to check any error.

* Large silver buttons must be removed with care from the muffle to avoid loss through spatting, occasioned by the escape of absorbed oxygen from the silver at the moment of solidification.

gold or silver it is known at once that a ton of the ore contains just a troy ounce of the metal.

The weight of gold found as above deducted from the weight of the bead before parting (or adding silver) corresponds to the weight of silver.

One ounce of pure gold has a value of twenty dollars and sixty-seven cents. The ounce of silver is worth about one dollar and fifteen cents; it varies with the market.

As nearly all commercial samples of lead and litharge contain traces of silver, those intended for use in assay should be carefully sampled and assayed, due allowance being made for silver found in calculating results.

The Zeromotor.

Mr. Isherwood has recently been employed to report to the United States Government on the merits of a very remarkable proposal made by Professor Gamgee. It will be remembered that this gentleman has given much attention to the construction of ice-making machines; and a few years ago his real ice skating rink in Chelsea attracted a great deal of attention. Of late Professor Gamgee has resided in the United States, and continued to occupy himself with ice and its artificial production. During the early portion of the present year he submitted to the United States Government the proposal to which we have referred, which is that he shall construct a new motor which will, to a large extent, take the place of the steam engine and work without fire. If such a scheme had been brought forward a few years since its inventor would have been regarded as a lunatic. But so much knowledge has been disseminated concerning the behavior of gases, and the conditions under which work is performed, that Professor Gamgee need have no fear now that his ideas will be neglected or passed over without due examination. Apparently the "zeromotor" is "perpetual motion" over again. But the inventor of perpetual motion engines is always trying to produce a machine which will work itself without external aid of any kind. Professor Gamgee's scheme has nothing in common with this. He proposes to utilize natural forces; and his engine would be, if constructed, a heat engine in just the same sense that the steam engine is a heat engine, only he proposes to work at much lower temperatures than the steam engine requires, and to use ammonia instead of water.

In order to make the principle involved perfectly intelligible, let us consider for a moment what takes place in a steam engine. We take water and heat it, thereby enormously increasing its volume, and converting it, in a word, into what we may call, for convenience, a gas. This gas is used to propel a piston against a resistance. It is then suffered to escape into a cool chamber, condensed, or in other words reduced in volume as much as it was before augmented, and pumped back in the boiler. We have thus a complete cycle, and the engine works between two temperatures, that of the boiler, say 320°, and that of the condenser, say 120°, and the efficiency of the engine is determined solely by the difference between these two temperatures. Now let it be supposed that the normal heat of the atmosphere was 320°, then water could not exist, but it would be still quite possible for beings who could live in such a temperature to work a steam engine, if only they could isolate steam from the air, which might be done easily enough; and if, besides, they possessed any means of reducing the temperature of a condenser to 120°. Given these two conditions, and their steam engine would work without fire. Considerable difficulties would, however, be met with in producing the low temperature required, while without the steam engine would be impossible.

Now we have several liquids which behave at normal temperatures, such as 60°, just as water would behave at 320°, and these liquids might be used to develop power if only we could obtain the low temperature needed to condense them. So long as sufficient difference of temperature exists power can be had; and it is of no consequence whatever, whether the range of temperature is at one end of the scale or the other. Power can just as well be obtained from a fluid working between zero and —200°, as from a fluid working between 320° and 120°. In the one we must provide heat to raise the temperature above the normal. In the other we must provide a source of cold, to speak popularly, and it is far more convenient to do the former than the latter. We have no stores of ice and salt, for example, to draw upon for the production of zero temperature, but we have stores of coal which will give us high temperatures. So much being understood, the rest will be easily comprehended. Without going into details it will be enough to say that Professor Gamgee proposes to work an engine between 60° and 40°, that is to say, through a range of 100°; and this he purposes to do by taking a quantity of liquid ammonia and putting it into a vessel, which we may call a boiler. In this the ammonia will be heated by the atmosphere to its own temperature. It will boil, and the gas will be used in an engine. So far all is quite clear. We have one-half the cycle, but we have yet to see how the low temperature, —40°, is to be obtained. It is, of course, out of the question to get this by the use of refrigerating agents; and it is here that the really beautiful portion of the invention comes in. When a gas is expanded and does work, it is cooled down. Professor Gamgee proposes to use his ammonia so expansively that it will be cooled down sufficiently to liquefy. Then it will be pumped back into the boiler and the cycle will be complete. An engine would thus be obtained capable of developing very great power without the use of fuel. It need hardly be said that the man who can achieve this object may hope for riches and honors such as the world has never before bestowed on inventors. Before we can say whether Professor Gamgee is or is not likely to obtain success, we must clearly understand the properties of the fluid with which he proposes to work.

Ammonia is a compound of one atom of nitrogen with three of hydrogen (NH_3). At ordinary temperatures and pressures it is a gas. Concerning certain of its physical properties a diversity of statement unfortunately exists. Thus, according to one authority, liquid ammonia—which must not be confounded with the water saturated with ammonia used by Lamm in a totally different way to propel tram-cars, as described in the *Engineer* for January 12, 1872, and popularly known when diluted as sal volatile and hartshorn—boils at —36° Fah.; while according to another it does not liquefy until a temperature of —40° is reached. The difference is apparently small, but it is very important at the lower end of the scale of temperatures. The higher the temperature at which liquefaction takes place the better in one way for Professor Gamgee. The specific gravity of the gas is 0·59, air being unity; and that of the liquid is 0·76, water being unity. The specific heat of the gas is 0·508. At a temperature of —22° the gas—to carry out the analogy we might term it ammonia steam—has a pressure of 17 pounds on the square inch absolute. At 32° its pressure is 60 pounds. At 68°, which is about the highest air temperature it is wise to reckon on, its pressure is 126 pounds on the square inch. The volume of the gas as compared with the fluid which produces it has not been tabulated. At atmospheric pressure and 62°, 1 pound of the gas would occupy about 23 cubic feet, and 1 pound of liquid ammonia would occupy about 36·5 cubic inches. The latent heat, or the heat absorbed by the liquid in becoming a gas, does not appear to have been ascertained. All the figures we have given must be considered as approximate only.

Hitherto comparatively little interest has attached to what we may term the mechanical properties of the gas, and this may account for the differences in the figures given by various authors, and the silence of all on such a question as the latent heat of gas. It will be seen that the maximum pressure which Mr. Gamgee can reckon on without the aid of artificial heat is 126 pounds absolute. But there is some doubt as to whether the gas will remain wholly unliquefied at this pressure and temperature. Kemshead states that it will liquefy at 60° and 105 pounds on the square inch; and it is more than probable that the pressures and temperatures we have given above are all critical; that is to say, those at which the gas is on the point of liquefaction. We do not think it would be safe under the circumstances to assume that a higher working pressure is attainable without the aid of heat than 100 pounds on the square inch.

So many points have to be considered that it is by no means easy to say precisely to what extent the gas must be expanded to produce the cold necessary for liquefaction. If we deal with it as a perfect gas we find that, if the initial temperature is 68° or 529° absolute, and the gas be expanded adiabatically three times, the final temperature would be —81°, or very much more than low enough. As, however, it will be impossible to prevent the gas from picking up some heat, it will not be safe to reckon on less than this amount of expansion; possibly much more will be required. A threefold expansion would give a terminal pressure of 33 pounds on the square inch absolute, but before this liquefaction would have begun, the average effective pressure in the cylinder would be 66 pounds less the atmosphere, 15 = 51 pounds, which is a good working pressure. So far it will be seen that much is in Professor Gamgee's favor, but it must not, therefore, be assumed hastily that its success is assured. Something remains to be learned concerning the behavior of the ammonia.

The zeromotor is in this dilemma, that if the expansion be not sufficiently extended no liquefaction will take place; while on the other hand, if it is sufficiently great, the engine may waste all its energy in overcoming the back pressure of the atmosphere. The intense cold of the cylinder will tend powerfully to reduce the pressure of the gas at the beginning of a stroke, while toward the end it will give out heat and prevent liquefaction. A very complex action has to be provided for, and nothing but direct experiment can settle the question at issue. Theoretically, the zeromotor is, so far as can be ascertained from the somewhat limited data available, sound in principle. It remains to be seen whether it can be reduced to practice. We agree with Mr. Isherwood, however, that the invention is one having sufficient promise to make its further investigation very desirable. "What is now mainly desired," writes Mr. Isherwood, "is that Professor Gamgee may be permitted to prosecute his experiment at the Washington Navy Yard to a conclusion, and there bring his engine to a practical test with as little delay as possible. Should the department be able to grant this, the favor will be well and properly bestowed in the interest of the navy and of the world."—*Engineer.*

Large Centrifugal Pump.

W. H. Allen & Co., Lambeth, have lately made a large centrifugal pump for the irrigation of extensive cotton fields in Egypt. The pump has a 60 inch disk and 36 inch pipes, and is capable of discharging 70 tons of water per minute. The lift against which it is to work is 15 feet. The pump will be driven by a horizontal engine of 125 indicated horse power, the power being transmitted by a belt 21 inches wide, and five-eighths inch thick.

Microscopic Structure of Metals.

Some observations on the minute structure of metals, recently communicated to *Nature* by Mr. J. V. Elsden, are both interesting and instructive. Notwithstanding the great opacity of metals, it is quite possible to procure, by chemical means, metallic leaves sufficiently thin to examine beneath the microscope by transmitted light. Silver leaf, for example, when mounted upon a glass slip and immersed for a short time in a solution of cyanide of potassium, perchloride of iron, or iron alum, becomes reduced in thickness to any required extent. The structure of silver leaf may also be conveniently examined by converting it into a transparent salt by the action upon it of chlorine, iodine, or bromine. Similar suitable means may also be found for rendering more or less transparent most of the other metals which can be obtained in leaf form. An examination of such metallic sections, says Mr. Elsden, will show two principal types of structure, one being essentially granular and the other fibrous. The granular metals (of which tin may be taken as an example) present the appearance of exceedingly minute grains, each one being perfectly isolated from its neighbor by still smaller interspaces. The cohesion of such leaves is very small. The fibrous metals, on the other hand, such as silver and gold, have a very marked structure. Silver, especially, has the appearance of a mass of fine elongated fibers, which are matted and interlaced in a manner which much resembles hair. In gold, this fibrous structure, though present, is far less marked. The influence of extreme pressure upon gold and silver seems to be, therefore, to develop a definite internal structure. Gold and silver, in fact, appear to behave in some respects like plastic bodies. When forced to spread out in the direction of least resistance their molecules do not move uniformly, but neighboring molecules, having different velocities, glide over one another, causing a pronounced arrangement of particles in straight lines. This development of a fibrous structure, by means of pressure, in a homogeneous substance like silver, is an interesting lesson in experimental geology, which may serve to illustrate the probable origin of the fibrous structure of comparatively homogeneous limestones like those of the Pyrenees, Scotland, and the Tyrol.

The Insulation of Electric Light Wires.

At a recent meeting of the New York Board of Fire Insurance Underwriters, the danger arising from the use of electric lights with uninsulated conductors came up for discussion. The matter had been investigated on account of an accident a short time ago in a jewelry store in Maiden Lane, when a man was on the roof running an electric light wire across. It came in contact with the telephone wire, and a flash passed down to the telephone box, destroying it. The shock loosened a considerable extent of plaster.

City Electrician Smith said that the shock must, he thought, have been very powerful, and had any one been at the telephone, he might have been killed; or if the flame had passed near light goods, there might have been a conflagration. The wires of the electric light ought to be thoroughly insulated.

Superintendent Harrison, of the New York Board of Fire Insurance Underwriters, said that the Board would ask the proper authorities to see that the electric wires were properly insulated. Owing to the rapid introduction of the electric light, and the many new wires that were being run over the city houses, the danger, he said, was constantly increasing. In the meantime buildings using the electric light would be rated as "specially hazardous," unless the insulation of the wires was approved.

A. A. Hayes, Jr., of the Brush Electric Lighting Company, has informed the board that the wires of that company were already insulated while the matter was under discussion; and since the action of the Board, the other companies have been experimenting in regard to the best method of insulation.

Actinic Zinc.

Dr. Phipson describes a zinc white of a dazzling purity obtained by precipitating a solution of zinc sulphate by means of barium sulphide, submitting the precipitate to strong pressure, and igniting it with limited access of air. If any barium sulphide escapes oxidation, the white compound, on exposure to the sun, begins to darken, and in about twenty minutes becomes of a deep slate color. If removed into a dark place it gradually loses color, and in about five or six hours it becomes again snow-white. This experiment may be repeated with the same specimen as often as desired. Further, this change of color does not take place under a slip of common glass, whether thick or thin; at most the compound takes a slight yellowish brown color on exposure to the sun for two hours. The sample on analysis was not found to contain silver or any other substance known as actinic.

The Fourth State of Matter.

The first public exhibition in this country of the experiments and apparatus employed by Professor William Crookes in his investigation of the ultra gaseous state of matter was made in this city, May 5, by Professor H. S. Carhart, of the Northwestern University, under the auspices of the New York Electrical Society. The experiments were admirably reproduced and explained by Professor Carhart, whose skillful manipulation of the delicate apparatus was only excelled by his terse and lucid presentation of the character and import of these novel explorations along the extreme verge of material existence.

THERMOPHONES.

BY G. R. CAREY.

Figs. 1 and 2 represent magneto-thermophones. In Fig. 1, A is the transmitter, which consists of a highly polished thin mirror, similar to Prof. Bell's photophone transmitter; B^2 is a hollow iron ball which forms the pole of the magnet, D. This ball should be made very thin and covered with lampblack in order that it may absorb and radiate its acquired heat rapidly. C is an insulated helix of copper wire placed around the pole of magnet, D, and having in its circuit the receiving telephone, E. Sound waves of any kind generated before transmitter, A, will cause the reflected heat and light waves to undulate in unison with the sound waves; these undulatory heat and light rays will strike the pole, B^2, of magnet, D, producing corresponding variations in its strength, thereby generating magneto-electric currents in coil, C. These magneto-electric currents will correspond in time and strength with the sound waves made before transmitter, A, and will reproduce by means of telephone, E, any sound made before transmitter, A.

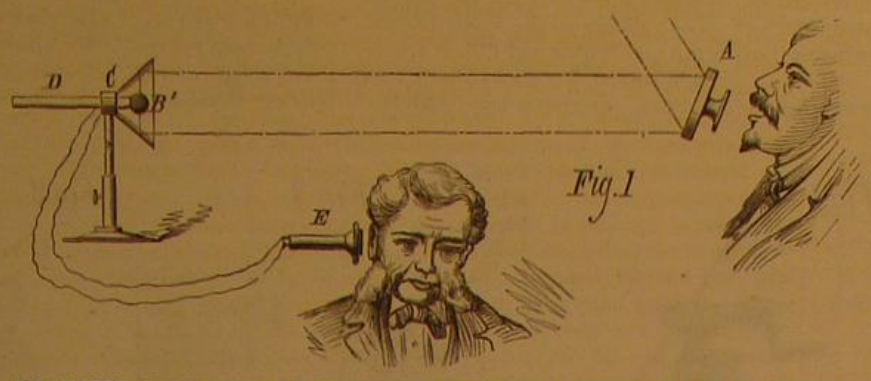


Fig. 1

MAGNETIC THERMOPHONE WITH REFLECTING DIAPHRAGM TRANSMITTER.

The operation of instruments shown in Fig. 2 is similar to that just described; the difference is mainly in the transmitter, which consists of a manometric flame apparatus, A, of the usual construction, the light and heat of the flame, B, being projected by the mirror, M, to the magnet of the receiver.

In Fig. 3 the receiver is a thermopile connected with a receiving telephone. The heat and light thrown by the reflecting transmitter, A, generate an undulating electric current in the thermopile, C, which produces audible effects in the telephone, E.

In Fig. 4, the chamber, A, of transmitter is supplied with gas by the tube, F. Speaking against the chamber, A, will produce undulations in the inclosed gas corresponding in time and strength with the sound waves generated before it, thereby vibrating the flame, B, and its emitted heat and light rays. These modified heat and light rays will generate electric currents in the thermo-electric pile, C, against which they strike, and these thermo-electric currents corresponding in time and strength with the sound waves at the transmitter, the magneto-telephone, E, being in the circuit of the thermopile, C, will reproduce any sound made before chamber, A, of the transmitter.

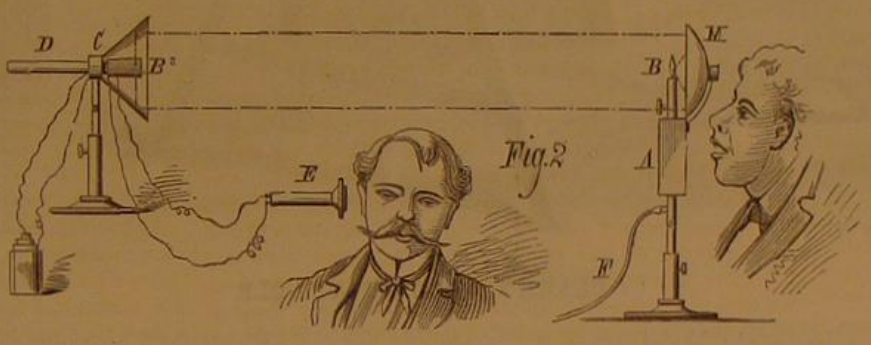


Fig. 2

MAGNETIC THERMOPHONE WITH MANOMETRIC FLAME TRANSMITTER.

The Atlanta Exhibition.

The plan of the proposed Cotton Exhibition at Atlanta, Ga., next October expands rapidly with the popular demands made upon the management. The indications now are that the Exhibition will be not merely a successful cotton show, but one which will include, also, all the great industries of the South, and so much of those of the North as are tributary thereto. The Exhibition buildings have been multiplied and enlarged accordingly. The main building, which is now in process of erection, will be 750 feet long by 90 feet wide, with a transept 500 feet by 90 feet.

The Exhibition will be held in Oglethorpe Park, chiefly a flat meadow surrounded by an oblong race-course half a mile in length. Outside the race-course the ground rises and will be terraced for the accommodation of the subordinate buildings of the Exhibition.

The main building will be devoted to exhibits of textile fabrics and the machinery for producing them. Another building, 250 feet long by 100 feet wide, will be filled with machinery for preparing sugar, rice, and similar products. A still larger one will contain exhibits of all varieties of tobacco, its products, machinery, and everything connected with it. A building on the plan of that which contained the Kansas and Colorado exhibits at the Centennial Exhibition will be given up to a comprehensive display of the agricultural, the mineral, and the woods of the South. This display is to be made chiefly by the Southern railroads, which are cooperating to make it the fullest and most comprehensive ever seen. All the territory south of the Ohio River will be ransacked for suitable objects to show here, and the result is expected to be a most important display of the surface and underground wealth of the South.

An annex to the main building will be known as the Foreign Department, and will be a bonded warehouse, under charge of a Treasury special agent, for the display of such foreign exhibits as the proprietors do not wish to pay duty on. This important concession has been made by Secretary Windom, and will secure a large amount of foreign exhibits. Letters have been received from a large number of manufacturers in various European countries, who express a desire to enter machinery for exhibition, but object to paying duties on it unless it is sold in this country, which, of course, could not be promised. In addition to the buildings mentioned there will be a large restaurant for the accommodation of visitors, and Director-General Kimball is particularly interested in "a press pavilion," which he intends putting up for the use of visiting journalists.

An exhibit which will probably attract the attention of more visitors than any other will be a cotton field, showing the plant in all stages of growth. Thirty acres of the park have been laid out in half-acre lots, and given to as many different planters for a competitive trial of skill in cultivation.

Pains have been taken to make this a complete display of every variety of cotton in the world. Seed has been imported from Africa, India, and other parts of the world, sometimes at great expense, a single half pound of a certain rare variety having cost $200 in gold. This plantation has been already seeded, and is now being cultivated under the general direction of Mark Hardin, a well-known representative Southern planter. Material for another interesting display is being gathered by Mr. Edward Atkinson, who has charge of the foreign exhibit of fabrics and fibers, and is collecting specimens of every variety of cotton goods, fibers, and primitive machinery for treating them. He is ransacking every portion of the world to make his gathering complete. A full display of agricultural implements will also be made.

There will also be a number of special exhibits of horses, cattle, hogs, etc. There will also be poultry and bench shows, and an agricultural and horticultural fair.

Fig. 3

THERMOPHONE WITH THERMO-ELECTRIC RECEIVER AND REFLECTING DIAPHRAGM TRANSMITTER.

Fig. 4

THERMOPHONE WITH THERMO-ELECTRIC RECEIVER AND MANOMETRIC FLAME TRANSMITTER.

The management of the Exhibition has been committed to H. I. Kimball, Director-General, with twelve chiefs of departments, several of whom have already been appointed.

MISCELLANEOUS INVENTIONS.

An improved axle box, patented by Mr. Willis Jones, of Brooklyn, N. Y., is designed to secure perfect lubrication of the journals and boxes of the axles of vehicles, securing as collateral advantages the exclusion of dirt, sand, or other abrading material from the bearing surfaces of axles and boxes.

Messrs. Robert Dodsworth and John W. Holdsworth, of St. Louis, Mo., have patented an improved mouth-piece for speaking tubes and telephones, which consists in combining an electric circuit closing device with the cover of the mouth-piece of the tube or telephone in such a manner that when the cover is opened the circuit shall be momentarily closed to give the signal.

An improved vertically swinging gate has been patented by Messrs. John Flinner and Jacob Hollinger, of Millersburg, Ohio. This invention consists in a peculiar arrangement of a locking mechanism for holding the gate down and preventing it from being raised, except when it is to be raised by the working levers.

Messrs. Frank Baldwin, of New York, and Howard Selvage, of Brooklyn, N. Y., have invented a scarf, so constructed that it can be folded in different ways, and will present a fresh wearing surface each time.

Messrs. John B. Grégoire and Hubert Hebert, of Lake Linden, Mich., have patented an improved bedstead. This bedstead has a horizontal frame supported by suitable legs, and provided with a series of transverse or longitudinal spring slats, upon which blocks supporting a like spring slat frame rest, this latter frame being provided with springs on both sides and with a hinged adjustable head rest.

An improved heat reflector for fireplaces has been patented by Mr. John Southward, of Mount Sterling, Ohio. This invention relates to certain improvements on the invention for which letters patent No. 197,205 were granted to William J. Cox and to the present inventor, under date of November 20, 1877.

An improved fabric for the manufacture of packages in which to put up ground coffee, spices, baking powder, and other substances which deteriorate by exposure to the air or to moisture, and which will serve to preserve their aroma or other desirable qualities for a long time, has been patented by Mr. Henry C. Crocker, of Milwaukee, Wis. The improvement consists in a paper fabric formed of one layer of waxed paper inclosed within two layers of common paper, whose edges project over that of the waxed paper and are pasted together.

Mr. Edward Birmingham, of Brooklyn, N. Y., has patented a shirt ironing board having a projection and rounded shoulders upon its forward end to fit the neck and shoulders of a shirt, and having slotted arms upon its rear corners, a pair of rollers for holding the shirt, and a handle for turning the rollers.

Mr. Friedr. Adolf Reihlen, of Stuttgart, Würtemberg, Germany, has patented a process of making wine from grapes, which consists in exposing for a few minutes to a water bath kept at a temperature of 212° Fahr. the mass of seed, flesh, and skins remaining after expression of the must; also macerating them in water or grape juice, and in mixing them with the must.

A spring cushion support for carriage seat backs has been patented by Mr. Charles C. Bailey, of Wellsburg, N. Y. This support is for the cushions of carriage seat backs between the seat backs and the lazy backs, to hold the cushion out against the backs of persons riding in the seats and prevent the cushions from sagging.

An improved travois or horse litter, especially designed for military purposes for the transportation of the sick and wounded, has been patented by Mr. Thomas M. McDougall, of Fort Yates, Dakota Ter. The novelty consists in pivoting the forward ends of the bed frame to the long shafts between which the draught animal is attached, and in providing hinged and adjustable legs or supports for the rear end of said frame, whereby it may be supported at different elevations; also, in providing an elastic or yielding socket for such supports.

An improved engineer's level rod has been patented by Mr. Michael L. Lynch, of Cameron, Texas. This invention relates to the class known as "self-reading level rods," and is distinguished from others by the peculiar manner of marking the scale upon the face of the rod, whereby the readings of fractions of a foot may be readily made without the use of a sliding target.

Mr. Charles A. Schneider, of New York city, has patented a lamp wick impregnated with a compound consisting of phosphate of ammonia, biborate of soda, sulphate of ammonia, and chloride of lithium.

NOVEL FOLDING CRADLE.

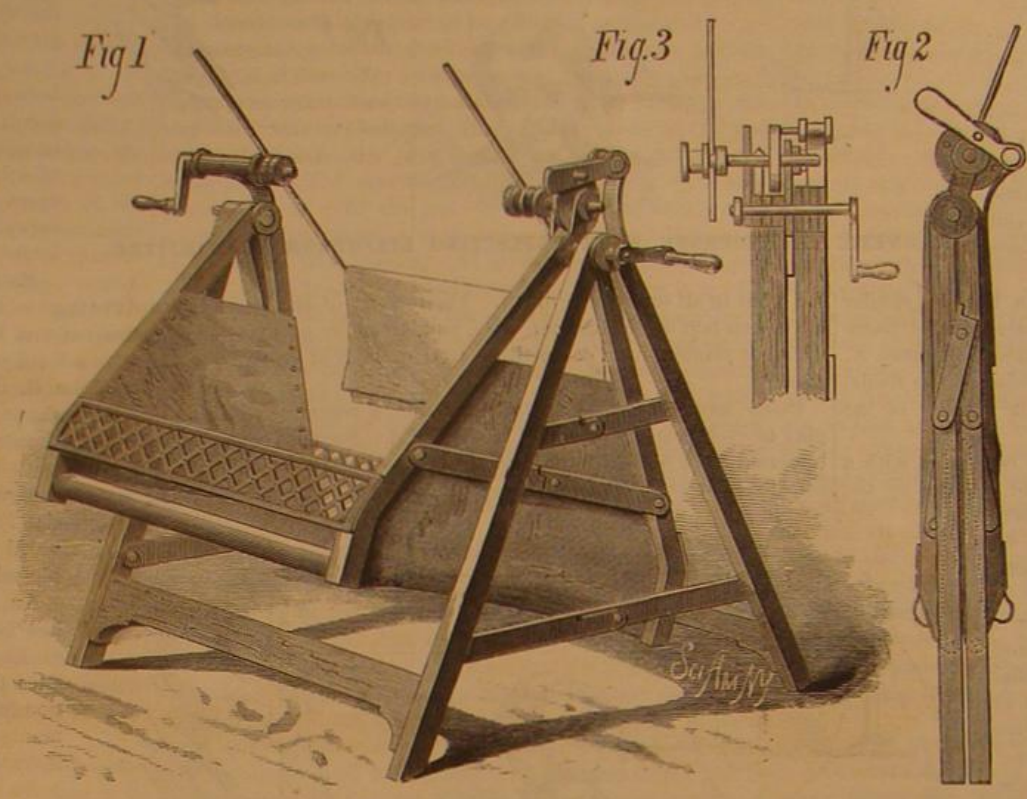
The cradle represented in the annexed engraving is capable of being folded into very compact form for storage or shipment, and, when extended, it possesses all of the conveniences of the best cradles in use. The cradle is formed of two triangular folding end frames provided with folding braces and connected by longitudinal rods, from which the canvas bottom is supported. These frames are pivoted at their apex on the top of two connected triangular folding standards, and are provided with a crank for swinging the cradle.

A bent rod, from which a fan is suspended, is attached to the bearings of the cradle in such a way that it moves in a direction opposite to that of the cradle when it is swinging, or the fan may be operated independently of the movements of the cradle. The two triangular frames forming the cradle are provided with pivoted folding braces and are suspended at their apex from shafts mounted at the apex of triangular folding standards which are also provided with the pivoted folding braces. The cradle ends are connected with each other by rigid longitudinal rails. The cradle frames are connected by the longitudinal bars from which the canvas forming the bottom of the cradle is suspended. Wicker work or a railing extends along the sides of the cradle.

The shaft, from which the cradle is suspended, is provided with a crank for swinging the cradle, and with connections for operating the fan. These connections are made adjustable, so that the fan may be moved more or less, and provision is made for swinging either cradle or fan separately. The cradle may be operated by means of a treadle, or by a string or belt, from an adjoining room.

Fig. 1 is a perspective view showing the cradle in condition for use, Fig. 2 is a sectional view, showing the operating mechanism, and Fig. 3 shows the cradle folded up.

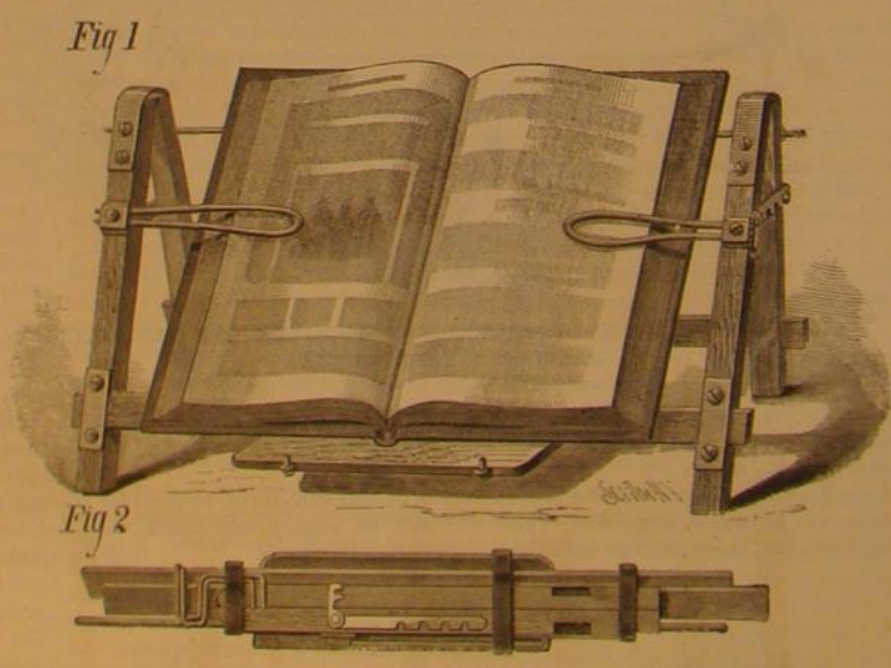
This invention was lately patented by Mr. C. C. Clark, of Brownwood, Texas.



CLARK'S FOLDING CRADLE.

NOVEL BOOK HOLDER.

The engraving shows a new adjustable and folding-book holder recently patented by Mr. Philip Lohges, of Pittston, Pa. The frame has two upright ends, each formed of two strips connected at the upper end by a hinge and by a band spring. These end pieces are provided with spring fingers for holding the book open, and are connected together by removable upper and lower longitudinal rails, one of the lower ones being provided with a shelf for supporting the book. The end pieces are provided with an adjusting device by means of which the inclination of the book may be changed at pleasure. The device may be taken apart readily and packed in very small compass. It will be found very useful by students, copyists, and readers generally. It is neatly and substantially made of wood and nickel-plated brass.



LOHGES' BOOK HOLDER.

Cooking by Electricity.

Of the many curious things certain to be seen at the forthcoming exhibition of electricity at Paris, not the least remarkable will be the electrical cooking range of M. Saligmac. That ingenious gentleman is going to fit up his apparatus in the grill room of the restaurant, and intends to furnish a great variety of meats which have been cooked by heat generated from the electric current.

At the last Paris Exhibition, M. Mouchot roasted mutton in condensed sunshine, and literally turned his spit on the hearth of the sun; but an enthusiastic admirer might say that M. Saligmac had far surpassed this in broiling steaks by lightning and warming coffee with the aurora borealis. As a matter of fact, the electric current is as well fitted to produce heat as it is to produce light, and just as electricity will, in all probability, be made to yield the principal artificial light of the future, so will doubtless it be applied to household heating. The same machines which light the house by night will heat and cook by day, besides performing other duties, such as driving a coffee mill or a sewing machine.

The Philadelphia Elevated Railway.

The elevated extension of the Pennsylvania Railroad on Filbert street, Philadelphia, is open for freight traffic. The line of the extension leaves the present passenger tracks at Powelton avenue, and passes over Thirtieth street on a wrought iron deck bridge 33 feet above the street. The Schuylkill River is crossed 42½ feet above ordinary high tide on a wrought iron double intersection triangular truss of three spans. About 190 buildings were removed along Filbert street in preparing for the construction of the work. The roadbed from Shock to Sixteenth street, a distance of 2,042 feet, is 106 feet wide, and contains nine tracks. Near Seventeenth street is a turn-table, east of which is a hydraulic elevator for mail express and baggage.

The building on the square bounded by Fifteenth and Sixteenth and Market and Filbert streets, formerly used for the freight station, has been entirely removed and rebuilt of iron and brick, two stories high. All the freight will be received from and delivered to wagons on the ground floor, being moved between the first and second floors by sixteen hydraulic elevators capable of lifting five tons each. All that portion of the second story from Market street is laid with four tracks for freight, with standing room for thirty-five cars. That portion of the second floor parallel with Filbert street, extending from Fifteenth to Sixteenth street, is intended for a shed for the incoming and outgoing passenger trains. Fifteenth street is crossed by the eight passenger tracks, 19 feet above the surface of the street. The space between Fifteenth street and Merrick street, a distance of 122½ feet, and extending from Filbert street southward 190 feet, is occupied by the passenger station, which is not yet completed.

RECENT INVENTIONS

Mr. Charles Barlow, of Cooksbire, Quebec, Canada, has patented an improved fire escape which consists of a cylinder provided with a piston filled with compressed gas, water, or other liquid, and having a wire coiled around its screw-threaded surface, inclosed, sliding, and revolving in another cylinder that is to be attached to the belt of the operator; and it consists also of an arrangement of valves and their connections, so that the operator may control the movement of the inner cylinder, and thereby the speed of the unwinding of the coiled wire and the rapidity of his descent.

Mr. John F. Rakes, of Greenup County, Ky., has patented an improved apple cutter and corer, so constructed as to cut the apples into pieces, separate the pieces from the cores, and discharge the cores from the machine.

A cigar-lighting device or lamp, which will not only be adapted for the purpose of cigar lighting, but at the same time embody an attractive and effective means of advertising, has been patented by Mr. William E. Parsons, Jr., of New York city.

Mr. George G. Niedomanski, of Washington, D. C., has patented an improved spring catch or lock to be applied to cigar boxes, by means of which nails are dispensed with, and a fastening is provided that may be instantly operated to lock or unlock the lid to the box.

Heretofore paper moulds have, in practice, generally been made up of alternate layers of unsized paper and sheets of tissue paper pasted together, which, while damp and more or less plastic, receive the impression of the type, and after being set by baking, form a matrix into which the melted stereotype metal is poured. The object of the tissue paper in the composition of the mould is to give a body to the same and to prevent ragged edges from sticking up. In making this kind of mould the paper of which the mould is composed has set once by drying, and is dampened when the mould is made. It has been found that it is not possible to reduce the paper, having once been set, to the proper condition of a plastic, no matter how damp it may be made, and when an impression is taken in such a composition the proper depth of impression is not obtained, and the tenacity of the tissue paper on the face of the mould causes it to draw, so that the cups of the letters and the spaces between the same are not of sufficient depth and sharpness. To remedy these objections Mr. Willard S. Whitmore, of Washington, D. C., has constructed a new composite mould, which is formed of a sheet of unsized paper covered with a layer of paper pulp which has never been set by drying.

An improved speaking-tube mouthpiece has been patented by Mr. George F. Richter, of New York city. The invention consists of an indicator that opens and closes horizontally, in combination with a vertically adjustable mouthpiece, that when adjusted for use closes the indicator, so that it can fall at the slightest puff of the operatar.

Mr. William F. Mann, of Mount Pleasant, Mich., has patented an improved form of buckle designed to be used, in connection with a strap, for fastening the mouth of a bag or other purpose.

An improved rack and spool for holding rope coils has been patented by Mr. Charles J. Le Roy, of Palestine, Texas. This invention relates particularly to certain new and useful improvements upon the rack and spool for holding rope coils, patented September 28, 1880, No. 232,733; and it consists in a peculiar construction of frame adapted for supporting spools of different lengths, as well as an improved construction of spool for expanding and holding the coil of rope in the center of the reel while being used.

A simple, inexpensive, and efficient device for propelling vessels, and for other purposes, has been patented by Mr. John C. Smith, of Troy, N. Y. It consists of a swiveled loop, and a propeller having a twisted plate at the opposite end of its shaft and a crank, whereby the twisted plate is worked in the swiveled loop so as to feather the paddle.

An improved moth trap, to be placed in front of the openings or apertures of beehives for the purpose of trapping the moths as they attempt to enter the hive, has been patented by Mr. Robert F. Ivey, of Williamsburg, Ga., The invention consists in a box or receptacle provided with two tubes, one inside of the other, the inner one passing through the box into the hive, and the outer one leads into the box, so that the moths that are not able to get at the inner tube must pass into the box, whereas the bees pass through the inner tube directly into the hive.

Mr. John F. Smith, of Erie, Pa., has patented an improved bit in which cheek plates are provided with suitable means for attaching them to the check rein and cheek of a bridle, the cheek plates being connected by elastic metallic bars, secured to each of the plates at one of their ends, and pass loosely through the other plate, and are provided with loops or other suitable means at their other ends for attaching them to the ends of the reins, whereby the cheek plates may be drawn together to clamp and compress the jaws of the animal without cutting, pinching, or otherwise injuring the mouth.

Messrs. C. and M. C. Jackson, of Denver, Col., have patented a stovepipe that may be adjusted to fit pipes of various sizes, so that one may be telescoped within the other any desired distance to lengthen or shorten the line of pipe and to make a closely fitting joint.

An improved chair brace has been patented by Mr. Floyd Heavener, of Denver, Col. This invention consists in combining with the chair two wires running from the crossbar of the back of the chair down through the seat, and thence to the front corners of the seat, and upward over these wires two other wires are strained, which pass from the two hind legs to the two fore legs.

Cement Floors.

A correspondent of the *Country Gentleman* states how he mixed cement and gravel for cellar bottoms and roads, which stand use and the weather.

In October, 1878, I put down a cement drive-way. The first coat was three and a half inches thick, seven parts of sharp, coarse sand or fine gravel, to one part of cement, thoroughly mixed in a box dry, then dampened with water. I spread it on the ground in sections or squares. As soon as it was set, I put on another coat, one inch thick, of one part of cement to three parts of sharp sand. When that was set, for a finishing coat I put half an inch thick of one part of cement and one part of sand. It will in a week or ten days do to drive over. For my cellar bottom I used five parts of clean, coarse, sharp sand (plasterers call it fine gravel) to one part of cement. This was mixed in the same manner as for the drive-way. It only requires to be damp enough to work well. It was mixed in a box, wheeled into the cellar, dumped, and spread smooth with a shovel, hoe, or trowel, about two inches thick. Take a spade or shovel, flat side, and beat it down hard and smooth. For finishing, use one part of cement to one part of sand; this is thoroughly mixed, and then watered so it is like plastering mortar. Dump it on the first coat, about half an inch thick, spread and smooth with a trowel. It will soon become as hard as stone. The cement I used is known as Portland cement, though I think the common hydraulic cement will answer if fresh.

Cruising for Icebergs.

The early appearance of icebergs in the track of Atlantic steamers, and the imminent risk which these wanderers from the north occasion to navigators and passengers, again call forth the query whether something cannot be done to diminish the hazard of them, if not to destroy them outright. Commander McKay, of the steamship Parthia, suggests that it would be a good plan to detail a government gunboat or two to follow one or more of these icy monsters to study their natural history after they have entered upon their voyage. A record of such observations, he says, would be of priceless value to the navigator, as it would help him to estimate the probable position of an iceberg, so as to avoid it after being told of its position at some previous date. This would give value to the now practically useless ships' reports, signaling, etc. He suggests, also, as has been recommended before in this paper, that gunboats might profitably be detailed to test the effects of shot, shell, dynamite, or torpedoes on these ice masses, and is disposed to think that such treatment might very much hasten the dissolution of the bergs.

For the benefit of readers who are not navigators Commander McKay adds that neither the air nor the water temperature gives the slightest help to the navigator in indicating the neighborhood of an iceberg, except perhaps when there is a fresh breeze blowing directly over it and in a line with the ship, or when there is a change of water temperature crossing its wake. But in the passages to and from America it is usual to cross their track on nearly a right angle. Consequently this last small factor as a guide to its whereabouts is lost. In the early part of last July he passed within three miles of an iceberg with temperature—air, 63°; water, 61°. In the latter part of the same month, 120 miles north and 100 miles east of the former position, he passed quite close to an iceberg with a steady temperature of air 64°, water, 60°.

Ammonia Vapor Engines.

A correspondent of *Engineering* says that one may find the theory of the subject discussed in a paper read in 1867 by M. Frot before the Société des Ingenieurs Civils (Paris), and reported in the *Mémoires* (1867, pp. 671, 688; 1868, p. 170). He might also consult with advantage the references under the entry "Moteurs," in the index to the *Comptes Rendus* of the Paris Academy of Sciences for 1865. See further, *Génie Industriel*, August, 1865 (vol. 30), p. 63, for an account of Delaporte's machine, with historical notices of other inventions; *Génie Industriel*, April, 1867, (vol. 33), p. 198; Fromont's ammonia vapor pump; *Annales du Génie Civil* 1865, p. 826; A. van Waeyenberch's engine. Tellier's machine is described in *L'Invention* 1865 (vol. 21), p. 87; and in *Le Technologiste*, December, 1865, p. 149. The use of such engines for driving tram cars is mentioned in SCIENTIFIC AMERICAN, November, 1871, p. 290; *Engineer*, January, 1872, p. 23; Dingler's *Polytechnisches Journal* (vol. 203), p. 234. Joy's engine is described in *Bayerisches Industrie und Gewerbeblatt*, 1872, p. 153. For an account of Laughland's engine, see *Engineer*, August, 1871, p. 131; *Mechanics' Magazine*, August, 1871, p. 152; SCIENTIFIC AMERICAN, July, 1871, p. 70; September, 1871, pp. 131, 199. See also the "Abridgments of Specifications Relating to Air, Gas, and other Motive Power Engines" parts, 1 and 2, in which he will find a description of all the ammonia vapor engines patented in Great Britain from the earliest period to the end of 1876.

INDIAN FAIENCE.

FAIENCE OF INDIA.

The engraving shows several examples of the curious faience of India, which is remarkable for the simplicity of its design and ornamentation, yet is truly artistic and pleasing. The ornamentation is of the character usually found in Eastern textile fabrics.

ELEGANT CHAIRS.

We give an engraving of two fine chairs from the manufactory of B. Ludwig, of Vienna. The frames are of solid mahogany or of ebonized wood, and the cushions and back are of richly embossed morocco leather.

CHAIRS UPHOLSTERED IN STAMPED LEATHER.

MECHANICAL INVENTIONS.

An improved spring brace for vehicles has been patented by Mr. George W. Cooper, of Pulaski, Iowa. The object of this invention is to brace the springs of buggies and other vehicles against the forward and rearward pitching of the vehicle bodies. It consists in constructing the braces with ball-and-socket joints to give the braces freedom of movement in every direction without employing loose joints.

A steam cock with a self-adjustable check valve has been patented by Mr. William Bronk, of Albany, N. Y. The cock has its rear end threaded to screw into the boiler, and is provided with the valve seat, to which is fitted a valve, which may be closed by the boiler steam and opened by a push pin.

An improved hose coupling has been patented by Mr. John B. Newman, of Milford, Pa. By this device hose or pipe can be coupled or uncoupled more quickly than by any of the devices in general use, and without the use of wrench, spanner, or any other special tool. The construction of the coupling is such that it cannot be described without engravings.

Petroleum and Plant Life.

At the last meeting of the California Academy of Sciences a discussion took place on the subject of the use of petroleum for destroying scale insects on rose bushes. Dr. Henry Gibbons said that two months ago he put petroleum on the trees in his garden. Since then the trees have grown better than ever before, they have grown faster than ever before, and given better roses than ever before. The petroleum seems to kill the scale insect. The handsomest rose he exhibited was from a bush which looked nearly dead a short time since. The petroleum was mixed with castor oil. It is not applied profusely and allowed to run down the roots. Perhaps in a crude state the petroleum would be bad, even on the stalks; but mixed with the castor oil it appears to be advantageous to the plant. The compound does not evaporate nor give out the insoluble portion. Therefore you have a permanent coating, acting on the entire surface of the plant.

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 ago was overrun with scale bugs and nearly dead.

Now, since using the petroleum and the castor oil, no sign of any scale insect can be seen in the whole garden. He thought castor oil was the only oil that will mix with alcohol, turpentine, and the benzines. It is soluble in alcohol, and when mixed with crude petroleum forms a sort of varnish or cement, which remains on the bushes, and does not fall to the ground. Petroleum, uncombined with castor oil, evaporates swiftly, but when combined forms a useful coating to preserve the plant. Many things have been thus tried. Trees have been whitewashed with caustic potash and lime. One of his rose bushes, nearly ruined by scale insects, thus treated, has borne an unusual number of roses, and a single cactus has borne 200 flowers this season. He thought these were practical facts, and quite as valuable as theoretical ones, although he valued both, and was glad to learn of any experience having a bearing of such importance to the agricultural industries of the human family. He cautioned persons against saturating the earth with petroleum, as such a course prevents future vegetation. Like all things else, its moderate use, wisely directed, is good, and its excessive use is destructive. A grain of opium relieves pain, but its habitual use persisted in brings death.

Dr. Behr said that as the mixture was not soluble in water, if it reaches the earth, it cakes the ground and thus shuts out the air, which must permeate the surface and is necessary to plant growth. A few applications will make rose bushes grow better if sparingly applied, and kill the scale bugs, but if allowed to reach the soil it renders vegetation thereafter impossible in that spot until it is eradicated.

Dr. A. Kellogg thought a simple wash of common lye would at first be sufficient in many cases. Petroleum deteriorates ground for crops. One scale bug has sixty offspring.

Mr. Verder received a large lot of lemon trees from Australia, covered with scale bugs. He applied refined petroleum to the leaves carefully, and they all fell off, but every bug died, and fresh leaves came out, and the plants continued healthy for many years. He afterward applied it successfully to orange trees. He thinks there is a misapprehension among those who condemn its use. It should not be allowed to reach the ground.—*Mining and Scientific Press.*

PURE olive oil will saponify by combination with spirits of hartshorn.

The Largest Anvil Block in the Country.

Mr. C. T. Thompson describes as follows the casting of the large anvil block for the 17-ton hammer, built by William B. Bement & Sons, of Philadelphia, for Park Bros., Black Diamond Steel Works, Pittsburg. Its general dimensions are:

Diameter of cylinder, 40 inches; stroke, 9 feet; diameter of piston rod, 11 inches. The ram is of Krupp steel, 6 feet 6 inches long, 46 inches wide, and 2 feet 6 inches thick. Dies, 32 inches long by 16 inches wide. Weight of falling parts, 17 tons. Frame and legs are of wrought iron. The plates, which are from ⅞ inch to 1⅛ inches in thickness, are riveted together with angle iron, which is, generally, 6x6 x⅞ inches. The legs are bolted to frame and bed plate; all the rest of the work is riveted together. Total weight, excluding anvil block, 190,000 lb.

In casting the anvil block there were in use five cupolas, four plain cylinders, 54 inches in diameter, and one Mackenzie. The spouts were joined together by a trough of fire bricks, in cast iron frame; these ran into a large receiver, capable of holding 30 tons. There was another reservoir, capable of holding 20 tons, to be used in case of accident to the first. These reservoirs were built of fire brick lined with fire clay. In the largest reservoir there were two openings, so that a large flow of metal could run out without any danger of not being able to plug them up. The anvil block is 12 feet 8 inches x 10 feet across the bottom; 10 feet high, 3 feet 6 inches x 6 feet across the top, with a recess for the anvil die, the size of which I am sorry to be unable to give. The mould was made so that the top of the anvil block was at the bottom of the mould, so that any dirt or slag could rise to the top, or rather the bottom of the anvil block, so giving a clean face for the die to rest on. The mould was sunk into the ground, so that the top was slightly below the level of the floor. A large plate of iron had been cast to build the mould upon. The outside of the mould was the same as in an ordinary loam casting; then, on account of the intense heat, came two layers of fire brick, and this was covered by half an inch of fire clay, and then blackleaded. The gates were six in number, at different heights, and were about 6 x 4 inches. They were connected by one slightly smaller, so that the iron would not back up and come out of a higher opening. These gates did not chill up, as it was supposed they would, from the fact of such a quantity of iron being poured each time. There were sixteen vents, about two inches square, for taking the gas from the bottom of the mould, but there was very little escape, or rather formation of gas. Around the outside of the brick mould, about a foot from each side, was a sheet iron case, riveted together, and between this and the mould sand was rammed, and then on the outside it was rammed up again, so as to make it a firm and secure backing for the mould. To dry the mould, fires were lighted around the brickwork before it was rammed up, and kept burning for about two weeks, and baskets were suspended, filled with coal. While the drying was going on, the mould was covered by sheet iron plates to keep the heat in.

The fires were started in the cupolas at 5:20 A.M.; the blast was turned on at 6 A.M.; at 6:40 the first iron was run into reservoir; reservoir was tapped about 7:20 A.M., and last run from reservoir made about 1:30 P.M.; the iron, through all the tappings, running very fluid. The mould, or rather, the casting, after having chilled sufficiently to form a skin, was covered with fine charcoal, and then sand, to a depth of about two feet, to be left for four or five months before being uncovered.

Coating of Metals.

To protect metals against the oxidizing influence of a damp atmosphere has long been an object of research of great practical importance. It is well known that a bright sheet of zinc, such as is used in covering roofs, very rapidly gets covered by a thin layer of oxide, and that this thin film becomes so thoroughly united to the metal below that it forms a firm coating and protects the metal against further oxidation. A precisely similar object has been followed by several inventors with regard to iron when they endeavored to provide it with an adhering coating of black magnetic oxide of iron. This, says *Engineering*, was done successfully in 1860 by Thirault, who employed a solution of chloride of iron, which was well rubbed upon the metal and gave it a black luster, when the artificial rust was converted in the black oxide after having been dipped in boiling water. In 1862 a similar result was obtained by Sauerwein, who used, besides chloride of iron, chloride of antimony and gallic acid, while another method was to cover the surface of iron with linseed oil and to expose it then to a dull red heat. By the process of Barff, in 1877, such a coating is obtained by subjecting iron at a dull red heat for six to seven hours to dry steam, when a black fast-adhering coating will be formed. More recently another method, of Mr. Bower, came in use, and it is now carried out on a large scale by a French company, the Société Française d'Inoxidation, which has its works at Val d'Osne. The coating of the iron articles is produced by first cleansing their surfaces and then by heating them in a furnace to a light red heat, when successively currents of carbonic oxide and carbonic acid are passed through it. In this way a bluish-black oxide of iron is formed upon either cast iron, wrought iron, or steel. This oxidized surface, on being polished with oil, takes a beautiful luster, and it is further ornamented by scraping some parts of it free from the coating, which are then either covered with a thin layer of bronze, gold, or platinum by galvanic action, after the invention of M. Dodé. Many articles made by the Société d'Inoxidation, such as statues, vases, fountains, basso rilievos, fire grates, stoves, balconies, candelabra, railings of staircases, and others, are really of a very beautiful appearance.

Teasels.

The teasels which are used in woolen mills for the purpose of raising the fiber out of the yarn when the cloth has left the loom, are a natural product, and not an artificial one, as those unacquainted with woolen manufacture might be led to suppose, and though wire cards have repeatedly been tried for this purpose, says the *Textile* (Eng.) *Manufacturer*, these teasels are still holding their place as the only suitable material for effectually raising the nap without any undue damage to the fiber.

A large amount of teasels are grown in Belgium. They are sown in spring, in August or September they are transplanted, and twelve months after this the first crop is gathered. The heads must be gathered before all flowers have bloomed, else the points are dried too much and lose their elasticity. The older and drier ones are always preferred to the fresh ones.

This plant is found growing wild in Middle Europe, but is then useless for manufacturers because in that state the points are not bent. In England the cultivated plant is grown chiefly in Yorkshire. Russia also raises a good crop in Poland and the Crimea.

The heads, after having been cut off the plant, generally pass at once into the hands of the dealers. The latter, in France, travel in July about the districts mentioned above, and buy the crops in the field, the price averaging from 25*s.* to 60*s.* per cwt. The dealer then sorts the teasels, taking out those which are crooked, too thick, or wormeaten; he removes the husks, cuts the stems to one uniform length, ranges them into first and second qualities, divides these again into eight or ten sorts, according to their length, and packs them into large casks, and sells them at so much per 1,000; a cask of the smallest size holding as many as 150,000, while one of the larger sizes only containing 10,000, but all weigh four cwt. In Russia they are sold by the cask, in other parts of Europe by weight.

As the teasel is a cultivated production of the thistle plant, it follows that its value for manufacturing purposes is enhanced by careful cultivation. The hooks, which are small bent leaflets of the flower, are generally set vertically in transposed rows, though in the French in the form of a spiral round the central cone, and closer at the bottom than the top. This leaflet has a strong rib at its back which is both stiff and elastic; the sides form, so to speak, wings, which are attached to the softer central core, and thus form an elastic spring which enables the hook to spring back in work, each hook also leans against its predecessor, so that when the force which pulls it is too strong, it turns a little sideways, and thus lets the resistance slip off. This is one of the principal qualities of the natural teasel, and has never been reproduced in artificial imitations. In the well-grown teasels the hooks are situated horizontally, and vertically to the spindle, while in the inferior ones they incline as much as 40 degrees.

The French teasels are pretty regular, the hook is horizontal, stronger, and longer than others, and dries better without losing its elasticity; the German kind is less regular or strong, but on that account is often preferred for fine qualities of cloth, which require more careful treatment. Dampness is injurious to all teasels, which soon mould and then lose much of their elasticity.

Glass Making.

A preliminary report issued from the Census Office presents the following statistics relative to the manufacture of glass in the United States for the year ending May 31, 1880, compared with the results obtained by the census of 1870:

	1880.	1870.
Number of establishments	194	154
Employes	23,822	15,567
Capital	$19,415,599	$13,826,142
Wages paid	9,112,301	7,589,110
Materials used	7,991,393	5,904,365
Value of product	21,603,464	18,470,507

The investigation into the growth and extent of this industry included only those works which manufactured glass from the crude material, and not those in which manufactured glass is a raw material, such as manufactories of painted or stained glass, mirrors, chemists' ware, etc.

A Whale Attacks a Ship.

The bark Anna lately arrived here in ballast from London to Read, Lauder & Co., after a most eventful voyage. One of the principal incidents is entered upon the captain's log-book as follows: "February 28, 3 P.M., latitude 42° 31' north, longitude 35° west, hard gale blowing and ship running under lower foretopsail and mainsail, sighted a large whale over bows. The fish bore down on us, and struck ship on the port side of the stern, and knocked the foreport into matches and kindling wood; sounded pumps, but no leak; whale went off, leaving a track of blood behind." Captain McPhail states that he was surprised at the whale dashing right into a large vessel in mid ocean. He says that when he first saw the big fish it was rolling and spouting water 15 feet high. He had not then any idea it would charge his vessel, but soon discovered that the whale meant business. As the whale came on he luffed a little to prevent it from striking the side of the vessel and ripping a plank off. It dashed by and just gave one slap with its tail that fairly knocked the cut water of the boat off from the 11 inch mark to the keel. He thinks it was stunned and hurt.

Manufacture of Nitro-Glycerine.

E. M. Eissler, in the *Mining and Scientific Press*, gives the following information concerning the manufacture of this remarkable explosive:

The practical production of nitro-glycerine, therefore, is accomplished by the treatment of glycerine with a mixture of concentrated nitric and sulphuric acid, in which treatment the sulphuric acid plays a secondary role, and by the absorption of the eliminated water it maintains the surplus of the nitric acid in a concentrated condition.

Different chemists employ different proportions in their mixtures of nitric and sulphuric acids, and also in adding the glycerine.

In the production of nitro-glycerine there is a very strong elevation of temperature, which must be avoided, as it may lead to explosions. There are also different methods employed to avoid this elevation of temperature.

According to Sobrero, 2 volumes of sulphuric acid of 1·831 specific gravity, and 1 volume of nitric acid of 1·525 specific gravity, are mixed, permitted to cool, and into this mixture half a volume of glycerine, of a very sirupy consistency, is introduced with constant stirring. The mixture is again cooled, and after having become turbid and been separated into two layers, poured into 15 or 20 times its bulk of cold water. The oily nitro compound sinks quickly to the bottom, is freed from unchanged acid and glycerine through repeated washing with water, and hastily dried in vacuo.

Praeger & Bertram add 1 part by weight of glycerine to 8 parts of a mixture of 1 part of concentrated nitric acid and 2 parts of fuming sulphuric acid.

Liebe recommends to pour 1 part by weight of glycerine into a mixture of 2 parts of nitric acid of 1·525 specific gravity, and 4 parts of concentrated sulphuric acid, to keep the mixture below 75° F., and to dry the washed nitro-glycerine in the steam bath. There are various methods proposed, but on working on a large scale, the process is carried on as follows:

The manufacture of nitro-glycerine usually takes place in three wooden sheds of light structure, separated from one another by strong earth banks of 25 to 30 feet in thickness at their base. The walls and roof are lined with straw, and the temperature, by means of hot water pipes, is kept day and night at about 60° Fahr.

In the one shed the glycerine is brought together with the mixture of acids; in the second shed the nitro-glycerine is poured into the water, and otherwise washed; in the third shed the complete elimination of acid from the oily compound is effected, and eventually the nitro-glycerine is worked up into dynamite.

These sheds are sunk into the ground, so that their flat roofs are barely above the level of the ground; they are lit up by reflecting lamps placed outside on the roofs; the floor is covered with fine sand. At some distance from these sheds are the huts in which the cartridges are made. They, too, are separated from one another through earth banks, and so is another shed, in which the packing takes place. Quite away from all these buildings are the storehouses, sunk into the ground. There are usually also cellars for keeping the ice, which latter serves for cooling the wash water. The storing of the raw glycerine and the sulphuric acid requires no special precaution.

Nobel's arrangement for making nitro-glycerine is very perfect, as large quantities can be produced by it at a time, as much as 3,500 lb. in one operation, and to accomplish it, only a few hours are required, and under the supervision of an able man the operation can be considered comparatively safe, as he keeps his mixture cool, and avoids in this way the great danger of the nitro-glycerine igniting and causing explosions. I shall enumerate the way the nitro-glycerine is manufactured in some large establishments on the Continent.

In one of the largest dynamite factories in Europe, where the daily production is over two tons, the nitro-glycerine is prepared in the following manner: 1,300 lb. of nitric acid of the specific gravity 1·48 are mixed in four cast iron pans with 2,600 lb. of sulphuric acid; this mixture, which is left to cool for a day, serves for the treatment of 630 lb. of glycerine. The acid is drawn from the pans into a wooden cylindrical vat, of about 6 feet high and 3½ feet in diameter, lined inside with thick lead, and containing along its lining two spiral lead pipes of about 1 inch diameter, which reach from the bottom to the top. Each of these spirals, or worms, forms a system by itself through which cold water circulates, and one may serve as substitute for the other in case one gets out of order. The mixture of acids is stirred first by itself in this vat; the stirring is effected by two iron disks covered with lead, disk and covering being perforated, which glide up and down on a vertical iron shaft, the gliding motion being effected by pulling the rope attached to the disks over a pulley. The two or three workmen who perform this task stand at a distance of 30 or 40 feet from the vat, behind a strong earth bank. When the acids have been introduced into the vessel, and the agitation has commenced, water of the temperature of about 25° Fahr. is let into the worms. The temperature of the acid can in this

way be maintained at about 50° Fah., as may be ascertained from a thermometer which reaches through the lead cover of the vessel into the acid. The glycerine, which is kept in a zinc tank on the roof of the shed in which the mixing vat is, is now allowed to run into the latter vessel. The flow is regulated by means of a tap, and also by letting the glycerine first run into perforated zinc boxes, placed on the lid of the mixing vat, and corking up, if occasion requires, some of the perforations. As soon as the glycerine falls into the acid the temperature rises at once, but by carefully regulating the supply of glycerine it may be kept at about 60° Fahr.

It is advisable not to allow the temperature to rise above that degree, though experience shows that a higher temperature yields a larger quantity of nitro-glycerine. It requires, according to the season and the temperature of the cooling water, two to three hours for 630 lb. of glycerine to pass into the mixing vat; the stirring must not be stopped for a moment during the process. When all the glycerine has been added to the acids, the mixture is at once drawn off through a leaden pipe to the so-called wash shed, where it passes into a tank about 8 feet high and 12 feet in diameter, which is half filled with cold water. The inlet tube carries a sieve to retain lead sulphate that may have been brought from the mixing vat. While the nitro glycerine flows in, stirring with wooden poles is begun, and continued until the nitro-compound has settled below the dilute acid. The bottom of the wash tank is slightly inclined, so as to allow a complete drawing off of the nitro-glycerine. The outlet taps are of stoneware. The nitro-glycerine is now twice washed with water, freed from acid and lead sulphate, and finally washed with water, to which some sodium carbonate has been added.

But even after this purifying process there remain traces of acid. To eliminate these the nitro-glycerine is transferred to a third shed, where it is agitated for about an hour in a rotating vessel called a butter machine, with about 50 lb. of a concentrated solution of sodium carbonate; after this time it will no more redden litmus paper. It is now separated from the alkaline solution, filtered through felt, and collected for further use in leaden reservoirs.

The yield differs greatly according to the condition of the raw glycerine, the concentration of the acids, and the temperature. The yield of nitro-glycerine falls generally below the theoretically calculated quantity. This short-coming is due to the formation of glycerides, which dissolve in the wash water. As a rule, the yielding in winter is greater than that in summer.

The above is a system employed by some continental manufactures, and, notwithstanding the precautions taken against the accidental rise of temperature during the production and washing of the nitro-glycerine, some very serious explosions during its manufacture have not been unfrequent; but Nobel has adopted a method of operation which, so far as experience goes, appears not to involve any special elements of danger if properly applied, and also presents advantages from an economical point of view, besides promoting the attainment of uniform results; and to his credit it must be said that when he made his first trial with his new apparatus he certainly exhibited a great deal of boldness and pluck, as it was a question of converting several hundredweight of glycerine into the explosive compound in a single operation. His mode of operation is successfully carried out by the Giant Powder Company of San Francisco. The plan pursued by some of the other companies established near this city differs somewhat in its arrangement.

A series of small iron kettles, or pots, are arranged in a trough, each provided with a stirrer, which receive their movement from a common shaft, which is revolved by a man stationed outside of the building. The pots are charged with the acids, and the glycerine is supplied either from a common reservoir by small outlet pipes, or above each pot is a small vessel containing glycerine, from which the same runs in a small stream into the acid mixture.

The iron pots are surrounded by a running stream of cold water while the reaction is going on, and stirring has to be constantly kept up. After the reaction is complete the pots are taken up and their contents dumped into large tanks filled with water, where the nitro-glycerine separates and is afterwards washed.

As simple as this operation may appear, the writer earnestly warns anybody who is not experienced in the matter to undertake any trials, as there are points connected with the manufacture of nitro-glycerine which can only be acquired by practical experience, and even then it is fraught with danger.

At G. M. Mowbrey's factory, near North Adams, in Massachusetts, the nitrification of the glycerine takes place in stoneware jars. 116 of these are distributed over 9 wooden troughs, which latter are filled to within a few inches from the top of the jars with ice-cold water, or a mixture of ice and salt. Each jar receives 17 lb. of acid mixture, and into this 1 lb. of glycerine is introduced, drop by drop, from glass vessels, which are placed on a shelf just above the acid jars. Below this shelf runs an iron tube, about 1½ inch diameter, through which cold, dry air is conducted. From this tube glass pipes branch off, joined by means of India-rubber tubes, into each jar, which thus receives, during the dropping of the glycerine, a constant current of cold air, acting both as cooler and as stirrer. Very beneficial influence is ascribed to this air current, which oxidizes also nitrous acid vapors.

The introduction of the glycerine into the acid must be finished within one and a half hours. There should be no rise of temperature, and certainly no appearance of red vapors. After the transformation of the glycerine, the jars are emptied into troughs containing water of 70° Fahr.; the nitro-glycerine sinks to the bottom and remains covered with about six feet of water, for a quarter of an hour, when first the water is drawn off from above, then the nitro-glycerine from below. The latter is transferred to oscillating casks, in which it is washed three times with water, and twice with soda solution, a current of air passing through the liquid all the time. The wash waters pass into a tub, from thence into two casks, sunk into the ground, where such nitro-glycerine as had been carried away by the water is retained. (The writer considers Mowbrey's plan very good, and strongly recommends some of its features to the consideration of nitro-glycerine manufacturers.)

The nitro-glycerine is carried in copper vessels to a shed, about 100 yards distant, and poured into stoneware jars (the writer objects to the employment of stone, porcelain, or such like ware for handling made nitro-glycerine; he would recommend vessels of India-rubber or paper, or something which does not break or leak) of 60 lb. contents, and the jars placed in reservoirs filled with water of 70° Fahr., and left here three days. Impurities rise to the surface, and are skimmed off.

The nitro-glycerine is now ready for commerce. It is filled in canisters of galvanized sheet iron, coated inside with paraffine, and capable of holding 56 lb. The floor of the shed where the filling takes place is covered with a thick layer of calcined plaster of Paris, in order that any spilled nitro-glycerine be absorbed at once. The canisters are then exposed to the cold of ice and salt for the sake of freezing their contents. In this state they are stored, 30 to 40 to a batch, in magazines at least 100 yards from all the other buildings of the factory. The transport of this nitro-glycerine takes place also while it is frozen.

Nitro-glycerine is an organic poison. It produces serious consequences when taken into the system—vertigo, weakening of sight, stupor, pains in the cardiac regions; in larger doses it acts like strychnine, being fatal when more than 10 grammes are swallowed. Even mere contact with the skin produces serious symptoms, though workmen get used to it after a time. In external contact, the nitro-glycerine may be of serious consequences if it is taken into the blood; so workmen, if they have sores or wounds on their hands, must be extremely cautious in handling it.

At ordinary temperatures it is an oily liquid, clear, colorless, or yellowish, refracting light, of sweetish and burning taste, without odor, of 1·6 specific gravity. It solidifies at a comparatively high temperature—40° Fahr. In water it is insoluble, but dissolves easily in ether, wood spirit, benzole, chloroform, and hot alcohol.

Pure nitro-glycerine does not decompose spontaneously at ordinary temperatures. Up to 120° Fahr. its loss is hardly perceptible by evaporation. By gradual heating in inclosed vessels up to 212° Fahr., it can be kept in that state for several days without explosion. If the heating is continued gradually and slowly up to 400° Fahr., it commences to decompose and loses its explosive properties. A sudden and quick heating to 380° Fahr. will explode it. The gases resulting from the explosion are: carbonic acid, water vapors, nitrogen, and oxygen, and combinations of the latter two elements.

Theoretically the explosive force of nitro-glycerine as compared with gunpowder is stated to be as 1 to 10, but in practice this figure is much lower, and different experimenters give different opinions. Putting a light directly to nitro-glycerine does not lead to detonation, but it is very dangerous to set fire to it, as in bulk the fire may heat the mass to its exploding temperature and lead to disastrous results. Some writers assert there is no danger if any amount of nitro-glycerine is set on fire. They say it will burn away quietly long before it is heated to the degree at which it explodes.

If heated in a closed space it explodes violently.

If it is exposed for some time to a strong heat, like in a tropical climate, it becomes very sensitive, owing to a partial decomposition; then any concussion, increase of temperature, or strong vibration in the air, will explode it.

Electricity will explode it. By putting the two poles of an electric battery into the fluid, and passing the sparks between them for some seconds, the surface of the nitro-glycerine becomes agitated, turns black, and then it explodes.

Mr. Abel says that nitro glycerine explodes by electricity or any other influence which produces heat; only then, when the intensity of the same or the time during which the same acts, is sufficient to produce a decomposition of a portion of the liquid, and if this decomposition has once commenced, the temperature rises by accumulation of heat to such a point as to cause its explosion.

Nitro-glycerine explodes by a blow or concussion, but gradually increasing pressure is unable to explode the liquid, but if a blow is given to it with sufficient vehemence and quickness, so that the force of the stroke will produce a sufficient heating point, then the particles struck will explode.

At about 32° Fahr., nitro glycerine becomes solid, and when exposed to that temperature for some time it becomes a hard substance. In this condition it is hard to explode, even with the fulminates (caps). Although in a frozen condition this substance is considered much safer than in its liquid state, it has still to be treated with due precaution.

Several accidents are on record where, in Europe, the frozen stuff was broken with a pick, and these accidents have proven that, although frozen nitro-glycerine is hard to explode with a cap, it will nevertheless explode easily when struck heavily with a sharp-pointed instrument. For instance, take a pick with a sharp point, of 10 lb. weight, and strike it against a hard rock with a velocity of 20 feet per second, and if there is any nitro-glycerine at the point of contact, this blow will exceed by far in intensity the concussion produced by an exploding triple-force cap, and consequently detonate the nitro glycerine.

An Electric Railway in London.

One of the novelties at the Crystal Palace on Easter Monday was the opening of an electrical railway, constructed by the Société Anonyme d'Electricité, of Brussels, on the Siemens system. On the upper terrace of the Palace grounds, overlooking the charming scenery of Sydenham, a miniature circular line of railway, consisting of three lines of metals, has been laid down, surrounding one of the ornamental ponds, and a small wooden hut erected beside it as a passenger station. On this railway, which is about 300 meters in length, and has a gauge of about 50 centimeters, or 19 inches, between the outer rails, stands the electrical locomotive. Its length is about four feet, its breadth about a meter, its height about as much, and its weight some three-quarters of a ton. It is, in fact, a Siemens dynamo-electric machine, neatly boxed in, and mounted on a truck with four metal wheels, and provided with a brake and alarm bell for its control by the man in charge. A stationary engine of about eight horse power nominal, in a shed about thirty yards from the railway line, drives a stationary dynamo-electric machine, from which the electro-motive current is primarily obtained. Two wires are connected with this fixed dynamo machine. By one of them the current flowing out is conveyed to the mid-rail of the railway, to which it is attached by an iron plate bolted on. The second or return wire is attached to the exterior rail of the railway. The mid-rail is supported upon wood blocks, and is thus in a certain degree insulated.

Beneath the electrical locomotive a brush of iron wires sweeps the mid-rail, and the electrical current is thus taken up into the locomotive, where it passes through the mounted Siemens machine within it, the large bobbin of which is thereby caused to revolve, and the current passing away by the wheels of the truck to the exterior rails of the road, is conveyed back to the stationary dynamo-machine. As the current thus circulates, and the bobbin of the mounted machine revolves, it drives the four wheels of the truck as the locomotive moves on, hauling after it a load of nearly three tons with ease at the speed we have named. The electrical locomotive is easily managed; by applying the brake the electro-motive current is cut off as a driving power, while the wheels are at the same time mechanically skidded. By reversing the current the locomotive can be driven in either direction, as desired. The circulation of the electro-motive current from the stationary dynamo-machine to the mid-rail, and from the mid-rail to the locomotive, from it again to the outside rail, and from it back to the fixed machine, depends entirely upon the superior conductivity of the metallic wires and rails over the conductivity of the earth; and this mode of driving the electrical locomotive seems to make such a system open to difficulties upon railroad lines of any considerable length.

Cod Liver Oil.

Under the heading of "Practical Notes," Mr. R. B. Fairthorne suggests, in the *American Journal of Pharmacy*, a new method of taking cod liver oil. As the use of this remedy is at the present time more extensive than ever before, any means employed whereby it can be more readily taken without causing disgust will prove of service to sufferers who have to use it daily. Mr. Fairthorne's method consists in adding two drachms of tomato or walnut catsup to each ounce of the oil, the mixture being well shaken whenever required for use. He has found this mixture to agree with many persons much better than any other form in which cod liver oil has been taken, and this he attributes to the association of substances generally employed as additions to food, bringing into operation those digestive faculties of the stomach which might otherwise remain dormant when such incongruous substances as sugar and one of the principal ingredients of fish are introduced together into the stomach. Mr. Fairthorne also states that the following forms a not unpalatable mixture, which is readily taken by the patient: Liebig's extract, ½ ounce; extract of celery seeds, ½ fluid drachm; vinegar, 1 fluid ounce; water, 2 fluid ounces; cod liver oil, 5 fluid ounces. The extract of beef is to be dissolved in water, and the oil and vinegar to be added and shaken well together with the extract of celery.

The Horse Power of the World.

It has been estimated that, in 1878, on the 270,000 miles of railroad, there were at work 105,000 locomotives, of an aggregate 30,000,000 horse power, while the total number of engines amounted to 46,000,000 horse power. Taking the nominal horse power at an effective force equal to that of three horses, and the work of a horse as equal to that of seven men, it will be seen that the steam engines represent the force of nearly 1,000,000,000 men, which is more than double the amount of workers on the face of the globe. The steam engine, which is fed by coal, has, therefore, tripled the productive power of man.

NEW INVENTIONS.

Mr. Frank W. Mix, of Terryville, Conn., has patented a novel lock case, designed to meet the requirement of that type of indicator padlock in which the bolt mechanism and indicator mechanism are arranged in different planes, with a supporting plate between the same. The object sought is to combine economy in the manufacture of the case with intrinsic merit in its structure, the principal points aimed at being the largest amount of room for the indicator mechanism in the smallest compass of case, and such a structure of a three-part case as will avoid strain on the rivets.

A simple, inexpensive, and efficient means for holding the sashes of a window at any desired adjustment, and locking them when closed, has been patented by Mr. Edwin L. Barber, of Larwill, Ind. The invention covers certain peculiar features of improvement upon that form of sash holder in which a bar is attached to the horizontal upper portion of the stationary window frame and depends to the upper edge of the bottom sash, and passes through a notch in the meeting rail of the same, each sash being provided with an attachment to the rod, which permit the sashes to be adjusted up or down upon the rod to open or close the window.

An improvement in the class of table frame whose rails and legs are connected by metal clamps having flanges that enter a groove in the legs, has been patented by Mr. James Pleukharp, of Columbus, Ohio. The improvement consists in providing the legs with vertical grooves which are inclined transversely toward each other, and the rails with grooves that incline toward the legs, and in locking the legs and rails together by means of metal clamps having flanges that enter the grooves.

An improved tire setter has been patented by Mr. Fredric P. Beucler, of Charleston, Iowa. The object of this invention is to facilitate the setting of wagon and other tires, and the adjustment of felly and spokes. It consists of a revolving swinging head carrying a central ring, which is provided with pivoted radial arms that can be retracted or extended to suit wheels of varying diameters, and is vertically pivoted in a block rocked on a vertically adjustable standard by levers from a horizontal to a vertical plane, and *vice versa*, whereby a wheel on the machine may be plunged into and withdrawn from a water tank.

An improved oiler has been patented by Mr. Alexander McMullen, of Ottumwa, Iowa. The object of this invention is to facilitate the oiling of pulley bearings, journal bearings, and other wearing surfaces, regulate the amount of oil applied, and prevent the escape of oil when not required.

Mr. William S. Bright, of Letart, West Va., has patented a stalled stock car, whose stalls can readily be enlarged or reduced in size to accommodate the largest number of animals, and the car is fitted so that the animals can be conveniently supplied with water.

An improved furnace for ventilating mines has been patented by Mr. John R. McBroome, of Woodville, Pa. This invention consists in a furnace of novel construction, placed in an arched passage within the mine, so that the furnace arch is surrounded at top and sides by an air space. The furnace arch and air space enter a vertical ventilating shaft at one point.

Mr. James Smith, of Philadelphia, Pa., has patented an improved apparatus for elevating bricks and mortar in hods It consists in features of construction for rendering the operation more perfect, and in a safety stop for preventing the hods from being carried over the upper wheels

Lead Poisoning by Cosmetics.

The death of a young lady in this city from lead poisoning by the excessive use of cosmetics has called out from Dr. Hammond the statement that the case was not an uncommon one.

"Lead poisoning," he said, "occurs more frequently than is generally thought. The public rarely hears of such cases. It is only once in a while that cases like that of Miss Blanchard attract the attention of the public outside of the medical profession. The use of any kind of cosmetics, even if not habitually indulged in, is attended with danger. There are very few, if any, that do not contain white lead. This poison is used in the manufacture of face powders, face washes, and hair dyes. Minute particles enter the skin and are taken up by the blood and communicated to the system. It produces various effects. Paralysis, colic, prostration of the nervous system, and insanity are among the most frequent results of its introduction into the system. A very distressing case came under my notice a few years ago, in the wife of the Governor of one of the Western States. She had been in the habit of using a certain hair dye—I forget the name at the present moment—which contained white lead in a large proportion. She became hopelessly insane, and death ensued finally. Another case was that of a young lady who used a so-called 'bloom of youth.' In this case paralysis preceded death."

In answer to the question touching the amount of lead necessary to be absorbed to produce symptoms of poisoning, Dr. Hammond said:

"In some cases the quantity is infinitesimal, but it varies. The most common kind of poisoning is occasioned by the use of water conveyed in lead pipes. The family of Louis Philippe suffered from lead poisoning while living at Claremont. The water upon examination was found to contain but one grain of lead to the gallon. A lead colic was almost unknown in Amsterdam till the inhabitants began to substitute lead roofs for tiles, when a violent epidemic of the disease occurred and caused great ravages. In experiments which I instituted with reference to the action of water upon lead I found that one pint of water remaining in a bright leaden jar for six consecutive hours contained, upon being tested by passing a current of sulphureted hydrogen through it, one-seventh of a grain of lead—a proportion amply sufficient to have produced the most serious results if the water in which it was found had been used as a drink for a few weeks."

Winter Cholera in Chicago.

During the first three months of the present year a remarkable outbreak of what is called "winter cholera" occurred in Chicago and many parts of the Northwest. Fortunately the disease was not fatal, though it no doubt increased indirectly the fatality of other diseases. The characteristics of the outbreak were described as follows in a report to the National Board of Health, by Dr. H. A. Johnson:

"The epidemic of so-called winter cholera the present winter in Chicago is noteworthy as decidedly modifying the usual health condition of the city, and also for its own peculiarities. From all that can be learned from conversation with physicians it appears that it became suddenly prevalent about the holidays, though there are records of a rather unusual amount of diarrheal trouble earlier in December. From that time to the present the epidemic has continued with more or less violence, but now seems to be somewhat abating. It is not possible to even approximately estimate the degree of its prevalence with any certainty. The disorder has made no marked figure in the mortality reports, and there are no returns of non-fatal diseases. Judging from the number of cases mentioned to me by physicians as having come under their own observation and treatment, and allowing for the whole number in the city, as well as the very large probable number of cases where no physician was consulted, I should say that at least 15,000 or 20,000 cases have occurred; and perhaps 30,000 or 40,000, of all degrees of mildness or severity, would be more nearly correct. In one of the principal suburbs, where it was easier to make an estimate, and where it was to all appearances much less prevalent than in the city, nearly 2 per cent of the population were more or less affected. Here, too, according to the experience of some physicians, a majority of the cases were adult males, whose business carried them to the city every day. Popular opinion was at first inclined to attribute it to the excessive cold of the winter, and many physicians were inclined to share the opinion. Bad sewerage and ventilation could not be generally credited with its production, as it occurred equally where nothing was wrong in these respects. It is probable, however, that it was aggravated in some instances by bad sanitary conditions. The fact that the disorder occurred simultaneously in many widely separated localities over the country is against the idea of any local conditions producing it—such as the drinking water, which was constantly and carefully watched by Dr. DeWolf and the health officers without finding any marked impurities, notwithstanding that the Fullerton avenue conduit was discharging from the North branch into the lake all winter. A number of physicians of extensive observation strongly suspected a malarial element in the disorder. In this connection I may state that a well known physician from the interior of the State, Dr. Howard, of Champaign, has said that in his town he had seen a large number of cases of severe bowel complaint this winter in children, and very few in adults. In all, or nearly all, cases he found that the sufferers had been eating snow, and that the disease was apparently directly traceable to that. He also favored the idea of its malarial character, at least in part. The facts known are very suggestive, but it will require much more extensive inquiry at a later period to justify any positive deductions."

The prevalence of diarrheal complaints in Chicago has continued into May, and the general sanitary condition is described as extremely bad. The death rate was higher than it has been before in many years, particularly among children.

Distemper.

Ceilings and walls are often finished in distemper, but very often turn out unsatisfactory from the want of knowledge in the mixing and laying on. Absorption in the wall should be checked or stopped, or one part will absorb more color than another, and an uneven or spotty appearance results. Various preparations are used for preparing walls and to stop absorption. One of these is to mix about a dozen pounds of the best whiting with water, adding thereto enough parchment or other size to bind the color, about two ounces of alum, and the same weight of soft-soap dissolved in water; mix well and strain through a screen or coarse cloth. In mixing the distemper, one writer says, "two things are essentially necessary, clean and well washed whiting and pure jellied size." The whiting should be put to soak with sufficient soft water to cover it well and penetrate its bulk. When soaked sufficiently the water should be poured off, which will remove dust from the whiting. It may then be beaten up to a stiff paste by the hand or spatula. Size is next added and mixed together. Care should be taken not to break the jelly of the size any more than can be avoided. Another caution is that distemper should be mixed with jellied size to lay on well; the color then works cool and floats nicely, but when the size is used hot it drags and gathers and works dry, producing a rough wall. A little alum added to the distemper hardens it and helps to dry out solid and even. The best size is made from parchment clippings, which are put into an iron kettle filled with water and allowed to stand twenty-four hours till the pieces are thoroughly soaked, then they are boiled for five hours, and the scum removed. The liquid is then strained through a cloth.

For mixing colors the whiting and the color required, finely ground, are dissolved separately and then mixed to the required tint. For example, lampblack mixed with whiting makes gray, and the most delicate to the darkest shades may be obtained. For French gray the whiting required is taken and soaked in water, and Prussian blue and lake finely ground in water are added to produce the necessary shade or tint. Buff may be made by dissolving in like manner, separately, whiting and yellow ocher. A little Venetian red gives a warm tone. A good salmon tint is produced by adding to the dissolved whiting a little of the same red, just sufficient to tinge. Drabs of various tints can be easily made by grinding up finely a little burnt umber and mixing it with the dissolved whiting. The sooner the distemper color dries after being laid on the better, and the best plan is to close windows and doors during laying and throw them open afterward.—*Building News, London.*

Qualitative Analysis of Alkaloids.

As well known, reagents for certain alkaloids and their salts have hitherto been wanting. Mr. Maurice Robin proposes, in a new French scientific journal, *Revue Scientifique*, a new method of qualitative analysis of these substances based on the use of sulphuric acid and cane sugar.

A small portion of the alkaloid to be examined is mixed with double its weight of common powdered sugar in a small porcelain capsule, one or two drops of sulphuric acid are added, and the mixture is stirred with a glass rod.

Hydrochlorate of morphine treated in this manner give a very beautiful *rose* color, which passes very rapidly to *violet*.

The latter color is persistent, and resembles that which is obtained on dissolving permanganate of potash. Sulphate of quinine gives a color which is at first *greenish*, then *bright yellow*, and finally *coffee brown*, surrounded by a yellow circle.

Sulphate of atropine gives a *violet* color, which increases in depth till it becomes at length *brown*. With narcotine there is developed a persistent and very characteristic *mahogany* color which cannot be mistaken. With salicine, a *bright red;* with veratrine, a *dark green*. With codeine the reaction is especially manifest, and this is the more interesting from the fact that up to the present time we have had no precise reagent for this alkaloid. The color obtained is a magnificent and very intense *cherry red*, which soon changes and becomes *violet*. This violet tint, which is very beautiful, differs somewhat from that which morphine assumes; and, moreover, these two alkaloids are distinguished very readily by the first reaction, which, in the case of morphine, is accompanied by a *rose* color. This reaction may also serve to show whether, as sometimes happens, codeine has been adulterated with sugar. If adulteration *is* present the *cherry red* and *violet* will make their appearance, while pure codeine acted upon by sulphuric acid shows no change of color whatever.

Suspension by Subdivision.

To the Editor of the Scientific American:

The fact that substances which are quick to obey the universal law of gravitation when in a mass are apparently lighter when in a state of fine division, will doubtless strike most persons as singular when they consider that the relative amount of air displaced by each part of a substance must be the same whether the part be large or small; while to make a body really alter its weight compared to air, it is necessary that the relation between its weight and bulk should be changed. Its specific weight has clearly not altered. How then is the suspension of finely divided substances to be accounted for when, if the same subdivisions be collected into a mass, they will rapidly fall; and also in view of the fact that the force of gravitation acts upon each particle without regard to its neighbors, and will exert its powers whether the particles are separate or aggregate?

It is easy to understand, for example, why a sphere of wood will fall more slowly than a sphere of lead of the same size, the wooden one presenting such a relatively greater resisting surface to the air compared with its weight than the one of lead.

Let us see, therefore, whether the mere act of dividing a substance can alter the relations of weight and resisting surface so as to permit an explanation of this phenomenon.

If two spheres of lead or other homogeneous substance, having the respective diameters of one and ten, be weighed, it will be found that their weights are related to each other as the *cubes* of their diameters, or as one to one thousand, while the relation between the areas of their great circles or surfaces of resistance are as one to one hundred, or as the *squares* of their diameters, thus making the resistance of the air relatively greater in the case of the smaller body.

Now, although only liquids resolve themselves into spheres when divided, yet this reasoning may be regarded as approximately true of the irregular subdivisions of solid bodies, while the levity of fog and clouds will be made more comprehensible. This principle is, of course, applicable to solids immersed in liquids, and also to the ascension of bodies of less specific weight than the fluids in which they are immersed. As the text books do not explain this common phenomenon, I thought that the above might prove interesting.

WM. B. COOPER.

Philadelphia, May, 1881.

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) W. R. S. asks: 1. How can I successfully weld cast and spring steel? Please give fluxes best adapted for each. A. You will find directions in 'Spons' Workshop Receipts," page 361. 2. What is the best flux for welding iron? A. Silex is most commonly used, also borax, and sometimes a mixture of the two. 3. Can cast iron be welded? A. No, but they can be united by burning. 4. What is the best method of tempering taps and dies? Is there any brand of American steel as well adapted for these as the English steel? A. Each maker has his own especial process. Sometimes the heating is regulated by heating in a composition having a determined temperature and then cooled in water. Others heat in a clear fire and cool in a special fluid.

(2) F. G. writes: To settle a dispute among foundry men please state the height which the tuyere should be from the base in a cupola 22 inches diameter in the clear? A. From 14 to 16 inches.

(3) H. C. asks: Has a boiler, 44 inches diameter and 26 feet long, showing 100 lb. steam, more power than a boiler 36 inches diameter and 26 feet long, with the same pressure? A. The pressure of steam determines the power. The form of boiler does not influence the question.

(4) J. A. G. asks: Can you tell me of any good method of bleaching woolen blankets, etc., without the use of sulphur? We have always used sulphur, but it gives a very unpleasant smell to the goods. A. We know of no way of bleaching such goods that will compare favorably with the sulphur method. If properly washed after bleaching no unpleasant smell will remain.

(5) J. L. L. asks (1) for the best way to frost machine work. A. Use fine emery cloth or paper on a small revolving disk. 2. Is there a better way of finishing up work than by the use of emery cloth? A. For plain surfaces use French emery paper, for irregular surfaces use emery cloth.

(6) W. B. P. asks how to ascertain the height of a steeple, using as the surveying instrument a pocket rule bent so as to form a right angle. A. Open your rule so as to form a right angle, place one arm of the rule on a level surface in the same plane with the base of the steeple, allowing the other arm to stand vertically; place a straight edge against the side of the rule so as to touch both arms and look along the straight edge, moving it until it is exactly in range with the top of the steeple. Now by noting on the rule the perpendicular height and base of the triangle, of which the straight edge is the hypothenuse, you have the proportions of a triangle of which the distance between your point of observation and the center of the base of the steeple forms the base; *a*, being the base of your triangle; *b*, its perpendicular height; *c*, the distance from observer to center of base of steeple; and *d*, the height of the steeple, your formula would be, $c : b :: c : d$.

(7) M. L. asks: 1. How many cells on each end of the Watson battery will it require for a telegraph line three miles in length? A. Use about eight cells at one end only. We cannot give definite information in regard to this without knowing the resistance of the line. 2. Does it need more battery for a ground connection than a continuous wire? If so, how much? A. No, providing the ground connections are good. 3. Which is the best way to make ground connections? A. Connect with gas or water pipes if you have them; otherwise, bury a sheet of copper 2 feet by 6 or eight feet in ground that is always moist, and fasten your ground wire to it by soldering. 4. Will sounders, with relays of twenty ohms, work successfully on the above line? A. Yes. 5. What distance is considered one ohm resistance? A. 330 feet of No. 9 B. wire gauge iron wire has a resistance of one ohm—a trifle over sixteen ohms to the mile; No. 10, about nineteen and a half ohms to the mile; No. 12 about thirty ohms to the mile.

(8) H. B. C. asks why an injector or inspirator will not do its work so perfectly when fed direct from water mains as from a tank. I have found that such is the case, and a number of theories have been advanced; but I apply to you for information. A. Probably because the current or agitation of the water in the main affects the regularity of the jet through the injector. This has been found to be the effect in other cases.

(9) J. L. asks: 1. If to an engine, 7 inches by 10 inches, running with 100 lb. pressure, cutting off at ⅝ stroke, another cylinder 12 inches by 10 inches be added, into which the first is to exhaust, and thence into the atmosphere; what will be the gain? A. From 30 to 35 per cent. 2. Will the area of ports in large cylinder have to be proportionate to its piston area, or will the area of ports of small cylinder do? A. Ports should be in proportion to area of piston. 3. Will the arrangement be of practical value? A. Yes, but it is very old.

(10) A. J. T. asks: Are the bulbs of spirit levels made curved for any particular purpose? If so, for what purpose? A. The glass is curved so that the bubble of air will rise readily to the central point of the glass.

(11) J. R. G. asks (1) how to make a paste to put fancy cards in an album, something that will not draw the paper and hold the cards perfectly tight. Have tried a prepared paper, but it does not answer my purpose. A. Thick starch paste mixed with a few drops of clove oil answers very well. It is better to strain the paste while hot through a coarse linen cloth to remove lumps. Use a rather stiff brush. 2. Will not an ordinary red paper do for making a lantern? A. No. 3. Tell me how to make a cheap drying box for drying the plates? A. Make a frame of three-eighths inch smooth pine, of a width and depth to suit the plates and long enough to hold two dozen plates one-eighth of an inch apart. Nail across this lengthwise at the top, close to the sides, two half inch pine strips notched at the face so as to loosely grip and hold the plates one-eighth of an inch apart. Similar notched strips are tacked inside at the bottom so as to support the plates and hold them apart. 4. Tell me how to make a sensitive paper to use on these plates? A. Nitrate of silver, 5 drachms; distilled water, 5 oz.; nitric acid, 2 drops; purified kaolin, 1 oz. Add the latter after the silver is dissolved, shake, and let settle. Pour off the clear solution into a clean shallow porcelain dish. Having cut good albumenized paper to the proper size, place it gently, albumen side down, upon the surface of the bath, lifting each corner in turn and letting it down slowly to exclude air bubbles. Remove from the bath in about two minutes, and hang it up by the corner to dry in the dark. When required for use expose it for about ten minutes to the fumes of aqua-ammonia in a tight box. 5. Will gelatine that you buy in grocery stores answer as well as Nelson's No. 1 gelatine? A. No, not very well.

(12) P. M. asks how to reclaim silver accidentally dropped in some diluted nitric acid. A. Dilute the acid solution with an equal volume of water and add muriatic acid until no further precipitate forms. Let settle, pour off the liquid, cover with clear water slightly acidified with muriatic acid, add a few fragments of clean zinc, and let the action proceed until the white chloride is reduced to spongy metallic silver. What remains of the zinc may then be picked out, the liquid poured off, and the silver washed with boiling water to remove all zinc chloride and cause the fine metal to dry quickly when placed to drain on filter paper. Mixed with a little borax and heated to bright redness in a small clay or blacklead crucible, the dry, spongy metal will melt and afford, on cooling, a button of compact and pure silver.

(13) F. W. writes: I am building a steam buggy, two engines, cylinders 2x4, with 50 lb. of steam what power will I get? Will boiler 15x30, with 30 one-inch tubes, 18 inches long, be enough to run them? A. With your boiler about 1½ horse power, your boiler is but about half large enough for your engines.

(14) J. M. J. writes: We have sunk a wood curb well, 12 feet square, 25 feet deep, near the bank of the Missouri river, from which we can take clear water, it soaking through the earth from the river; friction on the sides of the curbs prevented us from sinking further; also, in drawing water therefrom and taking out the sand when sinking, the quicksand would flow in about as fast as we could take it out, thereby causing the earth surrounding the curb to cave in and endanger the foundations of the buildings near the well. Now, in driving 2½ inch well points, from which we are satisfied we can get the same clear water, would they have a tendency to cause the quicksand to run in the same proportion as it did with the large well, and which make of well points in your opinion would be most suitable for the purpose? A. If there is underlying quicksand, the 2½ inch wells will draw it off and in time produce the same evil result as the large well. There are two modes you can pursue: either drive your 2½ inch well through the quicksand, so as to draw the water from lower strata, or select a location where you will avoid the quicksand, which you can do by boring.

(15) W. B. asks: 1. What could I put on an iron cider screw to keep the cider from eating it? It makes our vinegar dark colored. A. Clean the screw occasionally and keep every part of it well oiled. 2. Which would have the most force at the bottom: a tube one inch in diameter and ten feet high, filled with water, or a funnel-shaped vessel with an opening at the bottom the same as the tube, ten feet high, five feet in diameter at top, filled with water? Both vessels are to be kept full of water. A. The pressure per square inch at the bottom would be the same in both.

[OFFICIAL.]

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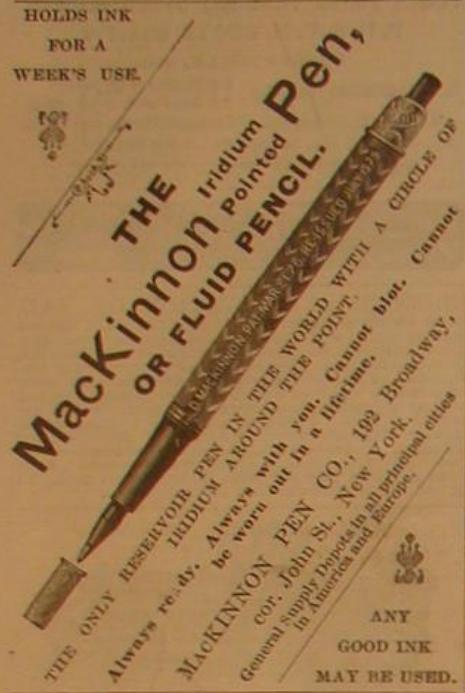

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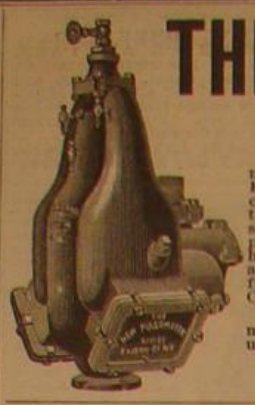

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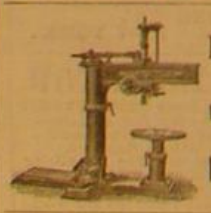

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PROGRESS OF THE HUDSON RIVER TUNNEL.

The larger of the three engraved illustrations on this page shows very clearly the manner in which the work of excavation and construction is carried on in each of the two parallel drifts of the double tunnel under the Hudson River between Jersey City and New York. The smaller cut on page 356 shows a section of the same working for about 80 feet of the advanced end of a tunnel, including the entire length of the pilot tunnel. Fig. 3, is a view of the shore ends of the tunnels from the working chamber of the caisson, looking toward the river. On the right is the entrance to the upper air lock, reached by a safety shaft extending to above the level of the river. The lower air lock, communicating with the bottom of the open shaft, is at the side of the cais-

[*Continued on page* 356.]

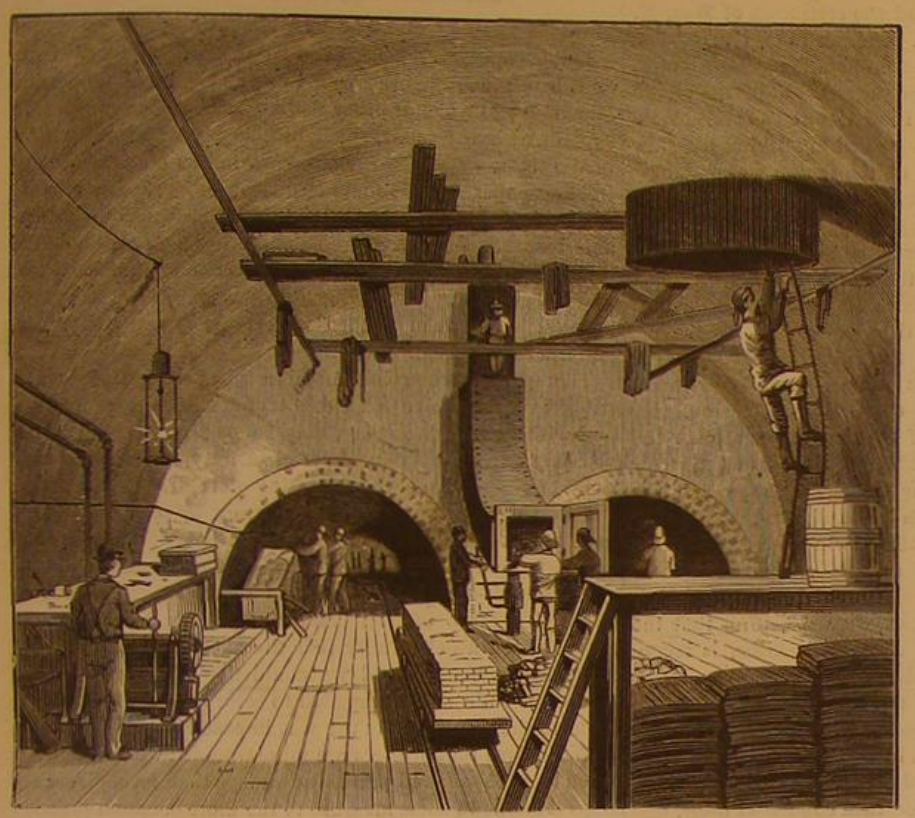


Fig. 3.—SHORE END OF TUNNEL.

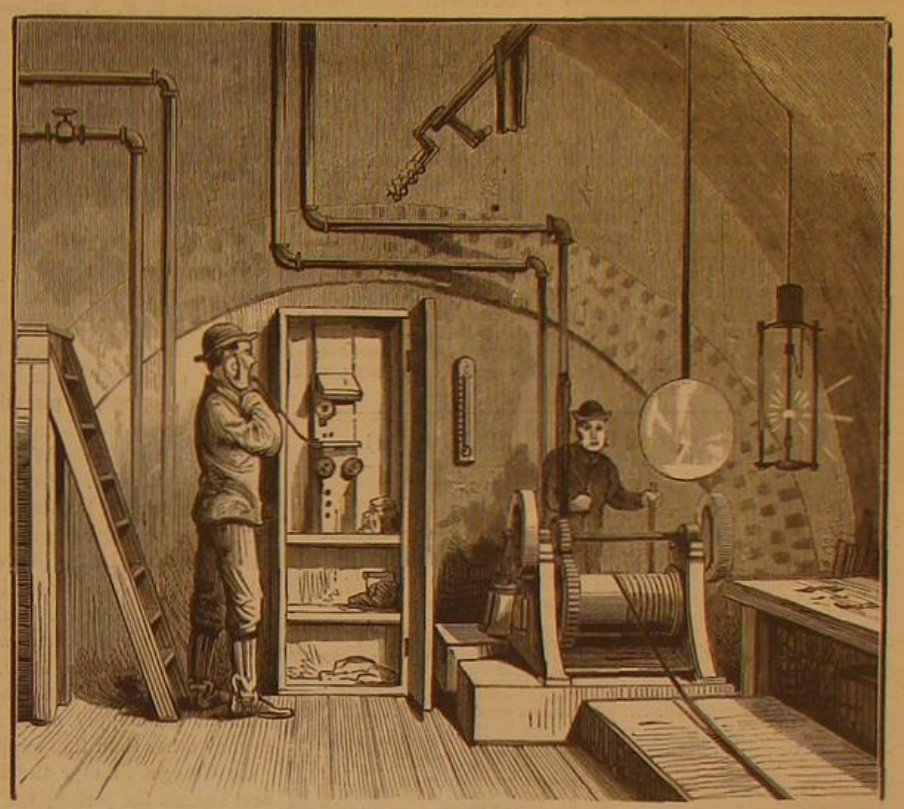
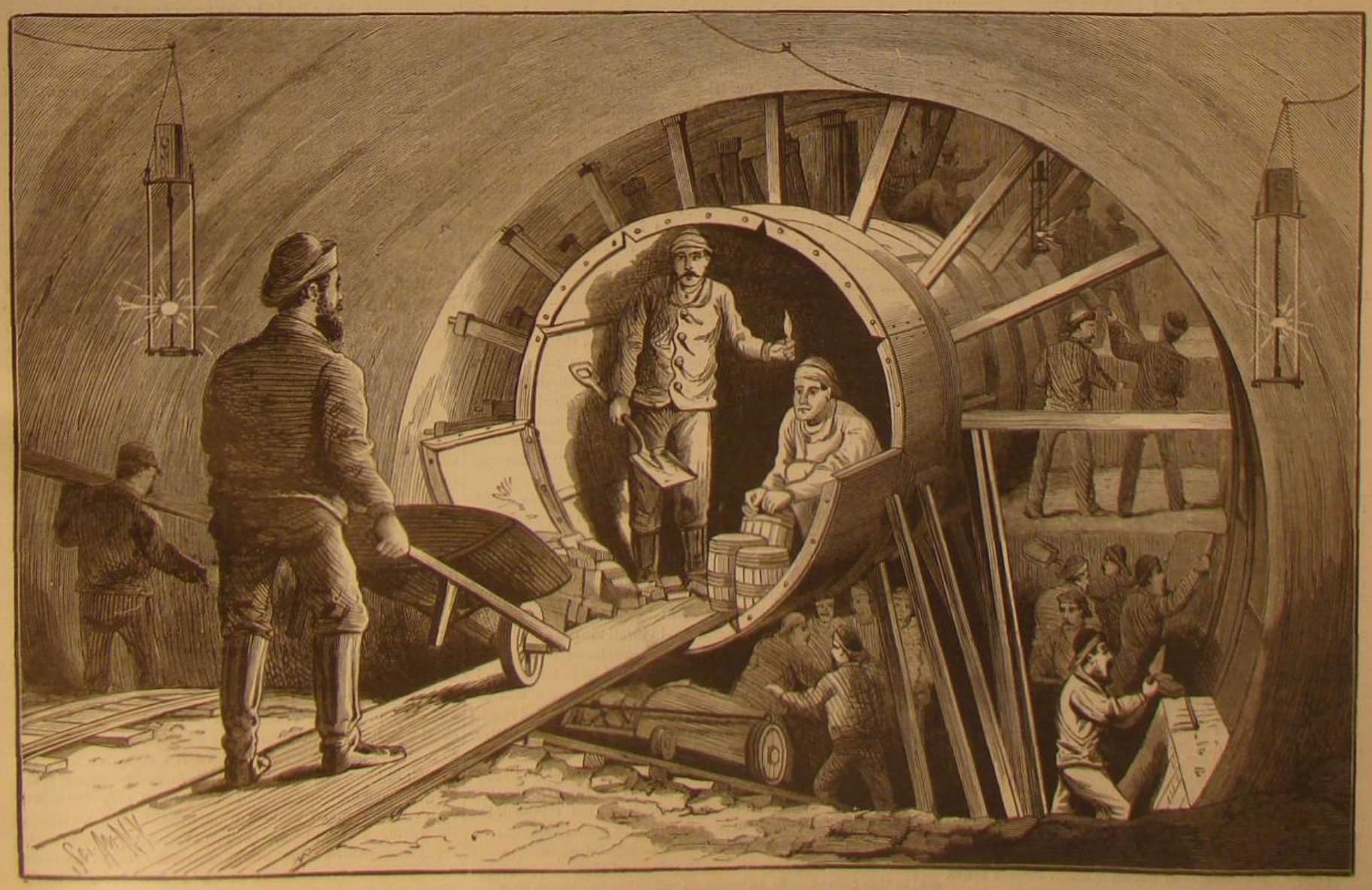


Fig. 4.—TELEPHONE AND WINDLASS IN CAISSON.



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PERPETUAL MOTION DELUSIONS.

We publish in another column sundry paragraphs relating to the zeromotor and other perpetual motions, among them a letter from Professor Gamgee. This communication is of interest, as showing that the Professor considers himself to be a persecuted saint and martyr, chiefly because he has, as he avers, supported himself and his schemes for the past two years. He also grieves that a man who has so clear and profound a knowledge of the zeromotor principles as Chief Engineer Isherwood, should be misunderstood and misrepresented to the degree of being charged with indorsing a perpetual motion.

It is a singular circumstance that such arrant deceptions as the Keely motor and the Gamgee motor should each have had for its godfather a prominent officer of the United States Navy. In the case of the Keely motor it was the former Engineer-in-Chief of the United States Navy, Prof. Charles H. Haswell, who supported the deception, in a report, from which extracts were given in the SCIENTIFIC AMERICAN of May 2, 1874. The Keely Company at that time also referred to William W. W. Wood, Chief of the Bureau of Steam Engineering, U. S. N., and also had the certificate of Wm. H. Rutherford, Chief Engineer, U. S. N., as to the correctness of their statements concerning the operation of the motor. We believe that it was chiefly on the strength of the certificates of these gentlemen and of Prof. Haswell's favorable report that the Keely operators succeeded in milking the New York bankers and brokers out of the thousands of dollars which they originally paid over for shares in the silly scheme.

In the case of the Gamgee perpetual motion, its claims to consideration rest mainly upon the report of Chief Engineer Isherwood, U. S. N., date of March 19, 1881, and published in the SCIENTIFIC AMERICAN, date of May 21, 1881. We inferred from this report that the Navy Department had already expended some of its resources on Isherwood's recommendations, in pursuit of the Gamgee delusion. He strongly urges the Secretary of the Navy to authorize the continued use of the Washington Navy Yard facilities for the same purpose. Prof. Gamgee, however, says that the expenses are paid by him, which is consolatory.

Another singular feature of these twin deceptions is that they are both based (or were originally) upon the same alleged principle of operation. It was claimed for Keely's motor (see SCIENTIFIC AMERICAN, June 10, 1876) that the vapor "does its allotted work upon the engine, is recondensed into its former state, and again becoming vaporized, starts again upon its mission of mighty pressure." All this without the supply of fuel, electricity, galvanism, or any agency other than that supplied by the machine itself.

In Gamgee's motor the liquid expands into vapor, which acts against the piston; the vapor then condenses itself, and runs back to act again against the piston, and so on in one perpetual round or "cycle" of duty. All this, too, according to Prof. Gamgee and Chief Engineer Isherwood, "by the working of the machine itself."

An improvement on the Gamgee plan, suggested in the letter of a correspondent, elsewhere published, consists in the use of ammonia cream or jelly.

Another correspondent, whose letter we give, a young man without money or friends, wants help to develop his perpetual motion. Perhaps the Secretary of the Navy will give him the same facilities that he is now bestowing upon enterprises of this nature at the Washington Navy Yard.

We give, from *Engineering*, a letter from Mr. Kilbourn, in which he explains the frigorific dangers of using motors on the Gamgee principle, namely, liquefaction by expansion. May it not be possible that the last glacial epoch was brought about by a race of men now extinct, through the ill-advised use of too many Gamgee machines, they and their motors having become solidified?

POLARIZATION OF SOUND.

Professor S. W. Robinson has an article in the *Journal* of the Franklin Institute, the object of which is to show, by theory and experiment, that longitudinal vibrations, such as sound waves, can be polarized; and not only this, but also to show that it is irrational and improbable for vibrations in extended media generally to be primarily otherwise than longitudinal. All this is aimed especially at the "transversal theory" of light.

The phenomena of radiation, refraction, diffraction, diffusion, interference, and polarization are, with the exception of the latter, common to light and sound, and it is for the sake of explaining polarization in light that physicists have set up the theory of transversal vibration. It is, therefore, only necessary to polarize the sound to place all the known effects of luminous waves in common with sound waves, or to make the theory of longitudinal vibrations universal. The author, after much study, became convinced about eight years ago that undulations generally could be polarized, and, after some preliminary experimentation, apparatus was devised by him last May, by means of which he obtained results which verified all his preconceived notions in the matter. The means adopted for polarizing the undulations was the same as that for polarizing light by reflection, but the apparatus can scarcely be described without the use of figures.

The results obtained by Professor Robinson establish the following facts for sound waves or for undulations: (1) A decided reflection occurs at a surface separating two gases of different density, confirming the views of Henry and Tyndall in this regard. (2) In repeated reflection from such surfaces the intensity of the final component varies with the relative positions of those surfaces, the same following the laws of polarization in light, from which we conclude that longitudinal undulations can be polarized.

With sound polarized, we complete the list of effects for longitudinal undulations which are known to light, viz., radiation, shadows, reflection, refraction, diffusion, diffraction, interference, and polarization; and the laws are common for like conditions.

The conclusions to which the author has been led are summed up as follows: (1) Vibrations in extended media, produced from the action of a remote single center of disturbance, can only be longitudinal, even in light. (2) Vibrations will be to a certain extent transversal when due to two or more centers of disturbance not in the same line, as when two or more independent coexistent systems of undulations combine into one, or when a simple system is modified by such lateral disturbance as a reflection or a refraction. (3) Undulations, to be in a condition called polarized, must consist of vibrations which are transversal, and no necessity exists for assuming vibrations transversal in front of a polarizer.

ELECTRICAL PAPER.

Letter paper, well heated and rubbed briskly by the hand or a brush, acquires, as well known, electrical properties. It adheres to walls or other flat surfaces, and even gives, in contact with the hand, small discharges, which are visible in darkness. The *Revue Industrielle* points out a method of treating paper so that these electrical properties may be increased to such a degree that the sparks shall be of considerable length. Ordinary Swedish filtering paper is immersed in a mixture of equal volumes of nitric and sulphuric acids, as in the process of making gun cotton. The paper thus pyroxylated is then washed in a large quantity of water, and afterward dried.

This paper, when laid upon a piece of oil cloth and rubbed very briskly, will exhibit very energetic properties, and with it, says the *Revue*, may be perfected nearly all the ordinary experiments in static electricity, such as the production of sparks, shocks, charging of the Leyden jar, etc.

Paper makers, as a general rule, know by practical experience that it is not difficult to get electricity into paper; and some of them would be glad to hear of some simple way to get the fluid—or what-is-it—out of the paper. We recently received a cargo of SCIENTIFIC AMERICAN paper that was so charged with electricity that the sheets would not separate without tearing, and we could not run them through the press. We were compelled to return the entire consignment to the maker, as its use was impracticable.

We believe that printers are more troubled with electricity upon their papers and presses nowadays than formerly. Perhaps it is due in some measure to the more common practice of running the sheets through the press in a dry condition. On the other hand, may not the rapidly increasing local uses of batteries and electric machines for telegraphs, telephones, lights, etc., yield such a superabundance of the mysterious element as to show itself in the press rooms?

The East River Bridge.

The work of laying the floor beams of the East River Bridge is now going forward quite rapidly. The manner of suspending these beams was illustrated in this paper a fortnight ago. There are now thirty-four beams in position on each of the land spans, and on the river span there are thirty-seven in position on both the New York and Brooklyn sides of the river. There are, therefore, one hundred and forty-two floor beams in position, or including the eight in the towers, one hundred and fifty in all.

Engineer Martin reports that three cargoes of creosoted yellow pine for the roadway of the bridge have been received. These beams, which are four and a half inches thick, will be laid directly upon the floor beams, and over them will be laid a covering of oak two and a half inches thick. The paving stones for the roadway are arriving in good numbers, and the work of paving will begin about the middle of June.

Flowers about Railway Stations.

For some years the Pennsylvania Railroad Company has endeavored to relieve the barren dreariness of the ordinary railway station by surrounding their country station houses with flower beds. More attention to this matter is being paid this year than ever before; and recently the company purchased 50,000 plants in this city for the adornment of the stations of the New York and Philadelphia division of the road. The practice is worthy of general imitation.

The Pepsine Treatment of Tapeworms.

The tapeworm is able to live in the stomach because of its ability to resist the digestive action of the fluids normal to the stomach. In a stronger peptic solution the live worm succumbs and is digested like any other flesh. Accordingly a French physician treated with strong doses of pepsine a child who had passed segments of a large tapeworm. About 45 grains of pepsine were administered daily for five days. The child experienced no harm and showed no special symptoms. Then a proper dose of sulphate of pelletierine with castor oil was given, and the discharges showed no signs of the worm. Subsequent experiments with vegetable pepsine—papaine—which is much more active, are said to have given very promising results. One child passed fragments of tapeworm ten inches in length, softened and partially digested.

Correspondence.

Plea for a Government Perpetual Motion.

To the Editor of the Scientific American:

In your issue (date of May 21, 1881) under the above heading, you urge, concerning my experiments in the Washington Navy Yard, that "no more of the public money be wasted on such stupid and irrational schemes." For over two years I have, at great personal expense and sacrifice, conducted work, in which I volunteered, at the urgent request of the late Surgeon-General Woodworth, with a view to the disinfection of ships by artificial refrigeration. The complete demonstration of the engineering side of the problem enabled me to prove to the satisfaction of, probably, the ablest engineer officer of any navy, that a low temperature engine, such as enabled me to abstract heat from air or water more cheaply than had ever before been accomplished, might take the place of the steam engine for all ordinary purposes requiring motive power. A clear and profound knowledge of thermo-dynamics enabled Chief Engineer Isherwood to recognize the step in advance I had reached. Thereupon the Secretary of the Navy permitted me, *still entirely at my own expense*, to make detail modifications of the machine, which has worked successfully since the 20th of last December, in an investigation to determine the practical feasibility of my zeromotor.

Those who never try, never fail. I have been willing to risk money and reputation, with no fair prospect of reward, in an attempt to check the inroads of a disastrous plague. The researches which enabled me to succeed in this had indicated, from the very first, the steps which might be pursued in a promising attempt to supersede the steam engine. Nothing but experiment could settle the question, and again I was willing to run the risk of failure without calling on the government for means to demonstrate the truth or error of a system which may, as Chief Engineer Isherwood says, "prove of more importance to the Navy of the United States than to the navies of the great maritime powers of Europe, with which it may come in collision."

I court fair criticism, and have sought objectors. Since the summer of 1878 I have steadily pursued researches without publicity, until this, with regret, became necessary, in obtaining a privilege almost essential to their completion. It is hard to believe that any competent American engineer should know so little of the history of heat engines as to lead him, for one moment, to suppose that Mr. Isherwood could indorse a "perpetual motion." If one so distinguished as he, in this special department of knowledge, can be misrepresented and misunderstood, it is not surprising that one who has labored in other fields should be regarded as a dangerous innovator. Failure implies my loss; success, the Navy's and the world's advantage, infinitely more than mine.

I am, sir, your obedient servant,

JOHN GAMGEE.

Riggs House, Washington, D. C., May, 1881.

The Electrical Self-Acting Steam Engine.

To the Editor of the Scientific American:

I would call the attention of Messrs. Gamgee, Keely & Co., to the following extract from Helmholtz's "Popular Scientific Lectures." As soon as their present jobs are finished, which will doubtless be ere long, here is a promising field for mechanicians of their peculiar ability.

"A speculative American set, some time ago, the industrial world of Europe in excitement. The magneto-electric machines often made use of in the case of rheumatic disorders are well known to the public. By imparting a swift rotation to the magnet of such a machine we obtain powerful currents of electricity. If these be conducted through water, the latter will be resolved into its two components, oxygen and hydrogen. By the combustion of hydrogen, water is again generated. If this combustion takes place, not in atmospheric air, of which oxygen only constitutes a fifth part, but in pure oxygen, and if a bit of chalk be placed in the flame, the chalk will be raised to its white heat, and give us the sun-like Drummond's light. At the same time the flame develops a considerable quantity of heat. Our American proposed to utilize in this way the gases obtained from electrolytic decomposition, and asserted that by the combustion a sufficient amount of heat was generated to keep a small steam engine in action, which again drove his magneto-electric machine, decomposed the water, and thus continually prepared its own fuel. This would certainly have been the most splendid of all discoveries; a perpetual motion which, besides the force that kept it going, generated light like the sun, and warmed all around it. The matter was by no means badly thought out. Each practical step in the affair was known to be possible; but those who at that time were acquainted with the physical investigations which bear upon this subject could have affirmed, on first hearing the report, that the matter was to be numbered among the numerous stories of the fable-rich America; and indeed a fable it remained." (Page 165.)

Possibly Mr. Isherwood would be benefited by reading the whole essay.

G. M. P.

The New Testament.

The first and authorized edition of the revised translation of the New Testament was published simultaneously in all English speaking countries May 20. There were sent to this country from the Oxford and Cambridge presses, 400,000 copies.

The Ammonia Jelly Motor.

To the Editor of the Scientific American:

I have invented a new engine to which I desire to call your attention and the attention of Professors Gamgee, Keely, and other gentlemen who can elevate themselves by lifting at the band of their breeches.

From a bottle filled with anhydrous ammonia, of the thickness of good jelly, by a pipe there is communication to a cylinder. I set the bottle in a basin of rain water. The latent heat of the water liberates the latent heat of the ammonia, which is thereby expanded into vapor, and passes into the cylinder, forcing the piston forward. Its further expansion to fill the space behind the piston—being work done—occasions a loss of heat, and with the loss of heat the vapor is condensed again to cream or jelly, and runs out by an exit port into another bottle. The second bottle stands also in a basin of rain water, and the latent heat of which again vaporizes the anhydrous cream—ammonia, I mean—and it is carried thence to the further side of the piston, which is then forced back to its original position, the expansion (after cut off) again condensing the vapor and preparing it to flow back to the first bottle. By connecting rods and crank the piston actuates a belt wheel, and that the machinery of the shop.

But I find that a curious result obtains. For if the ammonia expands and condenses, and after filling a large space immediately puts itself into a very small portion of the same space, thereby leaving a *vacuum* which is *filled* with something (possibly a "vibratory force," similar to Keely's new trick), I find that it will run back and forth between the two bottles, without the intervention of the cylinder and piston. Hence I discard the machinery, and set two bottles of "anhydrous ammonia," or any other "condensed liquefiable gas of adequate tension," directly under the flywheel, with a bit of bent tube running from one bottle to the other.

The only difficulty about the invention is that it don't work any more usefully than any other form of perpetual motion, and yet the principle, divested of technics, is just as sound as the principle of Gamgee's zeromotor, while at the same time my invention has a more appropriate name—the nomoter.

A. F. HARVEY.

Kirkwood, Mo., May, 1881.

"Zeromotor."

In our younger days we were told "that if the heavens should fall we could all catch larks," as true now no doubt as then, but before disposing of the larks it may be well to consider the likelihood of having such an opportunity to catch them. Concerning the "zeromotor," about which, of late, there are so many visionary speculations, it would seem that a moment's consideration of the facts pertaining to the vaporization and liquefaction of the condensible gases would satisfy any one that the scheme was altogether chimerical. In the vaporization of condensible gases heat is absorbed which *must* be discharged before liquefaction can be effected.

Inasmuch as the specific heat of a given weight of gas does not vary with any change of volume, it follows that liquefaction is *not* caused by *expansion*, and to abstract the latent heat of vaporization without compression some condensing medium must be provided, having a temperature *below* that of the expanded gas. The boiling point of ammonia at atmospheric pressure being 30° below zero of the Fahrenheit scale, it is not at once discoverable where a condensing medium of lower temperature is to come from. Without it liquefaction does not take place, the cycle is incomplete, and this beautiful theory vanishes in thin air. Once prove that complete liquefaction follows expansion, and we not only have perpetual motion but a perfect *ice machine*, which once set in motion would produce ice and give off power to the end of time, and would require an act of Parliament *limiting* the hours of continuous working, otherwise we might confidently anticipate the commencement of another Glacial Period.—*J. K. Kilbourn, in Engineering.*

Perpetualmotion.

DEAR SIR: I have Invented a Machine that has been worked upon for the last Centuries and is called *Perpetualmotion.*

I am a young man, with out Money or Friends to lend me Money. Now how can I get money for a Patent and other expenses. I cant give Security as I have nothing. I wish to ask Several questions concerning a Patent. In the first place what can I get a Patent on the word Perpetualmotion. Now for instance I will say Electrisity now we have Electrisity and there is no Patent on it and there can not be gotten any on it. Now if Perpetualmotion was made with Electrisity could I get a Patent on the word Perpetualmotion and Manufacture 7 or 8 differant kinds stiles of Machines in the line of Perpetualmotion with the one Patent. Or can I get a Patent on it that it is the only machine that is Perpetual and Manufacture the different kinds with the one Patent I wish to ask if you would Publish an Article in your Paper that it would strike some Capitalists Eye who would forward me the money and I would give him a share in the buisoness. I have no money to Pay for this Insertion but I hope to do something for your Paper by Advertising and obtaining other Patents of which I have about 60, of which I keep account in a Book. As I say I have no Money and you know as well as I do that with out Money I can do nothing. One more and the last question. does not the Goverment offer a Reward to the Inventor of this Machine. If you would Please answer these questions through letter or your Paper. And Oblige A Subscriber. Address H. C. B. Will be called for at Post Office St. Louis Mo. For any Information or Enquiries Address the Above.

Gymnastics as a Cure of Disease.

Physical vigor is the basis of all moral and bodily welfare, and a chief condition of permanent health. Like manly strength and female purity, gymnastics and temperance should go hand in hand. An effeminate man is half sick; without the stimulus of physical exercise, the complex organism of the human body is liable to disorders which abstinence and chastity can only partly counteract. By increasing the action of the circulatory system, athletic sports promote the elimination of effete matter and quicken all the vital processes till languor and dyspepsia disappear like rust from a busy plowshare. "When I reflect on the immunity of hard-working people from the effects of wrong and overfeeding," says Dr. Boerhaave, "I cannot help thinking that most of our fashionable diseases might be cured *mechanically instead of chemically*, by climbing a bitterwood tree or chopping it down, if you like, rather than swallowing a decoction of its disgusting leaves."

The medical philosopher, Asclepiades, Pliny tells us, had found that health could be preserved, and if lost, restored, by physical exercise alone, and not only discarded the use of internal remedies, but made public declaration that he would forfeit all claim to the title of a physician if he should ever fall sick or die but by violence or extreme old age. Asclepiades kept his word, for he lived upward of a century and died from the effects of an accident. He used to prescribe a course of gymnastics for every form of bodily ailment, and the same physic might be successfully applied to certain moral disorders, incontinence, for instance, and the incipient stages of the alcohol habit. It would be a remedy *ad principium*, curing the symptoms by removing the cause, for some of the besetting vices of youth can with certainty be ascribed to an excess of that potential energy which finds no outlet in the functions of our sedentary mode of life. In large cities parents owe their children a provision for a frequent opportunity of active exercise, as they owe them antiseptic diet in a malarious climate.—*Dr. Felix L. Oswald, in Popular Science Monthly.*

Separation of Nickel Oxide and Cobalt Oxide.

The author proposes to give a process for the separation of the two metals, derived from two known methods, and permitting the exact determination of the two oxides, and the preparation of the two metals in a state of purity. The two fundamental processes are that of Pisani, who uses caustic potassa in presence of an ammoniacal liquid, in which are dissolved the two metals, with exclusion of air. The nickel oxide is precipitated alone in bulk, but always carries down with it more or less of cobalt oxide. The second method is that of Terreil, who precipitates cobalt in an acid solution in the state of roseo-cobaltic hydrochlorate. The cobalt oxide is peroxidized by means of permanganate. We suppose that the two bodies, cobalt and nickel, have been obtained by known methods, either as pure oxides or pure sulphides, free from all foreign matter. The mixed oxides or sulphides are dissolved in an aqua regia containing a large proportion of hydrochloric acid. The solution is largely diluted with water and saturated with ammonia in excess. Permanganate is then added until the solution remains rose colored for some time. Pure potassa is then added, when the nickel is precipitated as hydroxide, carrying with it manganese oxide, derived from the permanganate. The precipitate is washed by decantation and filtered, redissolved in hydrochloric acid, and treated again with ammonia, permanganate, and caustic potassa. The washing waters which contain the cobalt are collected, saturated with acetic acid, and precipitated by sulphureted hydrogen. The mixture of nickel and manganese oxides is redissolved in hydrochloric acid, and the solution saturated with ammonia. The solution is exposed to the air for some time, and the manganese oxide is by degrees entirely precipitated. It is filtered off, the filtrate is saturated with acetic acid, and the nickel thrown down by means of sulphureted hydrogen. The process may be employed on the large scale for obtaining nickel completely free from cobalt.—*G. Delcaux.*

The American Medical Association.

The thirty-second annual session of the American Medical Association was held in Richmond, Va., the first week in May. More than five hundred delegates were present from all parts of the country. Dr. J. T. Hoguen, of St. Louis, presided, and many valuable papers were read. The officers chosen for the ensuing year were:

President: J. J. Woodward, of the United States Army. First Vice-President: P. O. Hooper, of Arkansas. Second Vice-President: Laertes Conner, of Michigan. Third Vice-President: Eugene Chisolm, of North Carolina. Fourth Vice-President: Hunter McGuire, of Richmond. Secretary: William B. Atkinson, of Pennsylvania. Treasurer: L. J. Dunglison, of Washington, D. C. Chairman of the Committee on Arrangements: A. J. Stone, of Minnesota. Vacancies in the Judicial Council were filled by the appointment of Dr. S. N. Benham, of Pennsylvania; Dr. J. M. Jones, of the District of Columbia; D. A. Linthicum, of Nebraska; William Brodie, of Michigan; H. D. Holton, of Vermont; A. B. Sloan, of Missouri; and R. B. Cole, of California. St. Paul, Minn., was selected as the next place of meeting.

Interesting Discoveries in Yucatan.

In Yucatan some discoveries have been made, of a very interesting character, mainly by Dr. Le Plongeon, the agent of the American Archæological Institute, who has excavated the ruins of Mayapan, once the capital of the Mayas, a powerful tribe among the aboriginal inhabitants. The later history of this important town is well known; for less than a century before the arrival of the Spanish invaders, the king of the tribe had been murdered by his nobles, his followers dispersed, and the royal city destroyed, so that the objects brought to light by Dr. Le Plongeon's exertions find their place immediately as historical documents. Among other things, portrait sculptures of the unfortunate king have been discovered, which are at once recognized as similar in face and figure to bass-reliefs at Chichen-Itza, the metropolis of Yucatan, where the lords paramount of the country held their court, and where the king of the Mayas is represented as doing a sort of homage to his suzerain. This coincidence seems to point to a period of special artistic development throughout that region, when pictorial or sculptured representations of the affairs of daily life had become somewhat habitual. Further proofs of enlightenment are found in astronomical instruments, such as stone dials of accurate workmanship, which were found still standing on a smooth platform of stone, covered only with a few inches of vegetable mould. Various observations were made in regard to the religious emblems discovered, but beyond a strong resemblance of some of them to those of Eastern Asia, no extraordinary developments are made. Dr. Le Plongeon's accounts show a remarkable and interesting continuity of language, family names, and even of habits, between the ancient inhabitants of Yucatan and their modern descendants. It has been well said that all archæological discovery originates in the endeavor to investigate traditions, which survive after stone and brick have crumbled to dust; and it is very probable that further acquaintance with the friendly and civilized natives may furnish clews to discoveries of great importance.—*American Architect.*

How the Weather Indications are Determined.

At the Signal Service Bureau in Washington the weather indications are recorded at 5 A.M., 11 A.M., 4 P.M., and 11 P.M. daily. A reporter undertakes to tell how the work is done, and this is what he sees:

Take a seat in the indication room with me, and we will see how the weather is gotten up. It is now 4 o'clock, Washington time, and telegrams are pouring in from all parts of the United States, Canada, British America, West Indies, Nova Scotia, and falling into the lap of the sergeant in charge. The territory covered is from Olympia, in Victoria, on the northwest coast of British America, across to Sydney, above Newfoundland, thence down to Havana, across to San Diego, California, and thence back again. There's a girdle for Puck. At a certain hour of the day—3 o'clock Washington time—observations are taken at all the stations, and then they begin to come in, chasing each other over the wires pell-mell, like a crowd of unruly school boys. These dispatches are called off to six gentlemen, each of whom sits before a map, one noting the thermometer, another the barometer, a third the condition of the weather, and so on. These are transferred to one large map, and then Old Probabilities makes his appearance. He glances over all; sees where a storm was at 1 A.M., and notes where it was at 3 o'clock. He takes into consideration the wind currents, the humidity, and all the minor details which his experience and learning have taught him. Not a word is spoken in the room. Old Probs is in a deep study. In a moment he will speak to fifty millions of people, and a few more over in Canada. His stenographer appears, and the indications are dictated for New England, then the Middle States, the South, West, Mississippi Valley, then, perhaps, a storm bulletin twenty-four hours in advance to warn some special section of the country.

Among the innovations made by General Hazen is the furnishing to sections of the country special reports of floods, the condition of rivers, and their probable rise or fall within the twenty-four hours following at given points. Then again reports are made for the Southern States on the weather during cotton picking time, signals being displayed from the telegraph stations denoting clear or bad weather coming. It is in contemplation to furnish the agricultural sections with indications for harvest time, so that the farmers will know when to cut their grain and when to take it in. The idea was to have small cannon at telegraph stations, and if a storm should be discovered in the night, which promised great damage, to awaken the farmers so they might save what they could. But it has been found that most country telegraph offices close at such an early hour that this cannot be carried out.

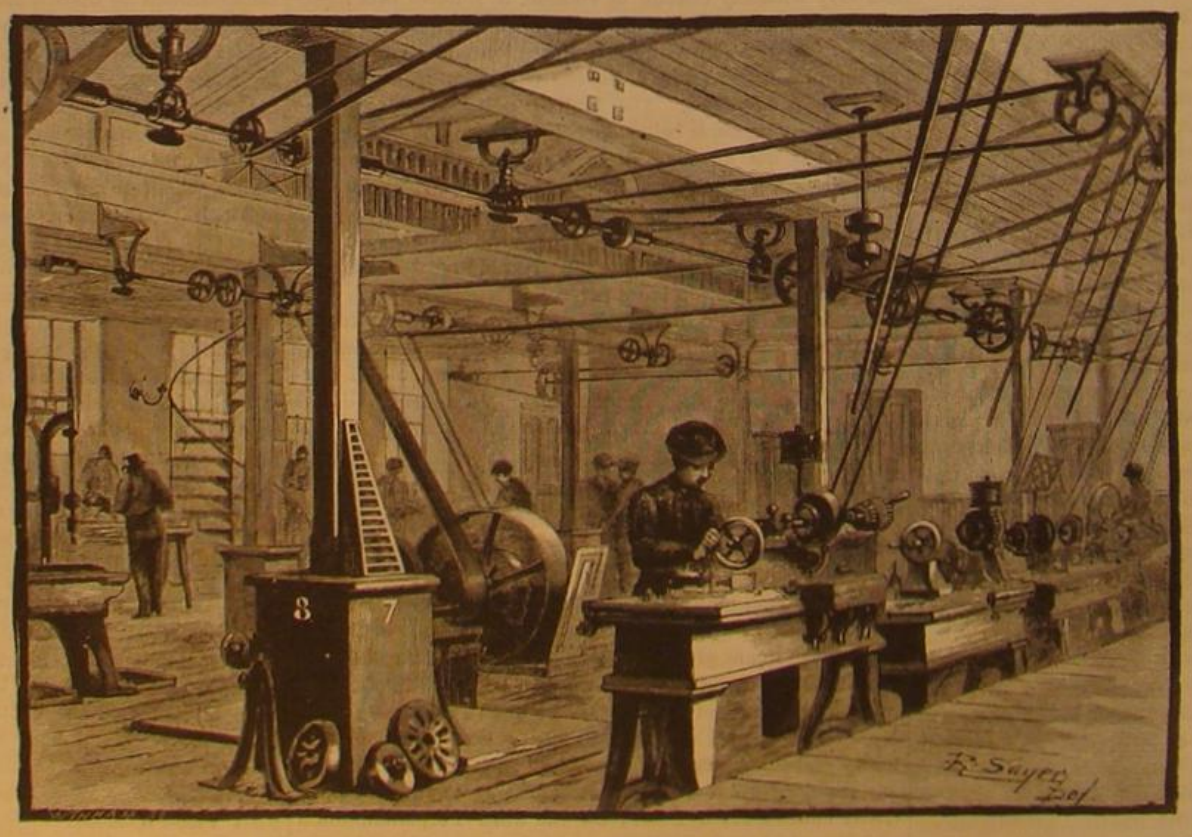
OPENING OF THE NEW WORKSHOP OF THE STEVENS INSTITUTE OF TECHNOLOGY.

This useful institution, as most of our readers know, is situated on the west bank of the Hudson River, in Hoboken, N. J., opposite Eighteenth street, New York, and one mile distant from our city limits. The unqualified success which for several years past has attended the efforts of the faculty in giving to the students, in connection with scientific study,

TOOL ROOM.—STEVENS INSTITUTE.

the opportunities for practical instruction in the mechanic arts, has rendered it desirable to enlarge and extend this branch of the establishment. The workshop has, therefore, been removed from the basement into the former lecture room of the institution, a building 50 by 80 feet, with high open roof and double galleries. This beautiful apartment has been generously fitted up by President Henry Morton, at his own cost, as a workshop for the students. He has filled it with the finest specimens of steam engines, lathes, planers, drills, milling machines, grinding wheels, and other mechanical appliances, all of which were formally presented by him to the trustees on the evening of May 14, and the occasion was one of much interest. The shop, brilliantly illuminated with the electric light and the machinery all in full operation, presented a very animated scene when the visitors entered.

The proceedings were opened by President Morton, who made a very admirable presentation address, in which he gave an outline of what the institution had done and aimed to do in the future for its pupils. Mr. Dod, of the trustees, accepted the gift of the President. Mr. Coleman Sellers, the eminent mechanician, followed with an excellent address, in which he paid a glowing tribute to the character of President Morton and spoke of the requisites for the education of the young mechanic. Mr. Horatio Allen and others also made addresses. The proceedings closed with a reception at the residence of the president. We give the addresses of the various speakers in our SUPPLEMENT. One of our engravings is an interior view of the new workshop. The other shows the tool room.



THE NEW WORKSHOP OF THE STEVENS INSTITUTE OF TECHNOLOGY.

The Pauperizing of English Labor.

The Macmillans have lately published a volume of thoughtful sermons by the Vicar of Granborough, England. In the introduction to the volume, the author insists upon the duty of the church to take a more active part in trying to ameliorate the condition of the English poor. He says: "I am the vicar of a rural parish in which more than 70 per cent of the population are potential paupers—that is to say, that out of some 70 families in the village, more than 50 are either actual or prospective recipients of the bounty of the poor law. I have not a single laboring man past work in my parish who is not either in the workhouse or in receipt of outdoor relief. When I lived among Sheffield workmen I used sometimes to come across people who asserted that they would rather starve than receive parish pay. I have never even heard of such a case in Buckinghamshire. I fear I have hardly a laborer in my parish who, if he were sick or out of work, would not welcome the visit of the relieving officer. Failing the 'wages of work,' the Bucks laborer learns to think of 'wages of the parish' as his of right. . . . We have fifty cottages, but have not one laborer's home with three bedrooms. We have seventeen with only one. Our death rate, which is generally so accurate an index of social condition, sounds satisfactory; it is only 18 per 1,000; but then one third of our deaths are infants under the age of 1. I need not, however, multiply deplorable statistics of that kind."

How Japanese Fans are Made.

A British consul in Japan gives the following particulars touching the manufacture of folding fans at Osaka:

As in many other branches of industry, the principle of division of labor is carried out in the fan-making trade. The bamboo ribs are made in Osaka and Kioto by private individuals in their own houses, and combinations of the various notches cut in the lower part are left to one of the finishing workmen, who forms the various patterns of the handle according to plans prepared by the designer. In like manner the designer gives out to the engravers the patterns which his experience teaches him will be most likely to be salable during the ensuing season; and when the different blocks have been cut, it still rests with him to say what colors are to be used for the two sides of each fan. In fact, this official holds, if not the best paid, at any rate the most important, position on the staff in ordinary. When the printed sheets which are to form the two sides of the fans have been handed over to the workman, together with the sets of bamboo slips which are to form the ribs, his first business is to fold the two sheets of which the fan is to be composed, so that they will retain the crease, and this is done by putting them between two pieces of paper, well saturated with oil, and properly creased. The four are then folded together and placed under a heavy weight.

When sufficient time has elapsed the sheets are taken out and the moulds used again, the released sheets being packed up for at least twenty-four hours in their folds. The next process is to take the ribs, which are temporarily arranged in order on a wire, and "set" them into their places on one of the sheets, after it has been spread out on a block and pasted. A dish of paste then gives the woodwork adhesive powers and that part of the process, is finished by affixing the remaining sheet of paper. The fan has to be folded up and opened three or four times before the folds take the proper shape; and by the time the fan is put up to dry it has received far more handling than any foreign paper could stand; indeed, foreign paper has been tried, and had to be given up as unsuitable for the work; but with great care the Osaka fanmakers have been able to make some fans with printed pictures which have been sent over from America, though they were invariably obliged to use one face of Japanese paper The qualities of native paper now used are not nearly so good as those of which the old fans were made, and, in consequence, the style of manufacture has had to be changed. Instead of first pasting the two faces of the fan together and then running in pointed ribs, the ribs are square, and are pasted in their places in the manner described above. The outside lacquered pieces and the fancy work are all done in Osaka and Kioto, and some of the designs in lacquer on bone are really artistic; but the demand for the highly ornamented description of fans is not sufficient to encourage the production of large quantities of first-class work. When the insides are dry, the riveting of the pieces together, including the outer covering, is rapidly done, and a dash of varnish quickly finishes the fan.

NEW BELT CLASP.

The simple and ingenious device herewith illustrated seems to exactly meet a great want among users of small machinery for a perfect coupling for round leather belts.

The fastenings now in use are the hook and the screws neither of which is satisfactory, since under a variety of conditions they both give out and have other objections which are too well known to need mention. The manner of applying the Whiting belt clasp is clearly shown in the engravings.

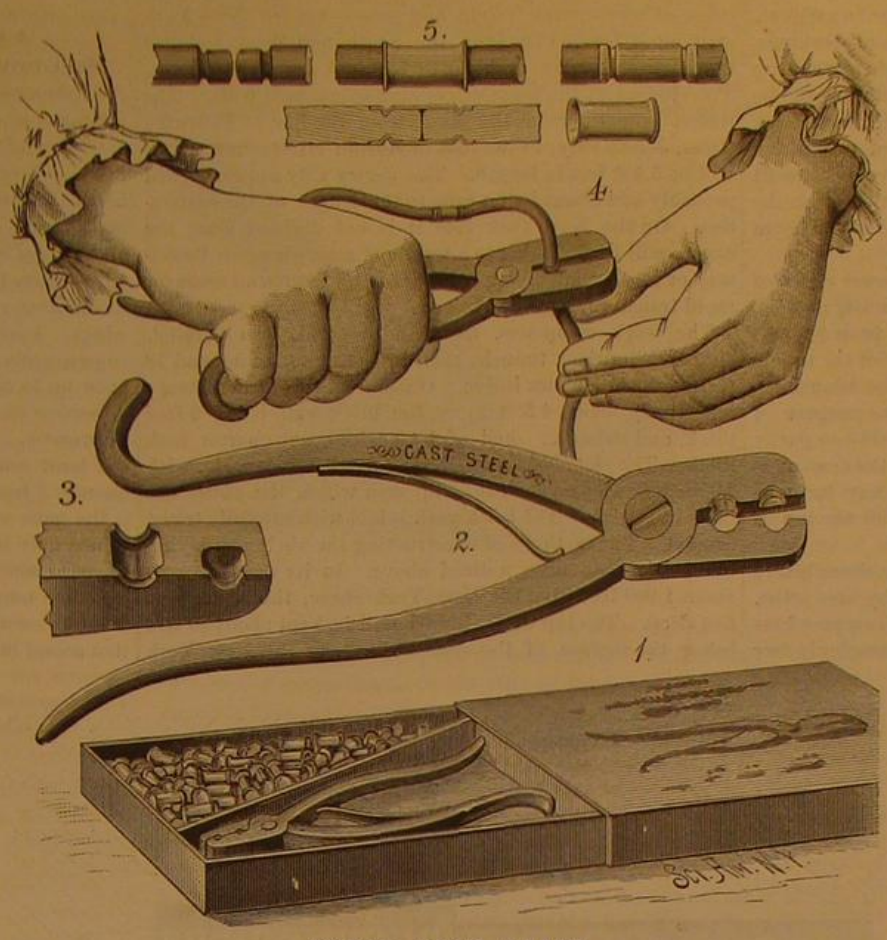
Fig. 1 shows the appliances necessary for coupling round belts; they consist of a quantity of thin brass ferrules and a steel pincer, (Fig. 2) of peculiar form for preparing the belt for the clasp, and afterward compressing it upon the belt.

In Fig. 5 the left hand view shows the belt compressed with a crease formed around it by the cavities in the ends of the pincer jaws (Fig. 3). The central view (Fig. 5) shows the ends of the belting inserted in the ferrule, and the right hand figure shows the ferrule after it has been creased by the transverse semicircular cavity in the pincer jaw. The ferrule, as will be noticed, is flanged on opposite ends to form a guide in applying the pincers.

When the metal of the ferrule is creased so that it sets down well into the crease in the leather of the belt it forms a fastening which is not only very secure, but it is perfectly smooth and does not wear the pulleys, and when belts are crossed they are not worn by the clasp. The joining is so perfect that pieces of belting of two inches in length may be used for a whole belt, and yet run as perfect as if there were but one joint. When the belt is broken or cracked the clasp can be applied without shortening the belt. When the belt is adjusted to proper length, and the clasp applied, no further attention is required, as it will last until the belt is worn out.

We are informed that the belt is now in use in hundreds of manufactories, giving the best of satisfaction.

Manufactured and for sale by the Whiting Stronghold Belt Clasp Company, 111 Liberty street, New York city.



NOVEL BELT CLASP.

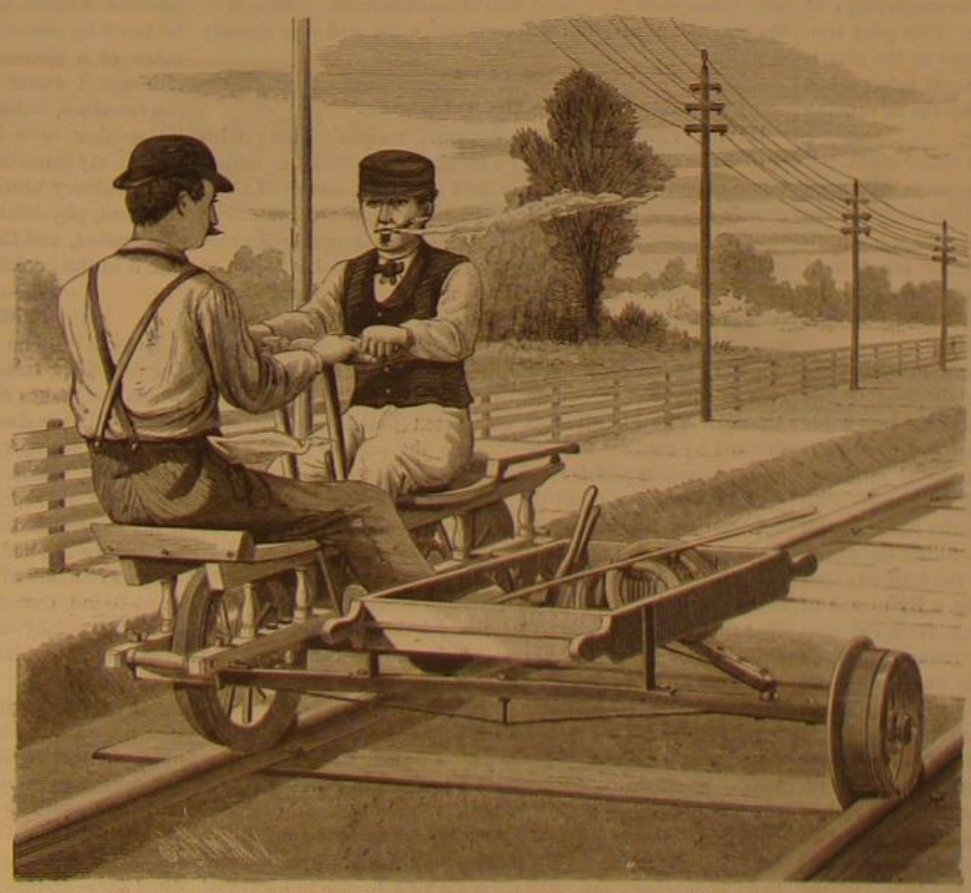
THE NEW NAVAL OBSERVATORY.—A tract of seventy-one acres of land on the outskirts of Georgetown, D. C., has lately been purchased for the site of the new Naval Observatory. It remains for Congress to pass the necessary appropriations for buildings and equipments.

TELEGRAPH HAND CAR.

In the SCIENTIFIC AMERICAN of April 16 we gave an illustration of a single velocipede hand car; we now give an engraving of a velocipede hand car adapted to two persons and provided with a receptacle for wire, tools, etc. It is very little heavier than the single machine, but with the power of two men applied the propulsion becomes easier for each man than it would be if their power were applied to two single machines. The speed may be greater than that of the single machines, and the carrying capacity is also increased. This machine is provided with two seats for the operators, who face each other and both work the same lever. The strength of this machine is adequate to the power applied and to the usage it is likely to receive, while at the same time it is so light as to be easily lifted from the track when occasion requires. And although it is made to accommodate two men, it may be easily operated by one person, or it can be readily run by two men, who may carry the third man in place of the tools, and if necessary a fourth man on the rear seat.

The value of this invention will be appreciated by those whose duty requires them to pass frequently over railway tracks, and who have heretofore used only the cumbersome and power-wasting hand car. It is invaluable to telegraph-line men, track repairers, bridge builders, and inspectors, and, in fact, to any class of men having to do with railways and telegraph lines. It is also well adapted to light section work, and has been adopted by several roads for this purpose, and so far with excellent success.

Further information may be obtained by addressing Messrs. George S. Sheffield & Co., Three Rivers, Mich.



SHEFFIELD'S TELEGRAPH AND LIGHT SECTION HAND CAR.

THE dome of the cathedral at Rome is illuminated inside and out by the Siemens electric light, and the effect is described as brilliant and charming.

Physiological Action of Salts of Gold and Other Metals.

A very remarkable series of observations has been made by Dr. James Blake, concerning the physiological action resulting from solutions of different salts when introduced into the blood of living animals. He finds that salts of the same isomorphous group produce an intensity of physiological action in proportion to their atomic weights. The salts of thorium, palladium, platinum, osmium, and gold showed great similarity in their physiological action, all of them having a decided and characteristic effect upon the heart. The action of gold compounds was surprising; in minute doses of 0·003 gramme per kilo, it kept up the action of the heart for several hours after death, though the temperature of the body had fallen 13° below the normal heat.

Tattoo Marks Made Useful.

"Why is it," asks Dr. Le Comte, who is physician to a regiment of dragoons, "Why is it that such quantities of soldiers die upon the battlefield?" And then he replies, confidently: "Simply because of the difficulty which arises in regard to arresting hemorrhages."

The compression of an artery being the best mode of stopping profuse bleeding, Dr. Le Comte proposes to teach each soldier first where these vessels are situated, so that he may assist himself while waiting for the surgeon. Therefore, he tattoos an image of some kind upon every portion of the soldier's body where there is an artery.

RECENT INVENTIONS.

An improvement in the manufacture of staples has been patented by Mr. Charles W. Dean, of South Wareham, Mass. This invention applies more especially to the manufacture of small staples or double-pointed tacks for fastening carpets, or for other purposes, but may be also applied to staples of any of the usual sizes for common uses. The staples are formed from bars of metal in lieu of wire. The staples being cut successively from bars of metal in a form approximating to their finished shape, with their legs diverging, and then bending these legs parallel, or nearly so, to complete the staple.

Mr. Archibald W. Reid, of Schenectady, N. Y., has patented an improved machine for fleshing and removing the hair from hides, in which machines the hides are placed upon a suitable support and the hair removed by tools carried by a revolving drum or wheels.

Mr. John Harger, of Toronto, Ontario, Canada, has patented a mode of preserving butter by incorporating with the milk or cream before churning, and with the butter after churning, boracic acid dissolved in hot glycerine, and sulphate of potassium dissolved in boiling water.

Mr. Gustav Rein, of Cincinnati, Ohio, has patented an improved annunciator for telegraph lines, which provides for raising the drop automatically by the devices used for connecting or breaking the lines, thus avoiding necessity of handling the drop and insuring its return to place. The further object is to prevent mistakes in connecting the lines.

An improved washing machine, patented by Mr. George Jackson, of Boscobel, Wis., consists of a semi-cylindrical tub having a semi-cylindrical cover and disks mounted upon gudgeons provided with inwardly projecting stops connected by rods and carrying oscillating paddles.

An improved trace clip and hook has been patented by Messrs. Joseph T. Haines and Horatio M. Stratton, of Swedesborough, N. J. This invention relates to that class of harness in which half chains are used for the traces, the object being the production of a cheap and durable loop or clip and hook which can be easily fastened without the employment of a spring or similar device, the loop or clip serving at the same time as a ring by which the trace is held up by the hip strap of the harness.

Ann E. Isham, of West Troy, N. Y., has patented an improved candy package which consists of a cone provided with an aperture in its bottom closed by a swinging or sliding gate, and with an opening in front having flaps and closed by gauze or netting, the whole designed to represent an army tent with flying colors.

An improved trace carrier, patented by Mr. Charles H. Fox, of Winnebago City, Minn., consists of a frame and a pivoted hook arranged and operating in connection therewith, by which provision is made for the attachment of the trace and for holding it securely in place.

In telephone-exchange systems, where it is necessary to have six or eight stations connected with one line wire, it is desirable that the telephone switches be placed correctly after using for speaking purposes, for if left in a wrong position there is much trouble and delay in finding and remedying the fault. To overcome this Mr. John D. Richardson, Jr., of Newport, R. I., has invented a telephone switch signal that reminds the person using the telephone, either by visible signals or by vibrations of the call bell, to place his switch in the right position, or that his switch is wrongly placed, thus preventing the switch from being left in a wrong position, and saving time and trouble in finding and locating the misplaced switch.

An extension magazine for coal stoves has been patented by Mr. Dewitt Van Evera, of Maquoketa, Iowa. The invention consists in constructing an extension magazine of a stationary or movable upper part having exterior ribs, and a movable lower part made in two or more sections, and having corresponding interior grooves, whereby the magazine can be lengthened and shortened.

Messrs. Peter D. Fischer and Charles Nonnenmacher, of New York city, have patented an improvement in extension folding lounges; and it consists in constructing them so that the links which connect the two parts will be inclosed with the frame out of sight when the lounge is closed; and the shell is so contrived that it is supported independently of the body when opened or extended.

PROGRESS OF THE HUDSON RIVER TUNNEL.

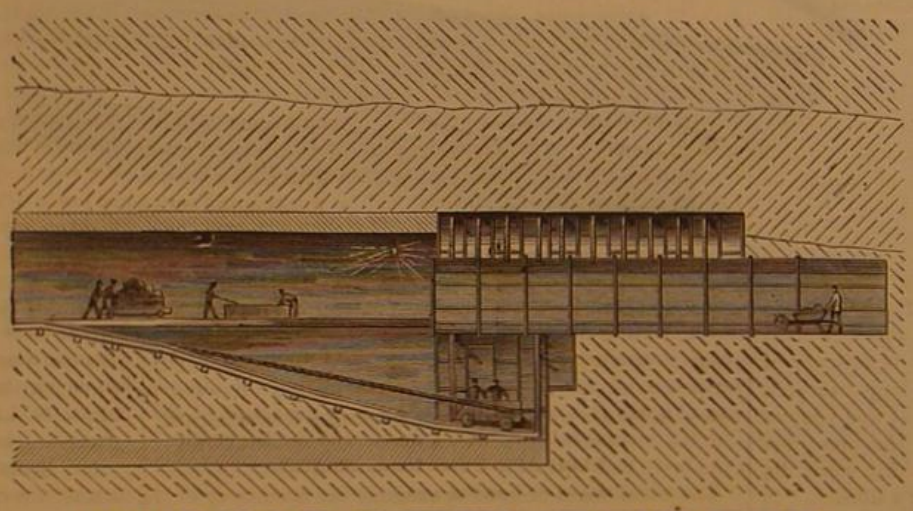
[*Continued from first page.*]

son near the foot of the ladder leading to the upper air lock. In the middle, between the tunnel openings, is shown the lower curved end of the chute for passing in bricks and other small materials, and which, in emergency, might serve as an additional way out for workmen. Fig. 4 represents the opposite side of the working chamber, with the telephone closet, compressed air pipes, electric lamp, windlass for operating the cable roads to the breast of the tunnel, etc. The tram cars laden with clay from the forward workings, are hauled to the shore end of the tunnel, where they are automatically dumped (as shown in Fig. 3) into the puddle underneath the floor of the working chamber. Here the clay is worked up with water to the consistency of cream and forced, by the air pressure in the tunnel (from 19 to 21 pounds according to the state of the tide) up through the blow-out pipe to the surface, where it is used for filling in low ground.

From the working chamber the visitor may enter either of the tunnels and follow the tramway to the breast, now between 450 and 500 feet distant, and advancing from 3½ to 4 feet a day. As he approaches the working end of the tunnel the roadway suddenly dips downward and the tunnel becomes a full cylinder. The guide explains the purpose of keeping the tunnel half full of clay to be two-fold—to partly relieve the strain upon the brickwork while the cement is hardening, and to furnish a broader passageway for men and materials. By this plan the full diameter of the tunnel is available for roadway.

The method of advancing the work can be described in few words when so much has been shown by the artist. The material to be removed is an extremely compact blue clay, which thus far has proved to be encouragingly free from softer streaks, seams, or other breaks, by which water can enter or compressed air escape in serious quantity. The advance is made cautiously, though, as already noted, with considerable rapidity.

First the quality and consistency of the material ahead are approximately determined by driving in slender rods of iron from the forward end of the pilot tunnel, which is 6½ feet in diameter. The breast of the pilot tunnel is kept from 15 to 20 feet in advance of the forward working of the tunnel proper. In this way any possible change in the character of the ground must be discovered before it can be a source of imminent peril to the main work. Besides, the pilot tunnel furnishes a substantial support for the braces which hold in place the advancing iron plates of the main tunnel until the successive rings are completed and the brickwork built up. The pilot tunnel is composed of ten segments or rings of stout iron plates, each 4 feet long, the whole securely bolted together and braced within by beams of wood (not shown in the engraving), to counteract the thrust of the exterior braces. This pilot tunnel is continually built up at the forward end as the clay is removed, the plates for the advancing segments being taken from the rear end, which has been passed by the advancing brickwork.



SECTION OF END OF TUNNEL AND PILOT TUNNEL.

The main excavation follows the pilot in six or eight terraces or steps, and the iron shell of the tunnel is advanced section by section as the clay is removed, the construction of the rings going on from the top around the sides until each ring is completed. When four rings (or ten feet of the shell) have been completed and securely joined, the circle is bricked up and finished with a coating of Portland cement.

The visitor cannot but be favorably impressed by the excellent character of the work now being done, and by the increased care taken to reduce to the smallest the inevitable hazards of a work of this nature. Two new features in the prosecution of the work will command especial approbation. These are the introduction of solid bulkheads with double air locks near the working ends of the tunnels, and the construction of an air-tight diaphragm filling the upper half of each tunnel, at a point still closer to the men engaged in excavating, plate laying, and brick laying. By means of these precautions the danger to the workmen from any possible inrush of water will be materially reduced. Work upon the bulkhead for the south tunnel is now going on, and at the time of our visit (May 17) the air locks were being put together for testing. The bulkhead will be placed at a point near where Fig. 2 begins; and the intention is to have one of the air locks always open as a refuge for the workmen. The diaphragm will be placed near the rear end of the pilot tunnel. Its office will be to prevent the outflow of air from the upper half of the tunnel between the diaphragm and the bulkhead, should a break occur at the breast of the working, thus insuring the safe retreat of the workmen to the air lock in case of such an accident. The doors of the air locks are made uncommonly large and strong, both for the safety of the workmen and their convenience in passing through materials. By the use of these bulkheads, as will be readily perceived, the workmen in the other tunnel and at the shore ends of both tunnels are relieved of risk in case an accident occurs at the working end of either tunnel. These bulkheads and diaphragms will be carried forward from time to time as the work proceeds.

The direction and immediate supervision of this important enterprise has lately been undertaken by the favorably known engineers, Wm. Sooy Smith & Son. An early beginning on the New York end of the tunnel is anticipated.

Full particulars as to the location, purpose, magnitude, and history of this great work will be found in the volumes of the SCIENTIFIC AMERICAN for 1880. For the convenience of reader, who have not the back numbers at hand, the following facts may be recapitulated:

The tunnel is intended for railway use, to obviate the expense of transferring freight and passengers for New York arriving at Jersey City from the South and West, and also to escape the delays incident to fog and ice on the river. The Hudson at the point of crossing is one mile wide. The tunnel proper (under the river) from the foot of Fifteenth street, Jersey City, to the foot of Morton street, New York, will be 5,550 feet in length. The Jersey City approach will probably add about half a mile to the length of the excavation. On the New York side it is not decided what the course will be—whether to a terminus somewhere on Broadway or into a contemplated system of underground roads for rapid transit throughout the city.

The work comprises, as already stated, two parallel, almost cylindrical, tunnels, each 16 feet in horizontal and 18 feet vertical diameter inside. Outside the measurements are respectively about 4 feet more, the brick wall being 2 feet thick, and the outer shell of boiler iron, one-quarter inch thick. The plates of the shell are 2 feet 6 inches wide, with 2½ inch flanges on each side, through which the plates are bolted together. The brickwork is laid with carefully tested cement. The methods of constructing the shell and laying the brick have been noticed above. In its deepest part, about 1,000 feet from the New York shore, the river is 60 feet deep. The top of the tunnel will be kept about 30 feet below the surface of the river bed. Near the New York side some rock and sand will be encountered. The rest of the way the excavation will be through the stiff clay already described.

Noises in the Telephone.

Having remarked that telephones transmit along with speech sounds of an unknown origin, the author has undertaken experiments in order to find out if the causes of these sounds are not those which oppose telephonic communication at great distances. To eliminate all possible sources of error, the following arrangement was adopted. A line of twenty meters was laid on the floor of several rooms, all the doors of communication being closed. It was connected at one end to a pair of telephones by means of flexible conductors, designed to arrest sounds which might communicate themselves mechanically along the metal to the telephones. The circuit was completed between these conductors by another flexible wire, on the path of which was an interruption pedal, rendering it possible to cut the circuit without changing at all the nature of the communications between the line and the telephones, and to prove that the sounds heard had an electric origin. The operator acted at the other end of the line which was not connected, directly or by induction, with any electric generator. He observed that the current produced by the friction of two wires of the same kind or of different kinds and that produced by closing a pressure screw were heard in the telephones. It is easily understood that when suspended, telegraph wires serve for telephonic transmission; this cause may occasion much trouble, since these lines are formed of pieces of iron wire connected to each other and to the stretchers by ligatures, more or less perfect, which are in a state of constant agitation. But this cause of failure may be removed by soldering the wires instead of tying them. Unfortunately there is another cause: the currents due to the influence of the vibrations themselves. To verify this hypothesis, the author placed in the circuit, at the end opposite the telephones, a rod of iron 1·50 meters in length, and connected to the system by supple conductors. This rod was struck sometimes transversely and sometimes longitudinally with a hammer. The sounds occasioned by the blows were distinctly reproduced by the telephones with their peculiar characters. This experiment if repeated with copper or brass rods, gave merely negative results. It seems that the phenomenon is only produced as an effect of the vibrations occasioned in the wire. Future experiments must decide whether it is due to a molecular change which the metal undergoes or to a peculiar action. If, as it is probable, the vibrations caused by the wind act upon the lines of iron wires like the blows upon a rod, it appears difficult to correspond at great distances with the existing means of transmission, till a method has been found of causing the telephones to speak by the aid of electric action so powerful that the currents arising in the line itself cease to be an appreciable cause of disturbance.—*M. A. Gaiffe.*

A Curious Case of Partial Deafness.

Mr. Edwin Cowles, of the Cleveland (Ohio) *Leader*, gives the following account of an infirmity which curiously limits the range of his sense of hearing:

"My deafness is somewhat of the nature of color blindness. There are certain sounds I never hear. I have never heard the sound of the bird since I came into this world, and until I grew up to manhood I had always supposed the music of the bird was poetical fiction. You may fill this room with canary birds, and they may all sing at once, and I never would hear a note, but I would hear the fluttering of their wings. I never hear the hissing sound in the human voice, consequently, not knowing of the existence of that sound, I grew up to manhood without ever making it in my speech. A portion of the consonants I never hear, yet I can hear all the vowels. I never could distinguish the difference between the hard sound of the letter 's' and the soft sound, consequently I frequently mix these sounds in a sad manner. It is the same with the soft and hard sound of the letter 'g.' It was only by accident, after my marriage, that I discovered the existence of the hissing sound in the human voice. I was then taught arbitrarily how to make it, but I never hear it in my own voice, consequently I frequently miss making that sound in my speech without knowing it. Owing to its having become second nature to me to omit the sound of the letter 's,' when I do make it I labor in doing so, which in a great measure gives my pronunciation the peculiarity it has. There are words which I pronounce literally according to the spelling, which gives an additional peculiarity to my speech. For instance, I used to pronounce the word 'parochial' just as it was spelled until I was corrected, when I now pronounce it 'parokial.' I cannot hear the difference between the sounds 'ch' and 'k' when embodied in a word. All these examples will give an idea how it is that my peculiar deafness affects my speech. Before I was taught to make the hissing sound my pronunciation sounded the same to everybody as theirs did to me. About a quarter of the sounds in the human voice I never hear, and I have to watch the motion of the lips and be governed by the sense of the remarks in order to understand what is said to me. I have walked by the side of a policeman, going home at night, and seen him blow his whistle, and I never could hear it, although it could be heard by others half a mile away. I never hear the upper notes of a piano, violin, and other musical instruments, although I would hear all the lower notes. I can hear low conversation, but cannot as a general rule understand a public speaker in a hall. Now you will understand how it is that my impediment of speech is owing entirely to my extraordinary hearing. I have consulted the most eminent surgeons, physicians, and aurists in the country in regard to my hearing, and they all tell me there is not another case like it in the books."

ENGINEERING INVENTIONS.

Messrs. William H. Bomgardner and Henry Kerns, of Omaha, Neb., have patented a system of car braking by which the brakes are set instantaneously by diminishing the speed of the engine, and by which they can be released by increasing the speed of the engine, the object being further to set the brakes automatically whenever the moving or standing train receives a shock from either end, the system being so arranged as not to interfere with hand braking as commonly applied.

Mr. Frederick W. Hales, of Charlotte Town, Prince Edward Island, Canada, has patented a ditching machine designed especially for opening ditches through wet or swampy grounds, and which may also be used with advantage for other ditching.

An improved speed recorder and indicator has been patented by Mr. Marmont B. Edson, of Brooklyn, N. Y. The object of this invention is to obtain a constant indication and permanent record of the speed of machinery. For this purpose I combine with indicating and recording mechanism of usual character devices fitted for rotary motion by connections to the machinery, and provided with weights fitted for centrifugal motion, that are in connection with the actuating rod of the indicating mechanism, whereby the indicating hand and recording pencil are moved in unison with the centrifugal motion of the weights.

An improvement in time signals for railroads has been patented by Mr. Alma P. Burroughs, of Seneca Falls, N. Y. This invention is an improvement upon the time signal for which Letters Patent No. 230,738 were granted to the same inventor on the 3d day of August, 1880, and it consists in the application of compressed air, and in the mechanism therefor, whereby the clock hands are ungeared by passing trains.

RECENT DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

PECK, ADMINISTRATOR, *vs.* COLLINS.—PATENT DRIVE WELL. —REISSUE.

Mr. Justice Bradley delivered the opinion of the court.

1. Upon a surrender of a patent for reissue, an interference declared thereon, a decision against the patentee, and subsequent refusal of a reissue, the patent becomes destitute of validity and absolutely void.

2. Under the law as it stood in 1866 a patent surrendered for reissue was canceled in law as well when the application was rejected as when it was granted. The patentee was in the same circumstances as he would have been if his original application for a patent had been rejected.

3. Under the law as it then stood surrender of a patent was an abandonment of it, and an applicant for reissue took upon himself the risk of getting a reissue or of losing all. The question of his right to any patent at all was opened anew the same as upon an original application for a patent.

4. Whatever may have been the effect of the new clause introduced in the law by the act of July 8, 1870, that "the surrender shall take effect upon the issue of the amended patent" in cases where a reissue is refused for other reasons, it would still seem that if the patentee's title to the invention is disputed and adjudged against him, the effect of such a decision should be as fatal to his original patent as to his right to a reissue.

In error to the Court of Appeals of the State of New York.

United States Circuit Court.—District of Maryland.

BOOTH *et al. vs.* SEEVERS *et al.*

Bond and Morris, Judges:

The recovery of profits and damages from the manufacturers of an infringing machine debars the patentee from recovering from a user for the use of the same machine.

STATEMENT OF THE CASE.

[This suit was brought under reissue patent No. 1,826, granted to complainant on November 29, 1864, for improvement in grain separators, for the use of a machine, which was one of a number, for the manufacture of which the complainant had recovered from the makers.]

The Railway Tell-tale.

An ingenious machine, called the "tell-tale," has been introduced recently on the Erie Railroad. It registers the speed of trains, when and where they stop, and how long. It is used especially for freight trains, and is fastened at either end of small cabooses or at the side of large cabooses, about four and a half feet from the floor. It was adopted because freight trains frequently exceeded the prescribed rate of speed. They would run very fast for some distances, and then take things comfortably for a time.

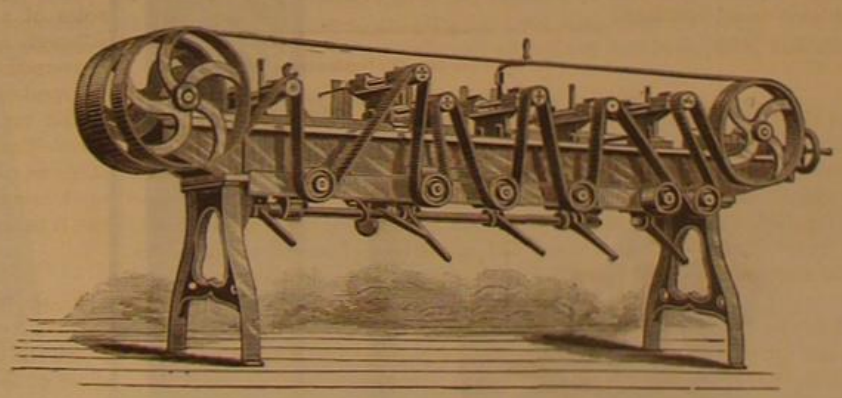
NEW GANG BORING MACHINE.

The gang boring machine shown in the annexed engraving is made by William White & Co., Moline, Ill. It will bore six or less holes in wood in any position on an area six feet long by four inches wide.

The piece to be bored is laid on a table or rest attached to the side of the machine opposite that shown in the engraving, and is moved up to the gang of bits by a suitable lever. This table is abundantly provided with gauges and clamps for handling the work.

The pulley on the right hand of the machine is carried in sliding boxes moved by the hand wheel and screw to take up and let out the belt as the location of the boring spindle is changed.

The boring spindles can be adjusted independently of each other by a screw, and can be moved along the bed to within three inches of each other. They are carried on V-ways, and are consequently parallel.



GANG BORING MACHINE.

All practical woodworkers know it frequently takes longer to "lay out" a stick in which a number of holes are to be bored than to do the boring. As the "laying out" is unnecessary with this machine it is easy to see why one man can do more than six men with a single bit machine, where there is six holes to be bored in each stick.

This machine can be furnished to order to bore over a greater area and a larger number of holes. The spindles are of steel, and the various parts are arranged for the greatest convenience and durability. Many of our extensive manufacturers are using these machines with great satisfaction.

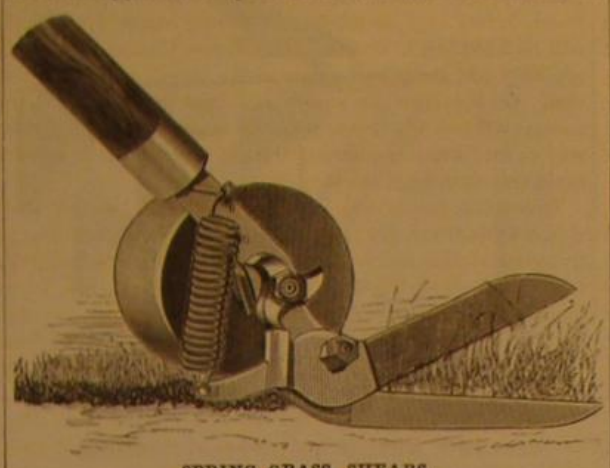
Incandescent Electric Lamps on Shipboard.

What has been wrongly described as the first attempt to light the saloons of an ocean steamer by incandescent electricity has been carried out with alleged success on the Inman steamer City of Richmond, which arrived in this port May 9. Our readers will recall the successful use of the Edison lamps on the steamship Columbia, on her trip from this port around Cape Horn to Oregon, a year ago. This later attempt, however, appears to be the first use of incandescent electricity in lighting an Atlantic steamer.

The system adopted on the City of Richmond is similar to Mr. Edison's, and was set up experimentally at the risk and cost of the inventor, Mr. Swan, an English electrician, whose lamps have been fully described in this paper. The main saloon of the City of Richmond was lighted by six lamps, and eleven others were placed in other parts of the ship. The light furnished was described as mellow and pleasant. The power for the generator was supplied by the ship's engines, and no estimate was made of the amount of energy consumed.

NEW SPRING GRASS SHEARS.

The trimming of the edges of lawns or grass borders is not always effected in the best manner, even with a pair of long-handled grass shears on wheels. Automatic action in such a tool is, therefore, an evident gain, and the patent recently obtained by Mr. Adie, of Pall Mall, will, we believe, be appreciated by all those who have ever attempted



SPRING GRASS SHEARS.

the work to which we have alluded. On reference to the accompanying engraving it will be seen that the tool consists of a pair of grass shears, on the tang of the lower blade of which is fitted a cam arrangement with three arms or teeth, and working on an axle communicating with a small roller on the opposite side. The upper blade is so formed that a shoulder is thrown forward to intercept the teeth of the cam, and a projecting arm is attached to one end of a spiral spring, the other of which is fixed to the tang of the lower blade above the cam. The tool is fitted with a long handle, having a cross piece at the top, and in working the action may be thus explained: The roller being set in motion communicates its revolutions to the cam arm, which, in turning, comes in contact with the shoulder before mentioned, and raises the blade with a downward pressure. As the shoulder escapes from the cam arm the spring quickly closes the shears. It will thus be seen that while the power of the roller is slowly stored in the spring the latter gives out its power suddenly when the shoulder escapes from the cam.

Trial of a Petroleum Engine.

The naval board ordered to examine the machinery of the Brayton Petroleum Engine Company, have reported to Chief Engineer Shock, giving in detail the results of their experiment with the Mystery, on the Potomac. They say: "As to the adaptability of this type of machinery to steam launching and its fitness for naval purposes, we would state that the principal advantage to be derived from the use of motive power of this description is the celerity with which machinery can be put in operation, only a few seconds being required for that purpose. The use of this motor is unattended with danger, and it is well adapted for special naval purposes, such as launches used at navy yards, for attachment to cranes and stationary engines; but on account of the danger from fire in carrying large quantities of crude petroleum on board our cruising vessels, and as our vessels often visit ports where petroleum cannot be obtained, which would render this type of machinery powerless, we can only recommend its use as above mentioned. The liability to derangement is about the same as in the ordinary steam engine." The report is signed by Chief Engineers Philip Inch and William S. Smith and Passed Assistant Engineer John Lowe. The board also report that they consider the Brayton motor as economical as steam under certain conditions.

Length of Jupiter's Day.

The Emperor of Brazil has transmitted to the French Academy a note of M. Crul's upon the time of Jupiter's rotation. The sharpness of outline and the bright color of the brown spot which has been so long visible enabled him to deduce from nearly 1,100 rotations a period of 9h. 55m. 36s.—*Comptes Rendus.*

NEW INVENTIONS.

Mr. Edward K. Morse, of Fall River, Mass., has patented a sharp-calked supplementary shoe to fit the lower side of an ordinary shoe between its toe and heel calks, the supplementary shoe being provided with lips at its toe and heel to overlap the upper side of the inner edge of the ordinary shoe, and having a locking plate connected with its rear end by cam-headed pivots, so that the supplementary shoe can be attached to and detached from an ordinary shoe while upon a horse's foot by swinging the locking plate in and out upon its pivots.

An improved device for tightening belts without removing or shortening them, has been patented by Mr. Horace D. Hicks, of Whitefield, N. H. The invention consists of a fixed eccentric on a lever controlled shaft, and of a lever-controlled eccentric sleeve fitted loosely on the same shaft, each eccentric forming the central bearing of a pulley, which pulleys are clutched together so that they may be revolved together, though they may be independently moved eccentrically for tightening their respective belts.

Mr. William Coupe, of South Attleborough, Mass., has patented an improvement in leather-stretching machines. This invention is an improvement upon the machine for which Letters Patent No. 178,361 were granted to the same inventor June 6, 1876. The invention consists of improved devices for adjusting and holding the leather in the machine, so that the work may be performed more quickly and the leather be stretched more evenly.

Mr. David Flanders, of Sing Sing, N. Y., has patented a process of changing the bearing years of fruit trees. It is well known that fruit trees, especially apple and pear trees, bear heavy crops of fruit on alternate years, and but very light crops on the intermediate years, so that in the bearing years apples are a drug on the market, and in many localities will not pay for the cost of gathering them; consequently the apple grower realizes little or no money from a most abundant crop, while in the intermediate years the trees that have nearly exhausted their vitality the year before by such abundant fruiting produce but little or no fruit, so that, though the prices rule high, the apple grower can obtain but small returns from his crop, because of its poverty. Could the so-called "bearing years" be changed—could the trees be made fruitful by any means or process in the intermediate or barren years—those applying the process to their trees would have the heaviest fruit crop when the prices were highest. The object of this invention is to accomplish this result; and it consists in applying to the blossoms of the trees in the spring of the bearing year, by sprinkling or otherwise, acid or alkaline solutions of sufficient strength to check the development and destroy the vitality of the blossoms, and to cause them to gradually fall off, the solution being sufficiently diluted so as not to injure the tree.

Mr. Ernest W. Noyes, of Bay City, Mich., has patented a head for clipping machines, so constructed that it can be applied to any part of the animal, and will avoid the necessity of an attendant to hold up the feet or legs of the animal being operated upon.

An improved lamp extinguisher, patented by Mr. George A. Greene, of Cool Spring, N. C., consists of telescoping tubes attached to a bellows, and provided with a loose curved tube and a tip capable of being inserted in the lamp burner.

An improvement in call-bells or alarms placed upon a single electric circuit, and so operated that any particular office or person upon such circuit may be called without disturbing or calling any of the other offices or persons upon the same circuit, has been patented by Messrs. George A. Cardwell and Nelson L. North, of Brooklyn, N. Y.

Mr. James M. Dennis, of Cambridge City, Ind., has patented a process for preparing the fibers of wood for the manufacture of brushes, which consists in first soaking the wood in heated alkaline water, then separating the fibers by pressing and pounding, or otherwise, then cleaning the fibers, then boiling them in agglutinated water, and finally oiling the fibers.

A simple and convenient device for containing shot and powder, and for weighing and delivering them without handling them, has been patented by Mr. Christopher I. Miller, of Richmond, Ky. The invention consists of a series of boxes, or a box subdivided into several compartments, whose bottoms incline to a common center. In the bottom of each box is an opening controlled by a slide, and beneath the boxes are inclined troughs or conductors, at the lowest point of which is fixed a receiver dependent from a spring balance, the bottom opening of the receiver being controlled by a slide, the intention being to devote some of the boxes to powder and the others to shot of different grades, so that by opening the slide on a box the contents of that particular box, or as much of the contents as may be desired, will run out into the conductor and thence into the receiver, to be weighed, whence they may be delivered into any suitable bag, box, or other receptacle by opening the slide of the receiver.

An improvement in carriage tops has been patented by Mr. Henry J. Miller, of Goshen, N. Y. The improvements relate to standing tops for carriages, the object being to produce more handsome, durable, and convenient tops than can be obtained by the usual methods of construction.

A Strange Accident.

A very peculiar accident occurred on the Philadelphia and Reading Railroad, near Tumbling Run crossing, on Monday afternoon. No. 62, one of the large engines lately turned out from the Baldwin Locomotive Works, was running down the road at a good rate of speed, w_en a number of persons who were watching her heard a loud report and saw the tank and caboose almost disappear in a cloud of smoke. Almost simultaneously with the report two figures which occupied the tank were seen to jump and turn half a dozen somersaults before they became motionless alongside the roadbed.

The engine continued on her way, the engineer being apparently unaware that anything of an extraordinary character had happened. Noticing, however, that his engine was the center of attraction to a large number of people who had been halted by the report of the explosion, the engineer, Andrew Quinn, left his cab and made an examination of the fire-box. The door was open and the tank contained a deposit of burning coal, but everything else was seemingly in proper order. The engine continued on her way and nothing of an unusual character has since been heard regarding her. The men who jumped from the tank were train men on their way down the line. Both of them were scorched by the explosion and bruised in their attempt to reach terra firma, but neither was seriously injured. Just previous to the explosion the fireman had put on a lot of fresh coal. It contained, it is supposed, a large quantity of gaseous matter, and this caused the explosion. The engineer was prevented from hearing the latter by the noise generally accompanying a moving engine, and as he was traveling at good rate of speed, and stood in the cab (on top of the boiler), while the force of the explosion was spent in the direction of the tank.—*Pottsville (Pa.) Miners' Journal.*

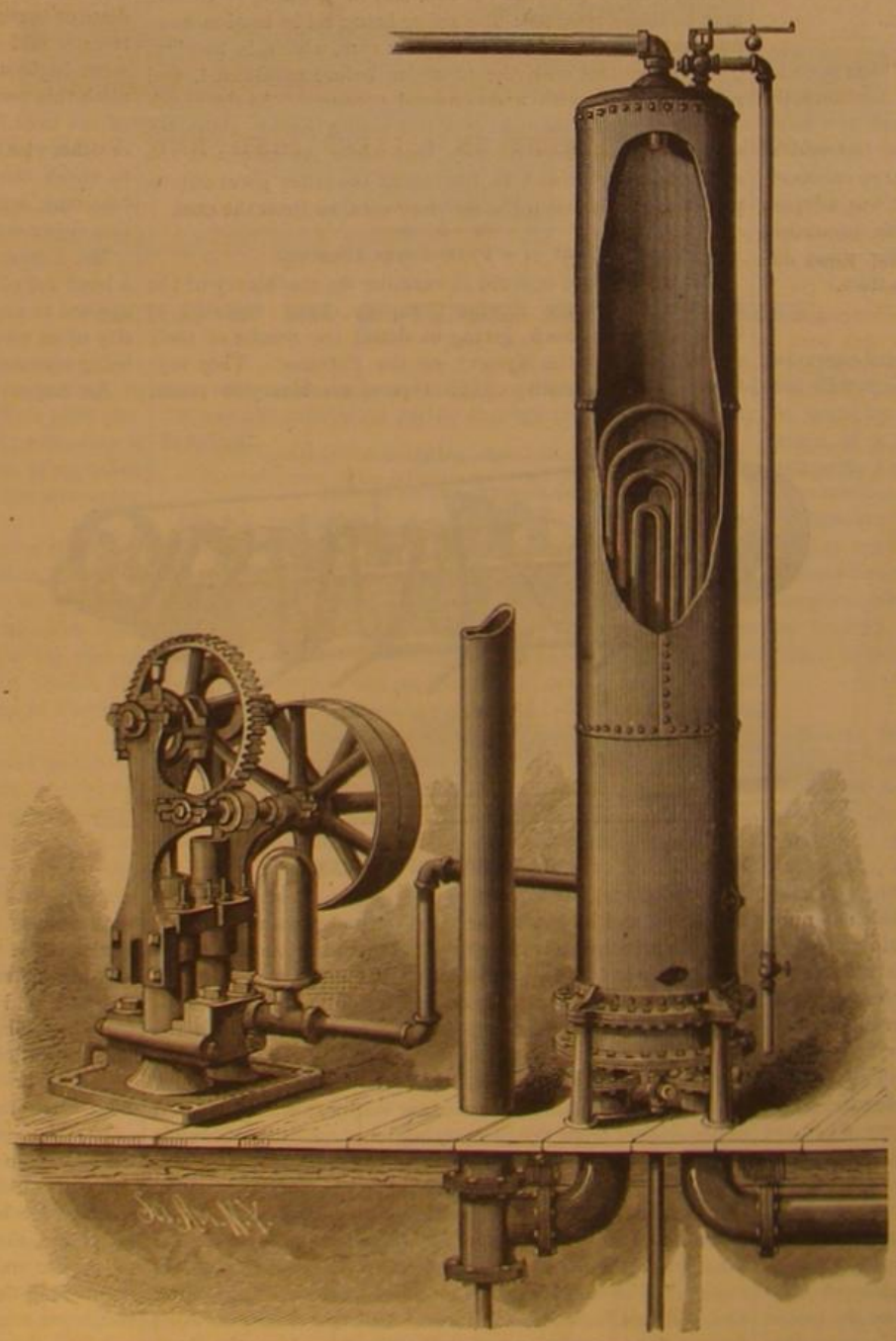
FEED WATER HEATER AND FEED PUMP.

The engraving shows the latest form of the now well known Berryman feed-water heater and purifier and feed pump. These appliances are in use in the principal manufactories in the country, and have established their claim to superiority by long continued and successful use. It is a well established fact that the most economical way of feeding a boiler is by means of a good pump in connection with an efficient and economical heater. Our engraving represents the Berryman, showing the point in the center of the heater, near the top, from which the feed water is forced into boilers; the water, being under a pressure constantly maintained by the feed pump, is in a quiescent condition, and on reference to the engraving, it will be seen that the supply pipe extends far enough into the heater to draw the feed water from the quiet or dead water space, below all surface impurities, and where it is practically pure. This point has been brought out by a long experience in the manufacture of this heater.

The engraving shows a surface blow-off pipe, the use of which requires no loss of time; it will expel all sedimentary or surface deposits. The ∩-shaped tubes are not injured by any strain by contraction and expansion; hence the heater never leaks. The tubes are of brass, seamless drawn, and tested beyond any strain they can possibly be subjected to in actual use.

The double pump shown in connection with the heater is well made in all its parts, and is self-contained and complete. The four valves, the only parts that can get out of order, are so constructed that they can be got at by simply unscrewing a brass cap. The gears are made from cut iron patterns, rendering them noiseless in action, and the pump, being double-acting, is easy on the driving belt, and its action very smooth.

Mr. I. B. Davis, of Hartford, Conn., is sole manufacturer of these appliances, and has made a specialty of this heater and feed pump for over ten years.



THE BERRYMAN FEED WATER HEATER AND PURIFIER AND FEED PUMP.

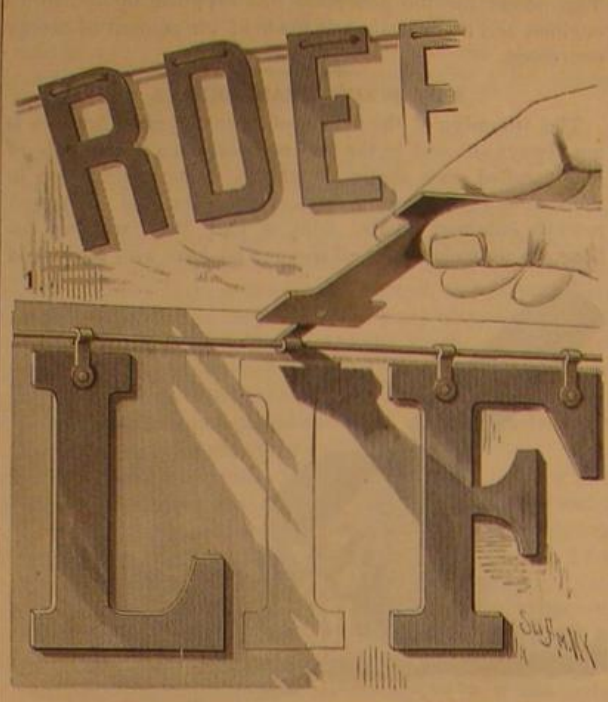
Remedy for Acid Burns.

Since vitriol throwing has become a common offense, it may be well to point out that in a case which occurred during a chemical lecture, described in the *Bulletin de Thérapeutique*, in which two students were seriously injured in the face by the explosion of a flask containing boiling sulphuric acid, the intense suffering at first experienced ceased entirely about a quarter of an hour after the application of a soft paste of calcined magnesia and water in a layer about two millimeters in thickness. M. Alande states that the magnesia requires to be renewed in twenty-four hours, but that patients, after recovery, retain no marks of the accident.

SMILAX and Japanese ferns are now made to twine around the same cord while growing, and thus become doubly valuable for decorative purposes.

NEW METHOD OF SPACING AND LETTERING SIGNS.

The engraving represents a new method of spacing and outlining the lettering for signs lately patented by Mr. John



CALLOW'S METHOD OF LETTERING SIGNS.

C. Callow, of 56 Beech St., Cleveland, O. With this device the spacing of letters in sign work can be easily and rapidly executed by unskilled persons with all the facility of practical sign painters, and letters and other forms can be readily traced around the edges preparatory to filling in with paint, and accuracy in spacing is secured.

This improved method consists in stretching a cord or wire at the proper point, and attaching thereto the appropriate pattern letters either by means of hooks or by passing the wire or cord through eyelet holes formed in the letters. In laying out a sign where several letters of the same kind occur more than once, it is only necessary to substitute any other letter of the same width temporarily, replacing it afterward with the outline of the proper letter.

The alphabets are cut from tough, heavy boxboard, and the letters are of modern shape and style, such as are used by the best sign painters. The letters themselves when painted, grained, gilded, flocked, or otherwise ornamented, and tacked upon a suitable backing, form a handsome and durable sign. The lettering outfit furnished by Mr. Callow enables any one, without previous practice, to proceed and produce a good sign.

The Manufacture of Plate Glass.

To cast, roll, polish, and burnish plate glass requires machinery of peculiar construction, and a "plant" that is costly by reason of its complex nature. The pouring of liquid glass from the furnace upon the cast iron plates, and the subsequent rolling, are processes comparatively simple. Any housekeeper who has used a rolling-pin on a batch of pie-crust dough, performs an operation very similar to this stage of plate-glass-making. It is the succeeding processes of grinding and polishing and final burnishing that require time and costly mechanism. After leaving the rolls and bed plate the glass is rippled and rough, and only fit for gratings or skylights. Each plate must be transferred to machines that resemble the turn-tables of a railway. On the revolving platform the glass is cemented into a bed of plaster of Paris, and the machine started. Bearing heavily on the surface of the glass are blocks of metal, and while in motion the surfaces are kept supplied with sharp sand and a constant stream of water. The next stage of the glass-grinding process is the same as to machinery, but instead of sand coarse emery is used. Then finer emery is used in another revolving table, and so on for half a dozen times. The final polishing is done by heavy reciprocating devices, fed with rouge, and maintaining a constant back and forward motion, and also a lateral movement over the surface of the crystal. All this requires the assistance of a large force of men, many of them skilled laborers. After going through these different grindings and polishings the plate that measured an inch in thickness is only three-quarters of an inch thick, has lost all its roughness, and is ready for the show-window of the purchaser.—*Pittsburg Telegraph.*

MECHANICAL INVENTIONS.

Mr. John H. Eddy, of Sidney, Ohio, has patented a cutter head so constructed that the knives can be adjusted to cut any desired bevel without pitching or tilting the spindle.

Mr. Albert A. Bennett, of Harveysburg, O., has patented a hand circular saw for cutting thin lumber, and it consists in a plate having near its middle and its lower edge a small circular saw loosely revolving in a bearing, and having in front and rear, and slightly projecting below the lower edge of the blade, a gear wheel which, as the plate is steadily pushed over the surface of the board, bites the latter, and through a train of gear wheels imparts a rotary motion to the saw, which, as the plate advances, cuts a kerf through the board with a circular sweep.

An improvement in pipe tongs has been patented by Mr. Deloss Worden, of Oil City, Pa. The invention consists in forming one of the tongs with a bit chamber or seat adapted to receive and hold a square, parallelopiped, or any many-sided removable bite-block in such manner as to present one edge of the bite block in position to take hold of the pipe, the block being retained in place in the chamber by a recessed button.

An improved button-polishing machine has been patented by Mr Homer W. Terry, of Springfield, Mass. This is a machine for applying buttons of horn or other material to the buff or polishing wheels in a more expeditious manner than by hand, as in now usually practiced. The invention consists in a movable and flexible or jointed band or apron distended between pulleys or drums, and provided with gripes arranged in a plane parallel with the plane of the belt, and arranged to seize the button by a movement in the plane, and hold them while passing under the buffs.

An improvement in breasts for cotton gins has been patented by Mr. Charles C. Tate, of Brown's Station, Ala. The invention consists in combining, with the breast heads, horizontal rolls arranged on arms thereof.

An improvement in middlings purifiers has been patented by Mr. John A. Kister, of Mill Brook, Ohio. This invention relates to the arrangement of parts whereby the bran and coarser particles are separated from the middlings. The nature of the invention is such that it cannot be described without engravings.

Mr. Benjamin F. McCarty, of Rolling Prairie, Ind., has patented an implement for cutting the wire bands of bundles or sheaves of grain before feeding them to a thrashing machine. The invention consists of a hollow handle or casing having its upper end reduced in size, the casing being adapted to slide a suitable distance on a central spindle which carries a spring and the cutting blades, the blades being so constructed and pivoted that their ends or shanks will be brought together by the downward thrust of the handle.

JOHN FITCH'S STEAMBOAT EXPERIMENT ON COLLECT POND.*

The population of New York city had nearly doubled in the ten years since 1786. Streets had been laid out, and habitations erected above the swampy fields in the region of Canal street. But although surveys had been made of the several streets about the Collect, or Fresh Water Pond, they were not graded, nor had building lots been found (for obvious reasons) marketable in that locality. The water of the pond was sixty feet deep, and the marshy ground to the northwest, as well as toward the East River, gave little signs of promise as to future value.

This beautiful pond, occupying the site of the present great gloomy pile of prison buildings known as the Tombs, was the scene, in the summer of 1796, of the trial of a boat propelled by steam. It was the invention of John Fitch. The boat was 18 feet in length and 6 feet beam, with square stern, round bows, and seats. The boiler was a ten or twelve gallon iron pot.

The little craft passed round the pond several times, and was believed capable of making six miles an hour.

The spectacle was watched with critical interest by Chancellor Livingston, Nicholas Roosevelt, John Stevens, and others, who had in common with philosophers and inventors in England and Europe been for some time engaged in the speculative study of the steam engine and its prospective uses.† Fitch belonged to the prominent Connecticut family of that name, was born in the famous old town of Windsor, adjoining Hartford, and had been inventing and experimenting for a dozen or more years, hoping to succeed in the application of steam power to navigation. His genius, idiosyncrasies, and impecuniosity were in perpetual conflict; otherwise he might have achieved the triumph to which he aspired. He was a man of striking figure, six feet two inches in height, erect and full, his head slightly bald but not gray, although fifty-three years of age, and dignified and distant in his general behavior.

JOHN FITCH'S STEAMBOAT EXPERIMENT ON COLLECT POND NEW YORK CITY 1796.

LEECH FARMING.

BY A. W. ROBERTS.

All leeches are not aquatic. In Ceylon there exists a small variety of leech that attaches itself to the brush and stones which it resembles in color. Here they hang on, in wait for any passing traveler, constantly reaching forth with their distended bodies in all directions, so great is their anxiety to attach themselves to any living animal. Hoffmeister, when collecting on the Island of Ceylon, discovered that his legs were covered with streaks of blood which flowed from hundreds of minute wounds produced by the bites of a terrestrial leech, *Hirudo ceylonica*. This same leech is found on the Himalaya Mountains, eleven thousand feet above the level of the sea. Several varieties of land leeches also exist in Japan, Chili, and Brazil.

Leeches drink the blood of their victims, and when gorged to the very lips fall off, and do not partake of food again for many weeks.

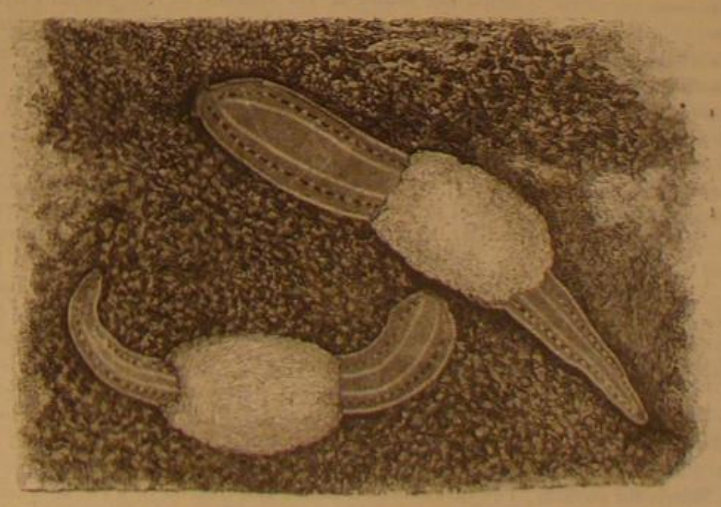
Leeches do not undergo any transformations of form, but are developed directly from the egg as perfect leeches. The perfection of the organization of the leech is always in proportion to that of the natural "host" or victim on which they prey, as, for instance, our mollusks afford safe harbor and food to various marine leeches which are much lower in development than those found on fishes, reptiles, and mammals.

Some time ago, being anxious to obtain specimens of a leech common in our hard clams, I applied to the "opener" of one of the most fashionable oyster and clam saloons of Fulton Market to save me some, leaving a bottle of alcohol with him. Calling, after the expiration of two weeks, I was surprised to find not a single leech saved, but was smilingly referred to the proprietor, who, I found, had given instructions not to save any for me, as he feared I was one of those newspaper "sketchists," working up a sensational article on hard clam trichinæ. These clam leeches are flat, an inch in length, and a quarter of an inch in breadth, and are attached to the outer wall of the stomach of the clam, which they resemble in color. Having great friendship for the hard clam, I must have swallowed alive many hundreds of these *Malacobdellæ* alive, and being of an inquiring mind I determined to have a mess of them cooked, and am forced to admit that they were very nice, very palatable, and of the most desirable Little Neck clam flavor, from which highly prized brand of clams they were taken.

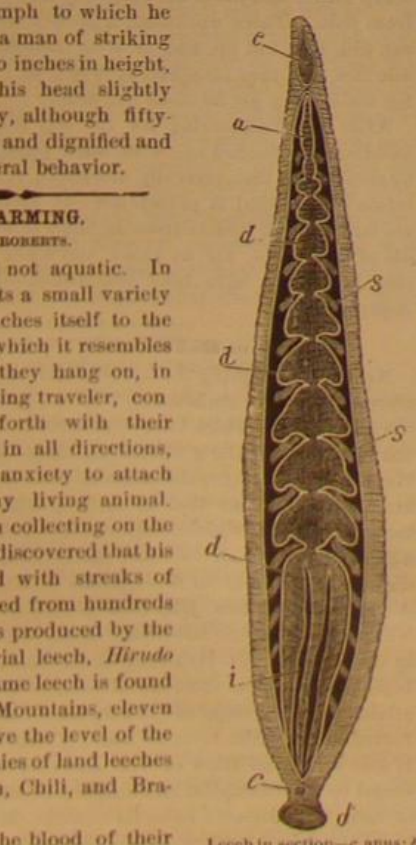
The Chinese eat both marine and fresh-water leeches.

That the leech is very sensitive to all atmospheric changes is proven beyond doubt, and the idea of utilizing this little creature as a sort of barometer is not new. The best leech storm-glass consists of a tall candy jar with tin top, in which perforations are made; at the bottom of the jar a flooring of peat with two or three smooth stones is placed; the jar is then filled with soft water, into which, after it has settled and become quite clear, two or three of the medicinal leeches are placed; great care must be taken in summer time to keep the temperature of the water down by placing the jar in a cool and shady situation, as heat is fatal to leeches. When the weather continues serene and beautiful, the leeches remain motionless at the bottom. On the approach of a rain or snow storm the leeches will be found at the top of the water, where they will remain till the weather becomes settled. When a wind storm is approaching the leeches will gallop about with great liveliness, seldom resting until the wind becomes violent. When a thunderstorm is approaching the leeches will seek a lodgment above water, displaying great uneasiness, and moving in convulsive-like threads. In clear frosts, as in dry weather, the leeches remain constantly at the bottom. The water must be changed every two weeks. The leeches are fed twice a year on blood tied in a thin linen bag, or on a living frog. The best leeches in the market are Russian and Swedish, and are of a dark brown color. The Hungarian leech is green in color, with yellow stripes, closely resembling our horse leech. In Pennsylvania a native leech has been used to some extent among the Germans, but it is found to be very unreliable when taken out of water and applied, dropping off the patient when only half gorged, but when covered with water will gorge to its full extent. I believe that this is the only instance known of utilizing our native leeches. The German and French governments were the first to offer large premiums for the encouragement of leech culture, but many years elapsed until a French fisherman, named Berchade, met with entire success, and at the same time accumulated quite a fortune, as leeches were at that time in great demand and brought high prices.

In 1841 a Mr. H. Witte established a small leech farm in Kent avenue, Williamsburg, L. I. In course of time this small establishment was abandoned, and one of thirteen acres was established near Newtown, L. I., and to him I am indebted for the following information and description of the only leech farm in America. The breeding ponds consist of oblong squares of one and a half acres each. The bottoms of these ponds are of clay, the margins of peat. In June the leeches begin forming their cocoons in the peat margins of the pond. These so called cocoons are very curious objects, consisting of a frothy mass of gelatin material of the size shown in the illustration. Through this mass the leech introduces his body and deposits the eggs. After the eggs are deposited the open ends of the

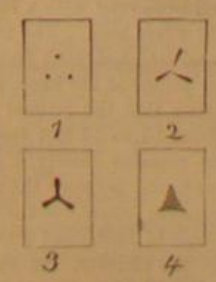


Leeches depositing eggs in cocoons, in section of peat.



Leech in section—*c*, anus; *b*, posterior sucker; *s s*, glands of the skin; *i*, intestine; *a*, œsophagus; *d d d*, stomach; *e*, anterior sucker.

1. Jaw of a leech.—2. Jaw magnified.



Different forms of the bite of a leech.

Cocoon of leech closed.

* By permission from the "History of New York," by Mrs. Martha J. Lamb. A. S. Barnes & Co., publishers: New York and Chicago.

† The statement that Robert Fulton was present at this trial of Fitch's steamboat on the Collect, in 1796, is an error, he being in England at that date, thoroughly absorbed in the study of Watt's steam engine and canals; he that year published in London a treatise on the improvement of canal navigation, with numerous well executed plates from designs of his own. He also about the same time, in England, patented a mill for sawing marble, for which he received the thanks of the British Society for the Promotion of Arts and Commerce and an honorary medal. In 1797 he passed over to Paris, with the intention of bringing to the notice of the French Government a submarine torpedo and torpedo boat.

cocoon close, and the gelatinous material becomes more dense and glue like. From each cocoon from thirteen to twenty-seven young leeches are developed. The young are hatched out by the heat of the sun, and begin to issue from the cocoons early in September. At first they are no thicker than a pin, but at that early age are capable of cutting through the skin of a horse. At the end of three years these leeches are ready for the market.

The greatest enemies to young leeches are musk-rats, water-rats, and water shrews, who dig the cocoons out of the soft peat breeding margins. Next to rats and shrews is overheating of the peat or the water of the pond. In fact, nothing is so fatal to leeches as a too high temperature. Mr. Witte says he has had leeches frozen in solid ice, but by slowly dissolving the ice and gradually increasing the temperature of the water the leeches sustained no injury. The depth of the water in the ponds during summer is three feet, in winter time the depth of the water is increased to avoid freezing.

The leeches are fed every six months on *fresh* blood placed in thin linen bags, which are suspended in the water. The leeches, as soon as they smell the blood, assemble from all parts of the pond, and attaching themselves to the outside of the bag suck the dissolving coagulated blood through the linen. Digestion proceeds very slowly in the leech, and more than a year will elapse before all the blood is digested in a fully gorged leech, during which time the blood remaining undigested in the stomach of the leech is in a fluid state, as if just taken in. The excremental deposits are of a grass-green color. The best substance for packing leeches in is the peat of their natural ponds made into a stiff mud. Water containing tannin, tannic acid, lime, salt, or brackish water must be guarded against always; iron is not objectionable, but is an advantage in small quantities.

The demand for leeches in the last few years has somewhat fallen off in the Eastern and Southern States. The Western States and California are now the heaviest buyers. Mr. Witte's sales alone average a thousand a day. The number of leeches imported to this country amounts to about thirty thousand yearly.

The custom of stripping and salting leeches, to cause them to disgorge after having been applied, has passed away, as many well established cases have occurred of infectious diseases having been communicated on the application of the same leech to a second party. A very popular error exists that a leech when applied takes only the bad blood (whatever that may be) and rejects the good; this is a mistake. With a leech blood is blood, be it the cold blood of a fish or the warm blood of a human being, no matter how diseased that human being may be. So long as blood is fresh and not tainted or putrid the leech will thrive on it. A friend of mine, who was the proprietor of a large leech-breeding establishment at the foot of the Harz Mountains, when wishing to feed his leeches was in the habit of hiring poor laborers, at six cents per day, to stand in the water for half an hour nearly up to their thighs that the leeches might obtain a full gorging of human blood.

In the marshy lands of Roumania the wild leeches are captured by means of men entering the water and allowing the wild leeches to fasten on to their naked bodies. The leech fishers then strip them off after reaching the shore.

How to Keep Leeches.

Take any wide mouth bottle that will admit the hands and fill it about two-thirds full of what is known as "Excelsior" (such as is sometimes used in upholstering and making cheap mattresses), wash the "Excelsior" with warm water and pour it off; then pour in cold, soft water enough to cover, and put in the leeches, tie a piece of thin cloth over the top, change the water once a month, and occasionally set the bottle and contents in the sun.

I have used this method for a number of years, and I do not remember ever finding a dead leech. It has certainly proved better than any jar, sponge, rusty nails, earth, or anything else I ever tried, and has the recommendation of being cheap and easily attended to.—*James S. Talbot, in New Remedies.*

Return of an Orchid Hunter.

On several occasions during the past year or two our readers have been indebted to Mr. Ernest Morris for curious and interesting information touching the natural history of the Amazonian forest regions communicated in his letters to the *World*. Mr. Morris lately returned to this city, bringing a large number of rare and valuable orchids, which he has collected for Mr. Erastus Corning, of Albany, N. Y., whose collection is valued at more than $100,000, and is considered the finest in the United States. Mr. Morris expects to return to his orchid hunting in South America, probably in Columbia and Equador. With the genuine explorer's feeling he says: "The valley of the Amazon is too civilized for me, and I want to get off the beaten track. When I come across an empty beer bottle hung up as an ornament in an Indian hut it makes me feel as though I was too near home."

Although the Amazon has been well explored, people have no idea of the richness in gums, herbs, and rubber of the country through which its tributaries flow. In trading along these rivers the Americans are far behind the English and French, although goods of American manufacture are considered the best and are most expensive.

Besides the orchids Mr. Morris brought a great quantity of herbs used in making the poison Wourali, with which experiments are to be made, as it is thought to be valuable as a cure for hydrophobia. Among other medicinal roots, he has some Macapa, which was once given to him by an Indian woman when he was very sick with fever and inflammation of the liver.

The business of orchid hunting may fairly rank among the most adventurous of the occupations of men, and the number of enthusiastic naturalists engaged in it is larger than is commonly suspected. As a contemporary points out, the owners of great floral establishments in Europe and America keep a regular staff of hardy botanists, who are to them what special correspondents are to a great newspaper. If the truth were known, it would probably be found that professional orchid hunters have explored more remote parts of the world than the foreign representatives of journals have ever done, but the world at large knows it not, because the orchid hunters are contented with the discovery of new specimens or filling their wallets and cases with rare specimens, and then returning quietly to their employers, while the special correspondent is bound to write and let everybody know where he is and what he is doing. A few years ago an orchid, *Cypripedium stonei*, variety *platinæum*, was sold in London for over £150, or $750. This is undoubtedly a tremendous sum to pay for a single plant, but the probability is that it had been brought from some distant part of the world at great risk and expense—perhaps from the Yunan borders of China, the fever-stricken and chimpanzee-inhabited jungles of Borneo, the mysterious lands lying north of the head-waters of the Amazon, the forests of Madagascar, or the northern extremity of the Transvaal. Great orchid merchants pay enormous sums annually to support their emissaries abroad, and in their estimation the discovery of a new specimen is so invaluable that, if merely told of its whereabouts, they will send out expeditions in search of it. Fifteen years ago an eminent West End (London) firm of florists heard of a strange orchid in the interior of Jamaica, and, thanks to their expenditure of a large sum of money, and the patience and energy of their emissaries, they were in possession of the coveted specimen within a year's time. At present the lovely wax-like flowers of the orchid are luxuries only for rich men and the possessors of conservatories, and this must remain the case so long as orchid hunting is such a costly and dangerous employment.

The Mastodon in Recent Times.

Prof. John Collett, Ph.D., State Geologist of Indiana, gives some statistics in relation to the mastodon, that dispels the notion that these animals did not live in recent times. Archæologists who argue the great antiquity of man upon this planet, based upon the fact that his remains have been found with those of the mastodon, will be compelled to seek other lines of proof for their theory. We quote from page 385, Geological Report for 1880. Professor Collett says:

Of the thirty individual specimens of the remains of the mastodon (*Mastodon giganteus*) found in this State, in almost every case a very considerable part of the skeleton of each animal proved to be in a greater or less condition of decay. The remains have always been discovered in marshes, ponds, or other miry places, indicating, at once, the cause of the death of the animal and the reason of the preservation of the bones from decay. Spots of ground in this condition are found at the summit of the glacial drift or in "old beds" of rivers which have adopted a shorter route and lower level, consequently their date does not reach beyond the most recent changes of the earth's surface; in fact, their existence was so late that the only query is, Why did they become extinct?

A skeleton was discovered in excavating the bed of the canal a few miles north of Covington, Fountain County, bedded in wet peat. The teeth were in good preservation, and Mr. Perrin Kent states that when the larger bones were cut open the marrow, still preserved, was utilized by the bog cutters to "grease" their boots, and that chunks of sperm-like substance, 2½ to 3 inches in diameter (adipocere), occupied the place of the kidney fat of the monster. During the past summer of 1880, an almost complete skeleton of a mastodon was found six miles northwest from Hoopston, Iroquois County, Ill., which goes far to settle definitely that it was not only a recent animal, but that it survived until the life and vegetation of to day prevailed. The tusks formed each a full quarter of a circle, were 9 feet long, 22 inches in circumference at the base, and in their water-soaked condition weighed 175 pounds. The lower jaw was well preserved with a full set of magnificent teeth, and is nearly 3 feet long. The teeth, as usual, were thickly enameled, and weighed each from 4 to 5 pounds. The leg bones, when joined at the knee, made a total length of 5½ feet, indicating that the animal was no less than 11 feet high, and from 15 to 16 feet from brow to rump. On inspecting the remains closely, a mass of fibrous, bark-like material was found between the ribs, filling the place of the animal's stomach; when carefully separated, it proved to be a crushed mass of herbs and grasses, similar to those which still grow in the vicinity. In the same bed of miry clay a multitude of small fresh water and land shells were observed and collected, which were kindly determined by Dr. F. Stein, as follows:

1. *Pisidium*, closely resembling *P. abditum*, Halderman. 2. *Valvata tricarinata*, Say. 3. *Valvata*, resembling *V. striata*. 4. *Planorbis parvus*, Say.

The shell bearing animals prevail all over the States of Illinois, Indiana, and parts of Michigan, and show conclusively that, however other conditions may differ, the animal and vegetable *life*, and consequently climate, are the same now as when this mastodon sank in his grave of mire and clay.—*Clinton (Wis.) Herald.*

How Cattle are Killed for New York Market.

In the city of New York there are two large abattoirs or slaughter houses. On the east side of the city there is a collection of several of these establishments, which occupy the blocks bounded by East Forty-third street, First avenue, East Forty-sixth street, and the river front. The total number of beef cattle slaughtered here last year amounted to about 100,000 head.

At the foot of West Fortieth street is what is called the West Side Abattoir, which is the largest establishment of the kind in the city. Its dimensions are 425 feet in length on Fortieth street, and 300 feet on Thirty-ninth street, with a uniform depth of 200 feet. The annual kill of beef cattle here is 2,200 head per week, or about 115,000 a year.

At Jersey City, across the river from New York, is situated another large establishment of this kind. It is not only a slaughter house, but the receiving point for the greater portion of the cattle coming into New York. It is very favorably situated, being not more than a mile by water from any of the European steamship wharves, and cattle for export can be shipped by boat from the abattoir direct to the side of the vessel. For this reason it is the principal place from which the live stock export traffic is done. The stock yard covers several acres, and is divided into large pens, partly roofed over, with water troughs and hay racks running along the sides. They afford accommodation for about 3,000 cattle, and the charge per head for each animal entering the yard, no matter how long or short may be the period of its stay, is 40 cents. During the time they are kept in the yard they are fed at the owner's expense. The slaughter house proper is a building 250 feet front by 300 deep, but with the offices and other additions the buildings cover an area of 270 by 390 feet.

When the company which controls this abattoir first started in business, in October, 1866, their establishment was at Communipaw, and in 1867 their receipts were 79,829 cattle, 456,939 hogs, 160,247 sheep, of which 16,791 cattle, 423,512 hogs, and 143,639 sheep were killed on the premises. The export trade in live stock brought a large increase in the receipts, and in 1875, the year after they took up their present location at Harsimus Cove, Jersey City, they received 258,550 cattle, 640,149 hogs, and 685,724 sheep; of these, 78,894 cattle, 543,919 hogs, and 431,241 sheep were slaughtered on the premises. From this time on the arrivals have continued to increase, until last year they reached 368,298 cattle, 952,371 hogs, and 634,191 sheep. The slaughter of beef cattle, however, had fallen to 43,758, while that of hogs was 940,200, and of sheep 630,700.

The cattle coming into New York average from 700 pounds to 800 pounds in weight, and at 10 cents per pound, about the usual figure, bring $70 to $80 each on the hoof. The method of killing is essentially the same in all the New York slaughter houses. A rope is fastened around the animal's hind legs, and he is lifted off his feet by means of a block and tackle, so that he hangs with his head downward, and just touching the floor. His throat is then cut with a large, sharp knife, and his death is speedy and comparatively free from pain. Three workmen, a dresser and two assistants, can kill, flay, cut up, and dress an animal in about twenty minutes, and they slaughter eighteen to twenty head daily, for which they get 59 cents per head.

After the slaughtering for the day is at an end all the buildings are flushed out with water pumped from the river by steam, and then carefully mopped over, so that no sign of refuse of any kind is perceptible—in fact, the floors, which are laid with an incline from the sides to a gutter in the middle of the houses, are as clean and white as the decks of a ship after they have been holystoned.—*Shoe and Leather Reporter.*

Source of Bad Taste in Croton Water.

Nearly every spring the users of our city Croton water are alarmed by an unpleasant "fishy" or "cucumbery" or "woody" taste, which lasts sometimes for weeks. This season it was particularly offensive. At a late meeting of the New York Microscopical Society, Mr. J. D. Hyatt called attention to the fact that in early spring the beds of all the mountain brooks which feed the lakes become covered with a gelatinous layer of minute vegetable organisms known as diatoms, sometimes to a thickness of a quarter of an inch. A very little of this jelly mass placed in a vessel of water will soon impart the same odor to the water as is observed in the Croton. Mr. Hyatt concludes that as soon as the jelly begins to disappear from the streams, which occurs when it attains a certain stage of growth, the same odor will be imparted to the entire body of water which flows to this city. If this is true no trace of the cause of the odor would be found by microscopical examination of the water in the city at such long distance from its source. Mr. Van Brunt said his observations confirmed this view.

The Ancient Cypress near Sparta.

The celebrated cypress tree that had stood near the city of Sparta, Greece, for over 2,800 years, and was described by Pausanias 400 years before the coming of Christ, has been destroyed by a band of strolling gypsies, who camped beneath it and left their fire burning. It was 75 feet high and 10 feet in diameter near the ground. The people of Sparta greatly mourn its loss.

The Mississippi River and the Grain Trade.

At the last meeting of the New York Board of Trade and Transportation some significant figures were given as to the relative cost of transporting grain from the West to Liverpool by rail to the Atlantic seaboard or by river to New Orleans. It was stated that grain can be shipped from St. Louis to Liverpool, by way of the river, for 17 cents a bushel; the rate by way of New York is 29½ cents. The rates from St. Paul, Minn., show a difference in favor of New Orleans of 15½ cents a bushel.

Under these conditions the increasing tendency of shippers of grain in the Mississippi valley to choose the southern route is not surprising. During the year ending August 31, 1879, the exports from New Orleans were 4,617,825 bushels of corn and 1,868,084 bushels of wheat. For the year ending August 31, 1880, the exports were 9,863,790 bushels of corn and 5,344,510 bushels of wheat. The total increase for the year was nearly nine million bushels. The increase for the coming year is likely to be still greater, as several barge lines and many new barges have been added to the grain fleet of the Mississippi River for this season's trade. By this plan one towing steamer is able to guide down the river a raft of barges carrying from eight to twelve hundred car loads of grain. The cheapness of the river route much more than compensates, as we have seen, for the increased length of the ocean trip. The passage from St. Louis to New Orleans is made in little over a week. The amount of the barge traffic already in progress may be estimated from the following figures given in the St. Louis *Republican* of April 8, with reference to the carrying capacity of barges then about to start for New Orleans:

"Steamer Iron Mountain and five barges with 220,000 bushels wheat and 50,000 bushels corn; Oakland and six barges, with 50,000 bushels wheat, 200,000 bushels corn, and 25,000 bushels oats; and the Bigley and four barges, with 40,000 bushels wheat and 100,000 bushels corn, making a total shipment for the week of 680,000 bushels grain, which by railway transportation, at 500 bushels to the car, would require 1,370 cars, and estimating 20 cars to the train, would make up 69 freight trains and employ about 400 train men. The amount of wheat carried will be 310,000 bushels, corn 350,000 bushels, and 25,000 bushels oats, to say nothing of the package freight, which will be large."

The reduction of the cost of transportation to Western Europe of ten or fifteen cents a bushel must have the effect of vastly increasing the power of our Western wheat growers to compete successfully with those of Hungary and Russia, and thereby largely increase the European demand for American grain. In this way the development of the river route (thanks to the successful working of the jetty improvements at the mouth of the Mississippi) cannot but prove advantageous to the farmers of the Mississippi Valley as well as to the merchants of New Orleans.

The effect upon the commerce of the Atlantic States is not at first so promising, unless by the improvement of railway, canal, and lake carriage the cost of transporting grain from the interior to the seaboard may be so reduced that the primary advantage of the river route can be overcome.

If it should prove that the East and West water and rail routes are unable to compete with the Mississippi in the transport of bulky and cheap agricultural products, it by no means follows that their profitableness will be seriously impaired in the long run. The prosperity which must come to the interior through the establishment of a cheaper way to market for its surplus products must tend to increase rapidly the purchasing power of its people and their disposition to purchase largely those commodities which compress more value into a little space and inevitably demand direct and rapid carriage. And the merchants and transporters of the seaboard may possibly find the farmers of the interior, owing to an increased though diverted grain trade, much more profitable as customers than they ever have been. Part of a great traffic may be worth more than the whole of a lesser traffic.

The Commerce of New York.

The twenty-third annual report of the New York Chamber of Commerce, just presented, covers the trade of the year 1880. In reviewing the imports of the year, the sugar trade is first considered, the course of this staple being regarded as a sure indication of the general condition of the country. The consumption of sugar was 819,000 tons, as against 743,000 tons in 1879. Of this quantity Louisiana furnished 89,000 tons, the remainder being drawn from foreign sources. If to this consumption be added that of sugars from beet root and maple groves the total is swollen to 900,000 tons. New York continues to be the chief port of receipt and distribution for this large trade, taking 570,000 tons against 506,000 tons the previous year.

The consumption of foreign molasses, owing to the falling off in the yield of the West India sugar crop, decreased from 34,500,000 gallons in 1879 to 33,100,000 gallons in 1880. The crops of Louisiana and Texas yielded 12,000,000 gallons, making the total consumption for the year about 45,000,000 gallons. The trade, like that of sugar, has been profitable. The history of the coffee trade for 1880 will be ever memorable for the lesson it has taught of the danger of attempting to force up the price of a great staple by monopolizing the supplies. Consumption, however, was not seriously disturbed by the speculation, the total amount being 176,000 tons, against 184,000 tons in 1879, a decrease of about 4½ per cent. The share of New York was 123,000 tons. The decrease in the receipts was from Brazil, the West Indies Mexico, and Holland, while the importations from Java and Sumatra show a large increase. The tea trade of the year was especially unprofitable to those directly engaged in the importation of China teas. The unprecedented figures of 3,000,000 pieces were reached in the importation of foreign hides, exclusive of Calcutta hides, or an excess of 900,000 over the figures of 1879. The wine and liquor trade was remarkable for its prosperity and the few disasters reported.

Concerning the exports of this country, the report says that cotton continues to be the most important in value. The crop for the year ending September 1 reached the enormous figure of 5,757,397 bales, an increase of nearly 700,000 bales over that of 1879. Of this quantity, 3,865,621 bales were exported and 1,624,805 were taken by American spinners. New York and Baltimore are the only two seaboard cities which notably increased their exports of this staple. The export of American cotton manufactures has slightly decreased. The entire value of grains exported was $288,000,000, against $308,000,000 the year previous. The fresh beef shipments from New York have increased from 44,000,000 pounds to nearly 61,000,000 pounds in 1880. The entire value of the provision exports from all ports of the United States was $61,000,000, against a value last year of $58,000,000. Of live animals nearly 500,000 were exported, valued at nearly $16,000,000. Of this trade New York had over $7,000,000. The value of the entire export of lard was nearly $28,000,000, an increase of $5,000,000 over the previous year. Noticeable also is the export from New York of oysters to the value of $400,000, out of a total exportation valued at $550,000. Of the entire provision trade, exclusive of animals, of $128,000,000 value exported, New York sent $91,000,000. The shipments of crude and refined petroleum were 8,000,000 barrels, against 10,000,000 barrels in 1879. The production seems to be in excess of the demand about 20,000 barrels per diem. The tide of immigration brought to this country during the year 457,257 persons, of whom 327,371 were landed at this port. Of the latter, 104,000 were from Germany, 66,000 from Ireland, 35,000 from Sweden, and 34,000 from England.

The Shingle Product.

In recent issues the *Northwestern Lumberman* has given elaborate statistics of the shingle product of the Northwest, the amount of which is something stupendous, as will be seen in the following recapitulation of the output of the past eight years, allowing 5,000 shingles to each 1,000 feet of logs:

1873	2,277,433,550
1874	2,473,216,555
1875	2,515,838,240
1876	2,900,530,725
1877	2,668,856,735
1878	2,561,490,750
1879	2,859,112,750
1880	2,972,912,160
Total	21,229,391,485

It is estimated that something between 800,000,000 and 1,000,000,000 feet of logs are yearly made into shingles in this country.

Previous to 1845 the manufacture of shingles in the United States was almost, if not wholly, confined to the article of "rived" or "breasted," terms applied to shingles made by hand with a drawing knife, involving a waste of fully three-quarters of all the timber which it was intended to convert to this use. The shingles were 18 inches long, one-half inch at the butt, and one-eighth inch at the point, and were made only from the finest pine, cedar, or cypress, the latter being wholly manufactured in the swamps of Virginia and other Southern States. About that date steamed cut shingles had been introduced, but never attained a wide spread reputation or market, because of imperfections in the manufacture. Not far from 1845 sawed shingles were introduced, and their claim upon public favor was based upon the fact that coarser timber could be utilized in their manufacture and the cost of the product cheapened. They were not at first received with favor, but have rapidly grown in public estimation until they have almost wholly superseded all others. With the cheapening of the manufacture and in the use of coarser timber, hemlock was utilized for some time in the East, but has in late years been but little used.

The shingle cut of eastern Michigan and Huron shore is almost wholly confined to an 18-inch shingle, the product being shipped to the East and Southeast, where no smaller size is salable. A thousand feet of logs is calculated to yield from 4,000 to 5,000 marketable shingles, besides the coarser grades which have no market value to warrant their shipment. The cut of western Michigan, Wisconsin, and the Mississippi district is wholly of 16 inch, for the demands of the Western market and the less stringent inspection as to quality enable the manufacture of from 7,000 to 8,000 shingles from 1,000 feet of logs.

American Awards, International Fishery Exhibition.

The medals from the International Fishery Exhibition, Berlin, just received, are of gold, silver, and bronze, three inches in diameter and quarter of an inch thick. The gold medals are 20 carets fine, and weigh 7½ ounces. The diplomas accompanying the medals are handsomely lithographed. The list of American awards includes, in addition to the great prize of $2,000, taken by the U. S. Commission of Fish and Fisheries, eight gold medals, sixteen silver medals, and twelve bronze medals; and fourteen other exhibitors received honorable mention.

The Water Power of the Atlantic Coast.

In his annual report, just submitted, Chief Engineer McFadden, of the Philadelphia Water Department, asserts that the available water power of the Schuylkill and of all the streams along the Atlantic coast has been highly over rated. Eminent engineers have estimated the working force of the Schuylkill to be equal to the pumping of a daily average of 100 000,000 gallons. Mr. McFadden undertakes to show that the real power is not half as great, all the water being used all the time.

The amount pumped by the machinery at Fairmount, running 54 per cent of the time, was a daily average of 21,551,630 gallons. "Had there been power enough to drive the machinery 100 per cent, or all the time," he continues, "it could not possibly have pumped more than 40,000,000 gallons per day. With these facts as a basis we may safely state that the machinery at Fairmount would use and exhaust the power of the river if it was subjected to a steady and equable flow by impounding the storm waters. Of course duplicate water-power works at Roxborough, by using the power twice, first at Roxborough and a second time at Fairmount, could be made to double this amount."

The pumpage for last year amounted to 21,120,792,386 gallons, an increase of 6 per cent over that of the previous year.

The Utilization of Blood, Bones, etc.

In our city abattoirs very little of a slaughtered animal is allowed to go to waste. The hoofs are sold for glue stock, and bring about 40 cents a set. Pates, for the same purpose, bring 1 cent to 1½ cents per pound. The tallow is generally rendered at the abattoirs, and brings from 6¼ to 6½ cents per pound. What is called "hot fat," that is, fat taken from the breast and kidneys of the animal while it is yet warm, is sold to oleomargarine manufacturers at 4½ cents per pound. The bladder, wizen, reed, and bung gut are sold for about 8 cents a set, and made into skins for wrapping sausages in. The head brings 30 cents, and the meat is taken off it and canned, while the bones are used as fertilizers. The flesh tail, worth 5 cents, is made into soup, and the hair tail, which is used for making mattresses, or mixed with lime and sand for building purposes, is sold at 4 cents. Horns, which bring 10 cents per pair, are converted into bone buttons, handles for cutlery, etc. The blood is dried by steam, which separates the water from it, and then baked in a drying machine and sold for sugar refining and fertilizing purposes. Of late years it has also been manufactured into buttons by means of a chemical process. A number of consumptives come to the slaughter houses daily, and drink the warm blood from the freshly-killed animal with very beneficial results in many cases. The stomachs are used for tripe, and bring 12½ cents to 15 cents each. The tongue is worth 50 cents to 60 cents, and is usually smoked. The heart and liver together bring 30 cents, and although sometimes used for human food, are generally sold for cats' and dogs' meat.

Artesian Wells in New York.

The number of artesian wells in this city steadily and rapidly increases, something like forty having been sunk during the past year. Their depths range from 200 to 2,000 feet, and the flow ranges from 1,000 to 2,000 barrels a day. These wells are used mainly by brewers and other large manufacturers who require a large amount of water, and who find the artesian well water economical both from its cheapness and its coolness, which enables them to dispense with much ice. Usually the wells are vertical. In one instance seven holes were drilled in different directions and at different angles, only one being vertical. The boring was carried to a depth of about 260 feet on the average, the longest at an angle being 457 feet deep. Water was struck in all the borings, and an abundant supply has been obtained continuously.

Improving American Tea.

Recently on receiving a number of packages of American tea from the experimental tea farm in South Carolina, Commissioner Le Duc invited a number of tea dealers in Baltimore and Washington to test the quality of the crop. They pronounced it very good tea, and said it compared favorably with East Indian teas. Last year's receipts from the same place had a weedy flavor. This year the same defect is only barely perceptible, the result being due to cultivation. By next year it is thought it will have disappeared entirely. It is even now only perceptible to the taste of experts. Letters from Mr. Jackson, the gentleman in charge of the tea farm, comment in very favorable terms upon the healthy appearance of the plants and the prospect for excellent results.

The Value of Good Brakes.

Recently, while the steamer State of New York, from this city to Hartford, Conn., with about two hundred passengers, was passing the drawbridge across the Connecticut River, near Saybrook, a heavy freight train ran upon the bridge at considerable speed. The engineer had been misled, perhaps, by a confusion of lights, and very nearly ran his train into the draw to the destruction of the steamer. The engine when the train stopped was within 30 feet of the draw.

A HEAVY WOMAN.—Mrs. Charles Ballou, known as the Mammoth Queen, died April 8. Her weight had been given as high as 575 pounds. Just before her death it was 400 pounds. The coffin was 6½ feet long, 3 feet wide, and 20 inches deep.

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) W. S. P. writes: I wish to print names on thin leather for the back of books. What is the best process to get it in gilt letters that will not rub off? I never saw anything of the kind done, and find that to simply print the name in type and then bronze them will not hold. A. Thoroughly beat the white of an egg, rub it thin over the place to be lettered, put on the gold leaf, and with type heated sufficiently to coagulate the albumen press upon the leaf. Remove the surplus leaf with a tuft of cotton.

(2) C. & H. ask: Which is the most profitable and best variety of fish to cultivate in an artificial pond of forty acres, and sixteen feet deep in the deepest part? How shall we proceed to stock it? A. Clear the pond of sun fish, eels, cat-fish, pickerel, pike, yellow and white perch—they being enemies to all young fish. For natural food leave the pygmy silver and striped dace and minnows; stock the pond with German carp and fresh water bass.

(3) W. A. F. asks: Will a 30 horse power engine run with the same number of pounds of steam, and do the work of 10 horse power engine with the same number of pounds of steam, as a 10 horse power engine will? A. The difference will be small; there will be a little more loss in the thirty horse power engine from friction, radiation, and condensation.

(4) J. H. G. asks how to transfer ordinary printed pictures to a sheet of glass, and to remove the surplus paper especially as in book illustrations, where the back of the picture is covered with printed matter. What preparation should be applied to the picture as transferred to render it transparent, or nearly so? A. Coat the paper thinly with a clear mucilage of gum-arabic, spread it out evenly on the glass plate, and let it dry. The paper may then be pared down with the greatest facility by means of a glove maker's knife, a piece of thin flexible steel, 3 inches wide by 5 inches in length. At one end a handle is usually affixed, the other end being ground to a very fine edge. It is used somewhat after the manner of a plane, the plate being pressed down nearly level with the paper, and the edge of the blade presented somewhat obliquely to the stroke so as to cut smoothly. To make the paper translucent saturate it with good castor oil and cover the back with a second glass plate.

(5) G. C. asks: What will remove hair from a person's face without pain or injury to the appearance of the skin? A. To remove the hair so that it will not grow again it is necessary to destroy the hair bulbs. We know of no chemical or depilatory that will do this effectively and is not liable to injure the skin or prove painful in its application.

(6) J. A. B. asks at what degree of heat, or what is the lowest degree, at which steam can be made. A. Exposed to the atmosphere at sea level water boils at about 212° Fah. As the pressure diminishes the boiling point becomes lower. In a vacuum pure water can be boiled at 45° Fah. 2. To what temperature may water be heated? A. Under adequate pressure water may be heated hot enough to melt lead. Under a pressure of 50 atmospheres water boils at about 500° Fah. 3. Is there any way of sharpening cast plow points? A. Grinding is the only method.

(7) J. S. B. asks: What is the best explosive agent to use, efficiency and economy combined, in getting rid of pitch pine stumps? The stumps are full of pitch and the top root prevents pulling out. The stumps are in Florida. A. Dynamite and giant powder are most effective in this connection. A pound cartridge when forced into a hole beneath the stump, loosely tamped and exploded, is usually sufficient to remove it completely.

(8) C. D. R. asks how to remove the sulphur odor of rubber goods. A. Caustic potash, ½ oz.; water, 1½ pints; dissolve and heat to boiling. Put the goods into this for a few minutes, rinse thoroughly and dry.

(9) W. W. C. writes: I inclose a sample of mica taken from a mine near here in pieces varying in size 6 to 12 inches and sometimes larger. What is its value and to what extent is it used? A. The mica is of very fair quality. It is used extensively for stove doors, lanterns, etc. See "The Uses of Mica," page 326, and answer to W. L. T., page 330 (8), current volume.

(10) N. J. A. asks: 1. What is the best method of preserving fence posts from decay, and is saturation in crude petroleum of any use)? A. See "The Preservation of Wood," SUPPLEMENT, No. 119. 2. The best paint to preserve fence boards]? A. Mix linseed oil thoroughly with dry sifted ocher, and thin with benzine for use. 3. How can fine shingles be made durable and at the same time less liable to ignite from sparks, if not fireproof? A. Water, 1 gallon; chloride of zinc, ½ lb.; digest in this the wood for forty-eight hours, drain, and put into a solution of crude tungstate of soda 1 lb., water 1 gallon (hot), for three hours; then dry. 4. The most desirable metallic roof (aside from copper) as regards cheapness and durability? A. Tin plate, with a good coat of asphaltum or similar varnish.

(11) W. P. H. writes: I have some copper coins which have been cleaned and finished with sweet oil for about two years; they now show signs of corrosion, and to save them I must remove the oil and verdigris. I am told that cyanide of potassium properly applied removes it readily, but that it has to be used very carefully. Will it poison the air we breathe in using it, or must our flesh or skin not come in contact with it? How can it be rinsed off or the coins cleansed after application? Will it do what I want? A. Dip the coins into a hot solution of ½ oz. caustic potash in 3 oz. water, to remove the oil; rinse in plenty of clean water, and rub them gently with fine tripoli moistened with solution of ½ oz. potassium cyanide in 5 oz. cold water. If the hands are free from open cuts or sores (through which the poison may enter the system), and are not allowed to remain long in contact with the liquid, there is little danger of poisoning. It is not safe to keep such a liquid about the house, however, as a few drops taken internally by mistake or carelessness of handling might prove fatal. Rinse the bright coins in water and dip for a few moments in boiling water; on removal from which they will dry spontaneously.

(12) J. D. C. writes: In reference to the new system of chemical nomenclature (yet new and disagreeable to many), I beg information on some points which seem to overthrow the propriety of the new style, at least as regards the use of the termination, "ic." When we say "ferric sulphide," "mercuric cyanide," "argentic oxide," etc., will those terms bear analysis, will they bear application of the searching process peculiar to the magnificent system on which it is sought to engraft them, resolution into constituent principles or elements? For instance, what is the meaning of "ferric sulphide?" The new school will reply "A combination of iron and sulphur." But what is the guarantee that these two principles are *all* that are in combination. The very term "sulphide" implies and completely expresses, *a comp und*; and when we hear one say, "It is a sulphide," we immediately inquire, "sulphide" of what? "oxide" of what? The "ic" does not do more than add a *third* principle to the already existing "oxide," "sulphide," etc., and at best, simply indicates a *trace* of the *third* principle. "Ferric alumina," is quite appropriate; because it expresses "oxide of aluminum with a trace of iron;" but "ferric sulphide" is unfinished, unsatisfactory, because it may be a sulphide of well defined character, with trace of iron. It will not do to say that "ferric sulphide" means "sulphide of iron;" for that would be foolishly tautological, if stated in full. If we say the "Germanic Confederation," we are not to be understood as meaning that the principle or element composing the "Confederation" are wholly German in character, custom, inclination, etc.; in other words, German, and Germanic, convey different characteristic ideas. A nation may be Germanic without being German. A "ferric sulphide" may be a "ferric sulphide of barium," or some such combination, unless my comprehension be wholly at fault. I have never seen nor heard any argument pro or con on this subject, and ask the favor of your views. A. Your comprehension is wholly at fault. Molecules contain at least two atoms, one of which is positive to the other, which is negative. In the case of binary molecules the rule is: Place the name of the positive first, then that of the negative, changing the termination of this into *ide*. If the positive atom varies in equivalence this fact is indicated by giving it for the higher of two stages the termination *ic*, and for the lower the termination *ous*. Thus ferric sulphide means bisulphide of iron (FeS_2), while ferrous sulphide means the sulphide, or monosulphide of iron (FeS)—definite compounds. Should a third stage be developed below the *ous*-compound the prefix *hypo* is given, as hyposulphurous oxide; or if above the *ic*-body the prefix *per*. Ternary molecules are similarly named, except the negative terminations are *ate* and *ite*, instead of *ide*. Potassium and chlorine united directly form potassium chloride, a binary, but if united by oxygen they form potassium chlorate. Consult Cooke's "The New Chemistry."

(13) F. G. asks for preparation that will stop rubber hose from leaking. A. The rubber companies sell a cement suitable for this pupose. It is prepared by dissolving gum caoutchouc in naphtha. See article on cements, page 2510, SUPPLEMENT, No. 158.

(14) A. C. B. asks: Is there any preparation with which I can bleach pressed botanical specimens (flowers) which have become brown in drying? I have a specimen of "magnolia grandiflora," which is brown, and I wish to bleach it, then color it white and pink again. A. Try exposing it to the vapor of burning sulphur, under a tight box. It should be moistened before exposing it.

(15) L. A. T. asks: Can you recommend any good work on volumetric analysis? I desire an easy test of that character to determine the amount of calcium sulphate in water. I can use barium chloride to precipitate the sulphate, but on account of its slow deposition, it is very difficult to determine when exactly enough has been added. Can I add anything to the water which by change of color or otherwise will show when enough barium chloride has been used? A. You will find Thorp's "Quantitative Chemical Analysis" a handy book. We know of no good volumetric method of determining calcium sulphate. Evaporate the water to dryness in a capsule over the water bath, redissolve the residue with a little pure hydrochloric acid, add to this solution a slight excess of a filtered aqueous solution of barium chloride, gently warm the mixture, let it stand half an hour, then wash into a weighed filter. Wash the precipitate on the filter, dry it at 212 until it ceases to lose weight, weigh and deduct the weight of the filter, or, what is better, having determined the weight of the ash of such a filter, ignite the filter with the dried precipitate in a platinum crucible, weigh, and deduct weight of ash and crucible.

(16) E. M. E. asks how to preserve natural flowers so that they will look natural, either single or in bouquets. I have seen them—it is something new. A. Dissolve by agitation and digestion in a closely stoppered bottle, ¾ oz. clear, pale, gum copal, coarsely powdered and mixed with equal weight of broken glass, in 1 pint of pure sulphuric ether (ethylic ether). Dip the flowers in this liquid, remove quickly, expose to the air ten minutes, then dip again, and expose as before. Repeat this dipping and drying four or five times. Most flowers thus treated will remain unaltered for some time if not handled.

(17) D. D. asks: 1. What would be a good recipe for red ink to use with a rubber faced stamp? A. Pour over two ounces of fine aniline red or violet about half a pint of boiling water, stir and shake together, then let stand to cool and settle, and pour off the liquid portion. A sufficient quantity of this stirred up with pure concentrated glycerine makes a good stamp ink. 2. Give also a formula for black ink for the same use. A. Use good soluble nigrosine as directed above, or triturate the powdered dye with the boiling water in a large mortar with the water until a smooth paste is obtained. 3. Would gum arabic in the ink be likely to injure such a stamp? A. Gum should not be used in this connection.

(18) U. D. M. asks how is the silica prepared, how is it mixed, and with what to give it the consistency and quality of paint? What mixtures give it the different shades, what is the manner of applying it, and for what is it adapted? A. The name is usually applied to paints wherein a sirupy aqueous solution of waterglass or silicate of soda is employed as the vehicle. Waterglass is prepared by fusing together in a crucible at a bright red heat pure white silicious sand or powdered quartz and carbonate of soda (three of quartz or sand to about five of anhydrous carbonate of soda). It dissolves in boiling water to form a sirupy liquid. Almost any of the ordinary mineral pigments—zinc oxide, white lead, barytes, ochers, chalk, etc.—may be mixed with it to form a paint. It may be used advantageously on common inside woodwork and walls which it is desired to render fireproof. Such paints when they become dry are quite hard, but not waterproof.

(19) G. A. W. asks: How much higher is one of our oceans than the other? A. The latest surveys discover no difference of mean level of the two oceans. The tides on the Gulf side are very much higher than on the Pacific side.

(20) C. L. P. writes: 1. In SUPPLEMENT, No. 83, your correspondent, "D," in giving instructions for making rubber stamps, says: "Vulcanized rubber is used." Can you inform me where it can be purchased—of what company? A. The rubber referred to is gum rubber mixed intimately with about 6 per cent of sulphur and rolled out into sheets. It may be obtained from almost any large rubber manufacturing establishment. See our advertising columns. 2. He also says: "Both together (mould and rubber) are placed in a screw press, and heat sufficient to thoroughly soften the rubber is applied." Can you say how this heat is applied? A. By placing the mould and rubber in an oven or steam chamber heated to the proper temperature, about 330° Fah.

(21) H. W. asks: 1. What will prevent new made flannel underwear from shrinking? A. Good flannel will not shrink much if properly washed. Very little soap should be used, the water should be barely hot, and all the waters used should have about the same temperature. The goods should be wrung as dry as possible and well shaken out before hanging up to dry. We know of nothing that can be put into the goods to prevent shrinking. 2. How can cotton or linen cloth or cord or twine be treated to make it rotproof or proof against rot? A. The deterioration of the fibers may be in a measure retarded by saturating them with a hot aqueous solution of soap, and after wringing out digesting them in a strong solution of alum, then rinsing out and drying. In regard to your other queries you had better consult some reputable physician.

(22) P. W. M. asks how to prepare self-raising flour. A. Reduce separately, by grinding, to impalpable powders, 1 lb. bicarbonate of soda, 2½ lb. cream of tartar, 1¼ lb. salt. These should be intimately mixed together and then with 100 lb. fine flour. All of the substances employed should be thoroughly dry.

(23) J. W. asks: Is there any preparation or cement, or any way that thin sheet lead can be fastened to cast iron, so that it will adhere firmly and resist the action of the weather, that is, will not be loosened by ordinary use and exposure? A. The new sulphur sulphide composition, called Spence metal, is said to answer very well for this purpose. In a capacious iron vessel with a loose cover melt by heat, 2 lb. sulphur. Heat to bright redness in a sand crucible 3 lb. of coarsely powdered sulphide of iron (FeS_2). Remove the crucible and melted sulphur out of doors, quickly, but cautiously, transfer the contents of the former to the latter, cover, and smother the flames by covering the pot with moist earth or sand. When cold remelt the contents of the pot at a gentle heat, and having packed the base of the joint, lead outside, with oakum, pour in the melted composition.

(24) E. A. R. asks for a formula for making the liquid for a barometer or storm glass. A. Dissolve 1 oz. each of potassium nitrate and ammonium chloride in 5 oz. of hot water and let it cool, dissolve in 3 oz. of spirit of wine, ½ oz. of good camphor. Filter the solutions, and gradually pour the solution of salts into the camphor solution with constant stirring until a slight permanent precipitate is produced. Pour this liquid into the tube and draw out the latter so that only a pin hole remains open.

(25) E. J. C. asks: What can be used in paste for wall paper to hinder its destruction by the silver moth? A. A small quantity of corrosive sublimate or zinc chloride—70 or 80 grains (dissolved in a little water) to the bucketful is usually employed and proves effectual.

(26) S. R. B. writes: I am a painter for a large iron foundry, and have much trouble to get a filler (that will harden quick) for rough castings. Some of our large castings are quite rough, and look bad when painted. Can you tell me of anything that will answer this purpose? A. The following would probably answer your purpose: Put 28 lb. each of common pitch and coal tar asphaltum into an iron pot and heat to boiling over a fire. Continue the boiling eight hours, or until all volatile matters and moisture are driven off. Let it stand all night, and next morning heat to boiling again and add 8 gallons of boiled oil, then gradually 10 lb red lead and 10 lb. litharge, and continue the boiling three hours longer or until a small sample of it when cooked on a glass plate will roll up very hard between the fingers. Then remove the pot out of doors (away from fire), let it cool down somewhat, and add 20 gallons of turpentine. This black will dry in less than half an hour if it has been properly boiled.

(27) J. R. asks: How can I render paper pulp or papier mache non-porous, impervious to water, and to the action of potash? Can I treat ordinary pressed paper to accomplish the above results? I want to turn out a sheet of paper with a glazed, marblized surface, about the thickness of an ordinary business card, rolled from the pulp, or of pressed sheets, that will be unharmed by weak potash in solution, somewhat stiff and tenacious, but not brittle. Can I do it? A. If not too expensive you might use a solution of gutta percha in purified benzole as a sizing. We can think of nothing cheaper that will fully answer your requirements.

(28) R. J. B. asks for a good mixture for covering steam boilers and steam pipes. I happen to have some finely ground soapstone, with a little plumbago and mica in it. Is there anything with which it could be mixed so as to use it for the above purpose? A. Mix the powdered stone into a paste with an equal weight of plaster of Paris and the proper quantity of water, and cast in flat bricks or semi-cylindrical well oiled moulds, to fit the pipes, etc.

(29) J. A. S. asks: What chemicals are used in the Babcock fire extinguisher, and what are the directions for using the extinguisher? A. Bicarbonate of soda, water, and sulphuric acid. The soda is dissolved in water, the acid being contained in a leaden cup or bottle so arranged at the top that, when the handle at the top is pulled up the acid vessel is inverted and the contents thrown into the solution of bicarbonate of soda, 1 part of strong acid will completely decompose nearly 3¼ lb. of bicarbonate of soda, resulting in the formation of sulphate of soda and carbonic acid (gas).

(30) J. C. K. writes: I am making brands out of pure copper, and very often have trouble in casting, as it does not run well and leave holes in the edges of the letters of the brands. Can you tell me how to prevent this? Can I mix anything with the copper, that it will make as good a brand as pure copper? If so, please name it. A. The addition of a small quantity of zinc and about one-tenth of one per cent of phosphorus will sharpen the casting and in a great measure prevent the formation of blow holes.

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

M. G. M.—The rock is hornblendic. It contains much sulphide of iron, some copper and zinc, but no appreciable quantity of free gold. The sulphurets may be richly auriferous, but an assay would be required to settle this point.—H. L. E.—Quartz rock containing crystallized sulphide of iron—pyrites—no value.—J. L. R.—The fine brassy piece is chiefly iron sulphide—pyrites; the other is manganiferous iron oxide and augite.—J. E. C.—It is a good ferruginous clay—almost too "fat" for brick-making alone, but good for pottery of some varieties.

COMMUNICATIONS RECEIVED.

Is Steam Explosive? By S. G.
On Tornadoes. By B. W. D.
On Gravitation and Motion. By W. R. B.

[OFFICIAL.]

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FOR WHICH

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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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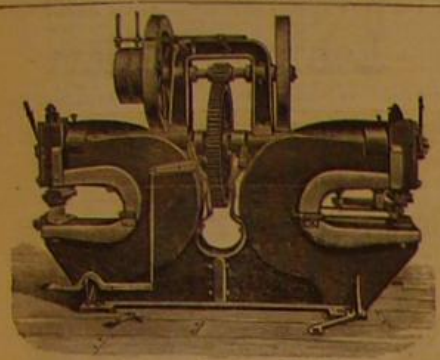

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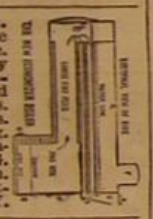

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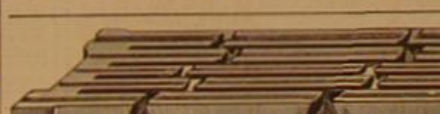

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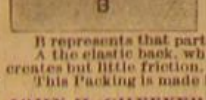

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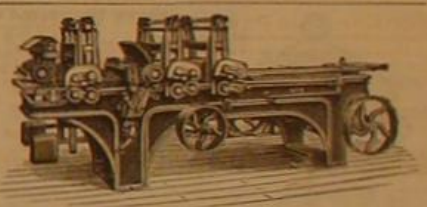

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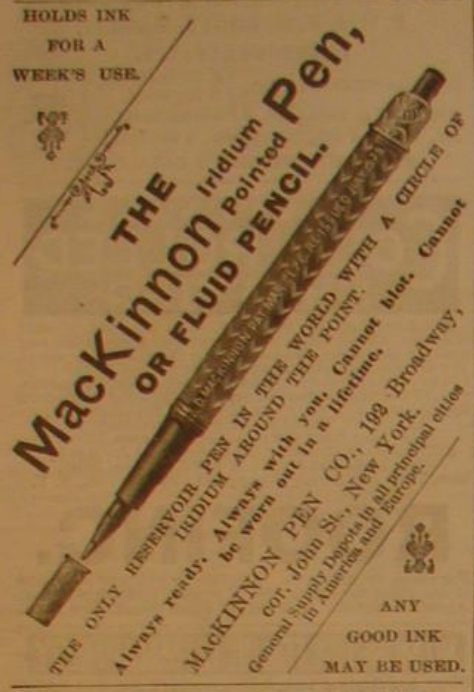

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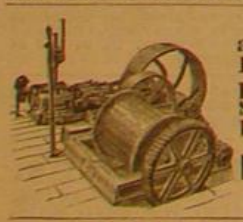

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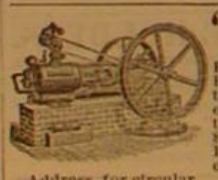

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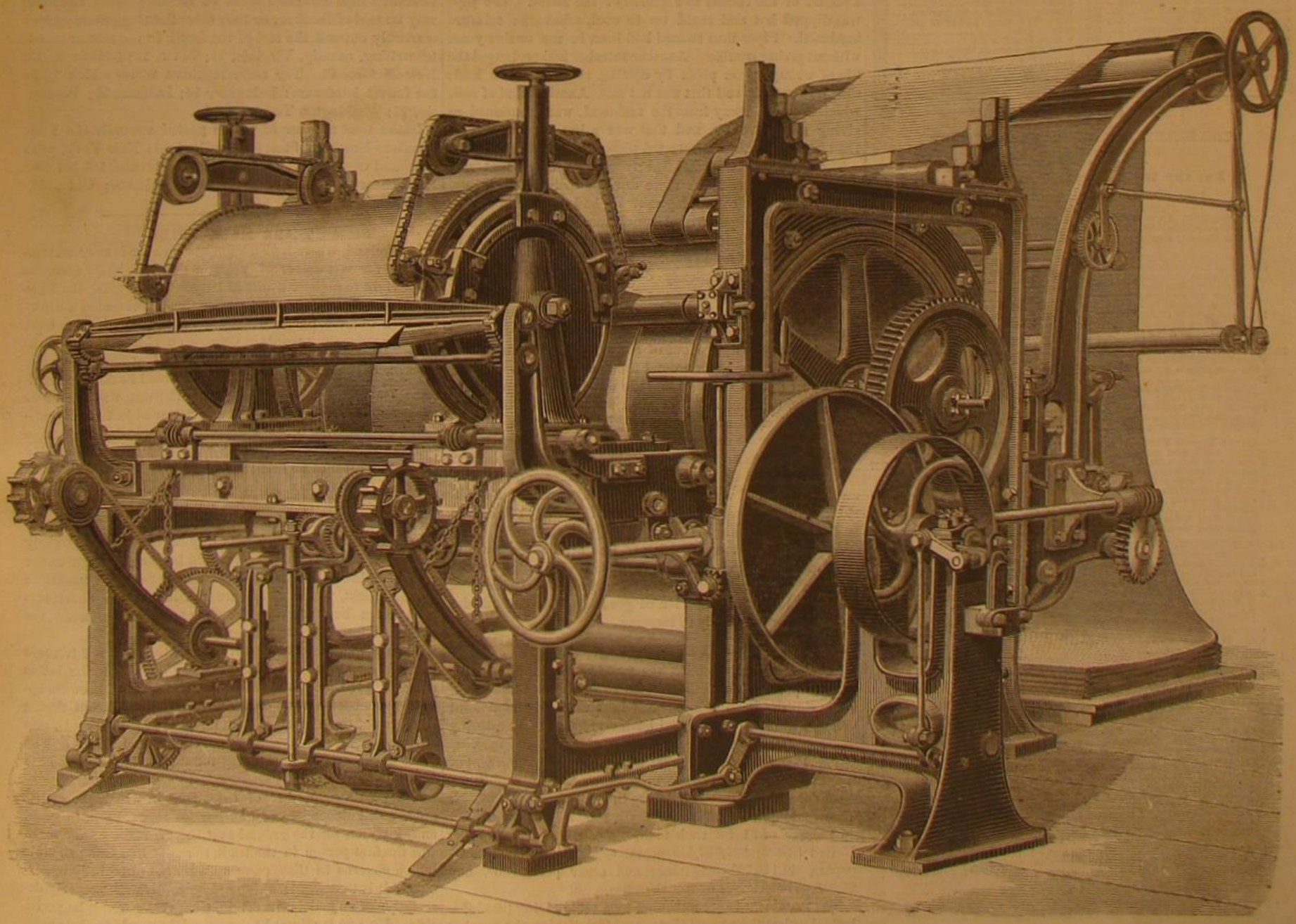
MACHINES FOR FINISHING FABRICS.

In the finishing of woven fabrics there are embraced a number of operations, according as the articles to be treated are of wool, cotton, silk, or a mixture of these, one forming the warp and the other the woof. The nature of the finish also varies, being hard or pliable, lustrous or dull, as the case may be. In addition, some tissues are treated with such materials as starch, dextrine, glycerine, gum arabic, gum tragacanth, etc. Two perfectly distinct operations are quite commonly confounded under the term "finish." The first of these consists in loading the threads with one of the materials above mentioned, and the second is a purely mechanical treatment. Cotton goods and some mixed fabrics of wool and cotton undergo both operations, being first charged with the finishing materials and afterward submitted to mechanical treatment to dry them. Silks of medium quality and articles mixed with cotton receive a small quantity of size, and are afterward passed through the machine. Fabrics of combed and carded wool receive a mechanical finish only. In finishing cotton fabrics the glazing material is applied, and they are then calendered on cylinders heated by steam, which gives them stiffness. But usually mechanical finishing is not resorted to, although it would be a great help. For fine cotton fabrics, however, and for carded and mixed woolen articles, it is indispensable to employ machines, so that the threads of the warp, and especially those of the woof, may be stretched, and thus given the rigidity necessary to make the fabric as stiff as it was in its raw state. The machines used for this purpose are costly, take up much room, and necessitate the employment of experienced workmen. This kind of machine applied to the treatment of fabrics, woolen and mixed, does not give a complete result, and necessitates a complementary operation. The two machines constructed by Messrs. Pierron & Debaitre, of Paris, France, one of which is shown below, are a great improvement in this respect, and have been very favorably received by manufacturers of woven fabrics. The first of these consists of a large copper cylinder, four to five feet in diameter by four and a half to five and one-quarter feet long, heated by steam.

An endless felt cloth covers nearly the whole surface of the cylinder, with the exception of the places necessary for the fabric to enter and leave the machine. The tension and separation of the felt is effected by rollers. In this machine, as shown in the engraving, the piece of goods is wound on the roller in front. Pressure brakes allow the tension of the fabric to be varied. The fabric, which may be passed over a vaporizer before entering the machine, is kept at its proper width by the tension and pressure of the felt. The steam which forms in the fabric is imprisoned therein, and has the effect of isolating the filaments from each other and of swelling out the threads, thus giving the finished goods greater thickness and greater closeness of texture. The wrong side of the fabric is placed in contact with the cylinder and the right side is turned toward the felt, the result being that the wrong side is made smooth, while the grain or nap of the fabric is brought out on the right side.

By this system such operations may be performed mechanically as are ordinarily confided to special workmen of long experience. When the operator feeds the fabric to the felt machine it often happens that he is not sufficiently careful about the selvages, and when the goods are rolled up the ends are irregular; or, if the fabrics are striped or printed, the lines or designs are wavy, and the goods consequently do not strike the eye of the buyer favorably. There are also in woolen fabrics fulled pieces which have narrower parts, that must be brought to a uniform width, an operation that, by hand, presents some difficulty. In order to overcome these difficulties mechanically, and to obtain results superior to those gained by this machine, the manufacturers have added a widening apparatus, which is represented in the annexed engraving. In this the different parts of the mechanism have been strengthened, and the apparatus is provided with a progressive movement (which allows its speed to be varied), and with various arrangements for rolling or folding the goods. This widening apparatus is composed of two disks, covered with caoutchouc, and of endless chains, designed for holding the fabric in place by pressure. These disks can be fixed obliquely to produce the widening, their distance apart being regulated according to the width of fabric desired. On entering the apparatus the fabric passes between the chains and conducting disks; in turning with the oblique disks it widens, and, on reaching the other end, it enters the finishing machine, between the cylinder and the felt, where it is dried. Goods finished with this new apparatus have very even and regular edges, and the threads of the woof being well stretched and pressed, the stripes or other patterns preserve their original arrangement. In the felt machine, as we have already seen, independent of the widening, a better finish is given the goods than by other methods; and the fabric, on coming from the machine, may be folded, and is then ready for the shop. The effect of the treatment on cotton fabrics is to make them soft to the touch, almost like wool.

The finishing machines made by Messrs. Pierron & Dehaitre work with great regularity; and, as a consequence of the advantages that they possess over other systems in use, they are being rapidly adopted by manufacturers in Europe.



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THE PRESERVATION OF GAS SERVICE-PIPES.

The inconclusive discussion of the means employed for preserving gas service-pipes, by the Associated Gas Engineers of New England lately, seems to point to a field of investigation which some thoughtful inventor may find profit in cultivating.

Secretary Neal, who introduced the subject, laid especial stress upon the destructive influence of the salt in the soil of seaboard places. In Charlestown, Mass., the wrought iron (ungalvanized) service-pipes were sometimes found to be so corroded that the least touch would destroy them; they were as thin as paper. He had no doubt that a great many of their service-pipes were badly corroded, but so long as they were not meddled with they continued to hold gas. A process to make them more durable was greatly needed, and he raised the question whether that end might not be attained by dipping the pipes in some substance like tar or asphalt, or by using a different material than iron for pipes. The cost of all their service-pipes had been written off, as they were considered more perishable than meters. The mains had been charged to construction account until lately, but the service-pipes were considered to be of a more perishable nature, and required to be renewed quite often. He was aware that in some places lead had been used for service-pipes, instead of wrought iron, and it had been suggested that cast iron might be employed; but there were objections to the use of cast iron for services, especially for small ones.

A member of the association said that he had been able materially to increase the life of service-pipes in soft, muddy ground by dipping them in coal-tar. To do this the services were heated not quite to a red heat; the whole length of the service being placed in a trough filled with thick tar. They were dipped right under, and allowed to remain long enough for the tar to fully cover them; then they were taken out, and the heat of the pipes would set the tar so that it was like pitch upon them. In an hour or so it would harden so that the pipes could be handled.

By another member mention was made of the fact that the Cambridge Company had been forced to abandon the use of plain pipes owing to the rapidity of their rusting in the salty soil of that place. Galvanized iron pipes resisted corrosion much better. The galvanized pipes cost fifty per cent. more than common pipes. An equally good result, it was thought, might be secured by using pipes lined and coated with cement, such as are sometimes used for water service. They would be cheaper, though open to the objection that the capacity of the pipe would be materially diminished by the cement lining. Good results had also been obtained by coating pipes inside and out with a mixture of rosin and tar, in about the proportion of a quarter of a pound of the former to a gallon of the latter. The pipe was dipped hot and stood up to cool, when the mixture hardened. Pipes thus treated had been in use twelve years without giving trouble. Another member had prolonged the life of wrought iron pipes by coating them with red lead; this, however, in soil that was not salt. Another kind of soil, which is found away from the seaboard, was mentioned as giving much trouble, and that was ashes used as filling. Laid in such earth, unprotected pipes rust out rapidly.

The President was satisfied from experience that galvanized pipes were much more durable than naked pipes, especially in soils containing salt. He had also learned from experience that pipes rusted much more rapidly in gravel than in clay. Indeed, when laid in clay impervious to water, pipes were found entirely free from rust, while pipes in gravel were completely destroyed. Corroded pipes answered for the gas so long as they were not disturbed; but when the water men came along and disturbed the ground the gas company had to renew hundreds of service-pipes. He might say that five out of six were set leaking by the disturbance of the earth around them, and by the shoveling of the dirt upon them. While the water men did not go to the gutter, they disturbed the pipes sufficiently to start them leaking underneath the pavement. In putting in renewal pipes they always used galvanized iron; and his experience with them indicated that they would last very much longer.

At the close of the discussion, the Secretary expressed his regret that he had not obtained more information that would aid him in obviating corrosive action of the salty soil he had to deal with. Lead pipes were too expensive.

As observed at the beginning of this article, there would seem to be a good opportunity here for investigation and invention. The interest involved is already a large one, and with the increasing adoption of gas as fuel the demand for protected pipes is likely to increase.

WHERE THE LETTERS ARE WRITTEN.

Last fall an official count was made of the letters mailed at each post office in the United States during one week. From this count an estimate has been made of the amount and distribution of the postal business of the country during fifty-two weeks, or the entire year ending Dec. 31, 1880.

The Post Office Department has just issued a statement of the results of this inquiry, which shows that the number of pieces of all classes mailed during the year was 2,720,234,252. The whole number of letters mailed was 1,053,252,876, or an average of 21 for each man, woman, and child in the United States; 324,556,440 postal cards, 812,032,000 newspapers, 40,148,792 magazines and other periodicals, and 21,515,832 packages of merchandise.

The statement is accompanied by a table giving (in alphabetical order) the several States and Territories, the number of letters mailed in each, and the average number to each inhabitant. The two extremes are, naturally, Alaska, with its unlettered population, and the District of Columbia, which, as the center of the postal system and the seat of National Government, must necessarily have more than the normal or domestic and business correspondence. In Alaska only one inhabitant in five is credited with one letter a year. In the District of Columbia there are 85 letters mailed for each inhabitant.

At first thought almost any one would mention as the probable regions of most frequent domestic and business letter-writing the States containing the great business centers, the regions of abundant schools and general literary culture, but he would be wide of the mark. The most letters are written where there is proportionally the largest intelligent adult population who are away from home, namely, the newer States and Territories. Colorado heads the list of letter-writing communities, with fifty-five and a fraction to each inhabitant.

The settlers in Arizona write 32 letters each a year; Dakota (omitting the decimal and giving the nearest integer), 30; Montana, 40; Nevada, 32; California, 26; Idaho, 25; Wyoming, 42.

The States which supply most of the letter-writers of the Territories in addition to being the great seats of manufactures, commerce, and general intelligence, come next: New York, with 42 letters to each inhabitant; Massachusetts, with 39; Connecticut, with 38. In the next group we may put the States and Territories which are near the average in letter-writing activity. They are mostly thrifty agricultural and manufacturing States, with an abundant and settled population. They are Illinois, 22; Maine, 20; Michigan, 20; Minnesota, 21; Nebraska, 23; New Hampshire, 22; Oregon, 21; Pennsylvania, 25; Rhode Island, 26; Vermont, 21; Ohio, 19; New Jersey, 18; Missouri, 18; Maryland, 18; Kansas, 18; Iowa, 18; Utah, 19. [The surprisingly low figures of Ohio may be due to the heavy draught upon its writing population to fill Government positions elsewhere.]

It will be noticed that no distinctively Southern State has yet been mentioned; the people of the South are not letter-writers generally, nor are they as much given to migration as the people of the North. They are more apt to spend their lives within hailing distance of their relatives and friends; and besides, those States carry a heavy population of blacks who are illiterate. The result is the contributions of the Southern States to the mail pouches are strikingly meager. The annual average for each inhabitant of Alabama is 7; Arkansas, 8; Florida, 11; Georgia, 9; Kentucky, 9; Mississippi, 6; North Carolina, 6; South Carolina, 7; Tennessee, 7; West Virginia, 8.

The higher rate of Florida is due, no doubt, to the new element which has gone there of recent years. The same may be said of the three or four other Southern States which markedly outrank the rest of the South in the matter of letter-writing, namely, Virginia, 11; Texas, 12; Louisiana, 15; New Mexico, 13. The more northern States which write the fewest letters are: Delaware, 16; Indiana, 13; Wisconsin, 17; Washington Territory, 15.

In the total number of letters posted annually the more populous Northern States naturally lead: New York, with (in round numbers) 211,435,000; Pennsylvania, 105,237,000; Massachusetts, 69,000,000; Illinois, 68,643,000; Ohio, 61,464,000.

TRADE MARK NOTES.

In England, where registration has been made very systematically for a number of years, a question lately arose as to the right to register words of languages not using the English alphabet. In one case the applicant presented a drawing of a Chinese phenix standing on the bough of a tree, having explanatory words in Chinese characters underneath. In another case, a merchant had noticed that his own name, "Tod," bore the same sound with a word in Arabic signifying "a high mountain;" the Arabic word was therefore presented to be registered. The registrar objected to registering such marks, because he did not think the distinction between different words in a foreign character sufficiently clear, and because he said that he could not be expected to know all the foreign alphabets, and be able to decide intelligently upon interferences. But the English courts said that the marks must be registered; the officer must meet these practical difficulties in the best way he could. Apparently the reason for such a decision would be even stronger under our recent law relative to trade marks in foreign commerce; for, no doubt, words which are not in English characters must often be used upon goods exchanged between the United States and some foreign countries.

Many readers have no doubt noticed the solid red triangle which is employed as a distinguishing device on the labels upon the bottles of Bass's ale. A rival firm of brewers applied to register a triangle which was not solid, but drawn be means of three broad stripes meeting at three points, and having a figure of a church edifice printed within. The court said that this device was too much like that of Bass & Company.

Every year a number of cases arise in which the courts are asked, independent of any law for registration, to grant an injunction on the ground that the claimant of the mark was the first person in the trade to adopt it. One principle which governs in these cases appears not to be fully understood; it is that words which are naturally and properly descriptive of an article, its origin, uses, etc., can not be exclusive. No one is allowed to appropriate words in their ordinary and proper meaning; such uses of them are free to all

the world. One who wishes to invent an exclusive mark needs to be careful that any words which enter into it are employed in an entirely arbitrary and fanciful sense. In one case reported during the winter, the mark was the phrase "Rye and Rock," applied to a composition of whisky and candy. A very entertaining argument, which, for its humor and literary brilliancy, attracted a good deal of attention among lawyers, was made to show that this was an arbitrary phrase; but the court considered that it was somewhat descriptive of the components used—rye whisky and rock candy; and that whoever used those elements in a similar beverage, had the right to use the same descriptive phrase. Similar was the decision where a clothing merchant called his store the "Tower Palace." The court said that the phrase was in its nature descriptive of the peculiar architecture of the building; it might be exaggerated, but it was of descriptive tendency, and therefore that when the clothier moved away from the building to another stand, he could not object to his successor's continuing to use the name. So the letters "I X L" have been pronounced no trade mark, for the reason that their sound gives them a meaning, and they have been widely used upon various goods. But a cigar dealer who styled his cigars the "Pride Cigars," was sustained in his exclusive claim, because "pride" has no natural proper meaning in such connection. There have been one or two decisions that an arbitrary number—such as "523"—distinctively or fancifully printed, may be protected. There are two English decisions giving considerable support to the idea that a peculiarly woven, party-colored border or selvage of calicoes, woolen cloth, etc., may be a trade mark. The names "Family Salve," and "National System of Penmanship," have received protection to a certain extent.

Within a few years past there have been two or three attempts on the part of manufacturers whose patents had expired, to sustain or continue to control the article, by asserting the exclusive right to the name as a trade mark, but such attempts have not been successful in the courts. Another decision of this class has just been made relative to the Singer sewing machine. As every one knows, the Singer Manufacturing Company had, for a term of years, the monopoly of making the Singer machines, by virtue of the patents; but, when the patent expired, rivals entered upon the business, and, naturally, advertised theirs as Singer machines. One of them was sued by the old company, which claimed that it had the exclusive right to the name Singer as a trade mark. But the court decided that the word "Singer," as applied to sewing machines, is in the nature of a description of their kind and character; hence, whoever has the right to manufacture machines of that kind has the right to advertise and sell them under the designation common in the market. After the patents expired, any person who chose might lawfully make these machines, and, as a consequence, the descriptive name became common property.

A person need not conduct the manufacture himself in order to enjoy an exclusive trade mark on the goods. Such at least is a decision by the New York Court of Appeals. A chemist, who had devised a serviceable composition, sent the recipe to Paris, where the article was manufactured, and he imported it in quantities from time to time, and arranged for its sale by various druggists throughout the country. He had an interest in these sales. As soon as it became popular others commenced making and selling it, and they used his peculiar name for it. He sued; and the infringers contended that, as he was not the manufacturer nor the seller, he could not complain. But the court decided in his favor, saying that the advantage of a trade mark does not necessarily consist in indicating the manufacturer. It may be useful as identifying the quality of the article; and when this is the case, it may be of value to any person interested in putting the commodity upon the market, and he may be the rightful owner of it.

DEAFNESS AS A CAUSE OF RAILWAY RISKS.

Dr. Lawrence Turnbull, of Philadelphia, lately read a paper before the Pennsylvania Medical Society, calling attention to the hazards to life and property due to deafness on the part of railroad men. Locomotive engineers, firemen, and conductors, he said, are liable to affections of the ear, with decrease of hearing, such deafness appearing to be, in his estimation, more dangerous than color blindness as regards the signal code, because the latter is usually a congenital defect which can be defined precisely before the individuals are placed on active duty, while the deafness is an acquired disease, but slow in its approach and sometimes unknown to the person affected; and a cold or injury diminishes the hearing more and more, or destroys it completely, if it is not properly and promptly treated.

After citing cases which had come under his personal notice, and referring to the reports of Professor S. Moos, of Heidelberg, with respect to cases of railway accidents through deafness, Dr. Turnbull dwelt at length upon the evidence collected by Ludwig Hirt.

In order to gain an unprejudiced opinion, Hirt traveled repeatedly on the locomotive. His longest uninterrupted journey covered 325 English miles. He notes the following causes which act on engineers and firemen when traveling: First, the violent concussion; second, the uninterrupted straining of the eye and ear; third, the cutting air (less noticeable on the engines provided with a protecting roof); fourth, the continuous erect position; fifth, the frequent change of temperature. The occasional troublesome or noxious influences are dust and irrespirable and poisonous gases. Hirt observed on himself and young firemen an increased frequency of pulse and respiration, pain in the knees and the calves of the legs, exhaustion, weariness, and excessive thirst and nausea, which, however, soon disappear. Whenever he traveled thirty-five to fifty miles without a stop, vertigo was perceived, associated with violent roaring in the ears, and he felt the urgent need of something to cling to. In addition to these symptoms, we have in the case of engineers and firemen the mental exertion of the most careful watchfulness and uninterrupted exertion of the higher organs of sense. Regarding the results of long years of traveling on the engine, Hirt says that, taking all in all, an engineer who averages seventy-five miles daily, or, in round numbers, 25,000 miles a year, may be as sound and robust after twenty years' service as he was in the beginning, providing he was then healthy and that he has met with no accidents. If we examine, says Hirt, a large number of engineers who have been long in the service we find that a majority of them are robust, sunburnt men, with well developed faculties, good digestion, and in an excellent state of health. The minority, however, in whom we see the disastrous results of their calling, must not be forgotten.

Dr. Turnbull recommended that all candidates for railway service should be examined by a competent physician, who should test them with special reference to their hearing. He also advised that the company's physician should report to the superintendent of the road every case of deafness discovered in trainmen, provision being made for the transference of men of impaired hearing to other positions where perfect hearing is less vitally important.

DANGERS OF DENTISTRY.

Usually dental surgeons take great care to keep their implements clean. Sometimes, however, the patient is disgusted with the sight of more or less ancient blood stains on forceps and other implements which are to go in his mouth.

A correspondent in Maine submits a local newspaper report of an accident to a Bangor dentist which suggests the query whether there may not be danger of blood poisoning to the hazard of the patient's life when the surgeon is not careful with respect to the cleanliness of his implements. In the case reported the accidental pricking of a finger with a sharp instrument used by the dentist while filling a tooth, resulted in a serious case of pyæmia. In this instance the dentist was the sufferer. Suppose the poisoned tool had pricked the gum of the patient? Whether the poison came from the diseased tooth then being operated on, or was due to some previous operation, does not appear, and would not much matter to a patient who should be poisoned in that way. In either case the injury might be fatal. From a moral point of view, however, it would make a great difference whether the patient furnished the poison or the dentist. It goes without saying that untidiness in the dentist's chair is dangerous as well as disgusting, and should not be tolerated.

A MUSHROOM FARM IN MAMMOTH CAVE.

BY H. C. HOVEY.

A novel proposal has lately been laid before the trustees of Mammoth Cave, Kentucky, and is now held under consideration by them with some prospect of a favorable answer. An enterprising Frenchman, who has already had experience in mushroom culture in the vicinity of New York city, complains that he finds no cellars sufficiently large for his increasing business, and also that the conditions of temperature and moisture are not uniform enough to insure the best results; and therefore seriously offers to rent a portion of the cave for the purpose of raising such varieties of edible fungi as may be found best suited to the locality.

This will not in the least interfere with the exhibition of the wonders of the great cavern to visitors. Many square miles of it are never seen by tourists at all, for the reason that their time is usually limited, and they have enough to do to follow the guides through the selected routes. The portion mentioned as possibly to be devoted to mushroom beds is what is known as "Audubon's Avenue," the first passage to the right after entering the cave, and therefore quite convenient of access. This avenue is said to be about half a mile long, and formerly cottages stood at its entrance, built for the use of consumptive patients, under the erroneous impression that the chemically pure air and the uniformity of temperature would more than compensate for the absence of sunlight and the cheerful sights and sounds of the upper world. The cottages are now forsaken and most of them demolished, and the long tunnel beyond contains little of special interest, unless it be the swarms of bats that hibernate in what is for that reason called "The Great Bat Room." The rich deposits of bat guano, that have been accumulating for centuries, lie as yet undisturbed, and if properly mixed with other fertilizers, might no doubt be used to facilitate the propagation of fungi.

The soil, which at present is extremely dry, might be easily moistened to any desired degree, as was done in working the saltpeter mines in former days, by conducting water through pipes from the cascade at the mouth of the cave.

The idea of thus turning caverns to profitable account for the cultivation of mushrooms, though new in America, has long been a familiar one in France, and has been demonstrated to be entirely practicable. One of these caves, at Montrouge, is said to have six or seven miles' run of mushroom beds, and the daily yield of marketable fungi is about 400 pounds weight. Another such cave, near Frepillon, is reported as sending, on favorable days, as many as 3,000 pounds of mushrooms to the Paris market, from beds aggregating sixteen miles in length. Still another, at Mery, and belonging to M. Renaudot, is said to have had under cultivation in 1869, over twenty-one miles at once, and afforded employment to a large class of laborers, who devoted themselves wholly to the business of raising mushrooms, not only for the French markets, but also for exportation. One house alone reports 14,000 boxes of preserved mushrooms as sent to England in a year.

The special advantage of subterranean over open air culture lies in the fact that, owing to the uniformity of temperature, which in Mammoth Cave hardly varies from 56° Fah. either winter or summer, the business can be pursued with equal success at all seasons of the year and in all kinds of weather.

It is the supposition that when choice mushrooms are known to be raised by responsible parties, and with every guarantee of freedom from the admixture of poisonous fungi, they would find a ready market in Louisville, Cincinnati, and other Western and Southern cities; or, if not, they could be hermetically sealed or made into catchup and easily sent to more distant markets, where such esculents are appreciated. The business has become highly remunerative in England as well as France; a fact brought out lately in the trial of the Metropolitan Railway Company, for taking possession of a mushroom nursery, showing that this curious branch of horticulture yields from 150 to 200 per cent. One witness is quoted as saying that, "if $250 were expended, in twelve, or possibly in six months, the sum of $1,000 would be realized."

It is probably an error to regard the economic value of fungi as of unimportant character; and it is worth considering, in these days, when so much has been said on the importance of multiplying the materials of cheap and wholesome food, whether such immense quantities of nutritious fungi ought to be annually lost, either by reason of ignorance of their excellent esculent qualities, or through fear of serious consequences arising from eating those kinds that are unfit for food. Caution should not degenerate into prejudice. And really the difficulty of telling edible from poisonous fungi is no greater than that of discriminating between the poison ivy and harmless ampelopsis, or between the wild and cultivated parsnip. A very little attention to the subject will enable any one to tell at sight a few of the best and most common varieties as readily as he now tells the vegetables from the weeds in his garden. It may be added that, in fact, the cultivation of the mushroom has been mainly restricted to a single species, so that most people who are fond of it, will hardly recognize any other as fit for food; while there are many varieties of esculent agarics known to the mycophagists, some of which, no doubt, might be found by experiment to be as suitable for cultivation as the common *Agaricus campestris*.

Our knowledge of American fungi is known to be extremely meager, being mainly limited to the results of researches in the Carolinas, Texas, and Cuba, made by Curtis and Ravenel; and a wide field of investigation is open to any competent person who will specially devote himself to this branch of botany.

Increased Importance of Iridium.

Mr. Holland's process for fusing and moulding iridium enormously widens the scope of the useful applications of iridium, and gives increased importance to any natural sources of the metal that may be discovered. The *Standard*, of Portland, Oregon, states that certain heavy black particles associated with gold in that State, and hitherto supposed to be iron, have been found to be iridium. The *Standard* says that the iridium appears as a black shiny sand in the gold washings, in particles a little coarser than blasting powder, and adds: "There are portions of this State and the adjoining Territory where this metal may be found in abundance. So that we have in our midst an undeveloped source of wealth that may outshine anything ever before known."

Moth Preventive.

A correspondent of the *Furniture Gazette* recommends the following remedy for exterminating moths in carpets and furniture: After some years of experience with the troublesome pests, says the writer, I found a sure preventive of moths in pitch paper, the same as roofers use. The moth will live and grow on cayenne pepper and tobacco, while I never could see that the use of these articles kept the moth miller out. The plan for the furniture dealer or housewife is to cut the paper in slips and place about the room, under and behind sofas, chairs, etc.; this should be done as early as the middle of April, and in warm climates earlier. If the dealer wishes to make parlor suits moth proof, he should place on the inside of backs of chairs and seats, small strips of the pitch paper, and rest assured that the miller will not select these places to deposit eggs. It is the miller that is the foundation of all the mischief.

A Heavy Mississippi Tow.

The towboat Oakland left St. Louis for New Orleans May 15, with the heaviest tow yet taken seaward that way, namely, eight barges carrying freight as follows: 160,000 bushels of wheat, 140,000 bushels of corn, 5,000 barrels of flour, 3,000 sacks of bran, 6,000 sacks of oats, 5,000 packages of general freight. The total tonnage exceeded 10,000 tons. Most of the grain was for export.

The Lyman-Haskell Multicharge Gun.

Work has been begun, in the pattern room of the Reading Iron Works, on the first Lyman-Haskell accelerating or multicharge cannon. The gun will be twenty-five feet long and have a bore six inches in diameter. Along the bore four pockets will be located, in each of which a charge of powder will be placed, with the view of accelerating the speed of the ball after it leaves the chamber of the gun and during its progress through the bore. The charge of powder will be 130 pounds, and the weight of shot 150 pounds. It is calculated that a shot from the gun will penetrate through two feet of solid wrought iron. The expected range of the gun is ten or twelve miles.

NEW BENDING MACHINE.

The common method of bending wrought iron bars practiced in many shops is to make a cast iron form, around which the heated bars are bent by hand. In this way, uniform shapes are produced at a slow rate, and with severe and exhausting labor, and withal requiring considerable skill on the part of the workman.

We illustrate a bending machine to which cast iron forms are attached, between which the work is bent by power with great rapidity and accuracy, requiring no skilled labor in the operation. Its capacity is limited only by the amount of work that can be heated and placed in or removed from the machine.

The engraving shows a pair of dies or forms attached for bending iron plow beams, and at the side of the machine a plow beam after it has been bent is also shown.

There is hardly a crooked piece of wrought iron about a plow, wagon, thrashing machine, engine, mining or railway car, reaper, seed drill, or other machine, using bent pieces of wrought iron that cannot be bent on this machine with a great saving of time and labor. Much of the work that has been done on punching and drop presses is being done on this machine. It covers an area four by thirty-six inches.

The cross head moves seventeen inches and gives one stroke, while the tight and loose pulleys make forty-eight revolutions, thus giving a great leverage. Its weight is five thousand pounds.

We are informed one purchaser of this machine has over forty different patterns of dies or forms. It is manufactured at the Moline Iron Works, of Williams, White & Co., and is used in many of the largest works in the country.

Coal in Manitoba.

The people in Manitoba are rejoicing over the discovery of an important bed of coal, twenty-five miles northwest of Emerson. The bed is six feet thick, for two-thirds of its thickness very pure. Prof. Tilley describes it as a first-rate coal for general purposes. The bed is nine feet below the surface, under a stratum of red fire clay. It is thought to extend over a large area, and great advantage to Southern Manitoba is anticipated from it

NEW PUMPING ENGINE.

In many cities and villages the water supplied by the public works is unsuitable for toilet, potable, and culinary purposes, because of its hardness or the presence of earthy or vegetable impurities, and many families continue to use rain water from reservoirs or tanks placed in the attic, and others would prefer to do so but for the labor of pumping. Generally these reservoirs are supplied by pumping by hand from a cistern in the basement—a laborious operation, affording an unreliable supply, because it is frequently neglected by the person having it in charge.

The engine shown in the engraving is designed to do this work by using the hydrant water for power. It will be noticed that the apparatus has two cylinders, one being a hydraulic or water engine, operated by the water from the street mains, and conveying power through the piston rod to the other cylinder, which is a pump, taking water from the cistern and discharging it through suitable pipes into the reservoir above. It can be set in motion or stopped by hand, or it may be automatically controlled by a float in the reservoir arranged to open or close a valve in the service pipe.

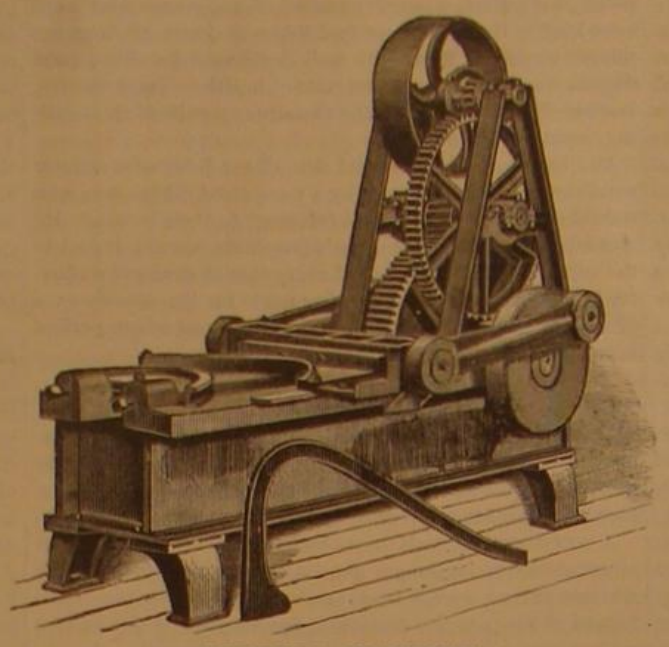
The water from the engine may be used for irrigating lawns, or other purposes that do not require it to be raised to any considerable height. A number of these engines have been in use for one to two years, with the most satisfactory results.

The size of cylinders must be in proportion to the pressure in the service pipe, and height of reservoir above the cistern. A safe rule is to calculate that one pound pressure on the engine will raise the cistern water one foot, the two cylinders being of equal size. Unless otherwise ordered, cylinders of equal dimensions, 3 inches diameter by 4½ inches stroke, are supplied. This size will pump from 75 to 100 gallons per hour from the cistern into the reservoir, and will require about the same quantity of hydrant water for power. Larger sizes for hotels and factories are made to order.

The Holly Manufacturing Company, of Lockport, N. Y., are makers of this pumping engine. New York office, 157 Broadway.

The Sub-Treasury Gold Wagon.

The little dingy-looking "gold-wagon," which has been used for twelve years past to carry the money received for duties from the Custom-house to the Sub-Treasury, has been retired from service. Sometimes it made as many as a dozen trips daily, carrying as much as $80,000 in glittering gold coin each time. The money was usually put up in bags of $20,000 each, which were placed in heavy oaken boxes with massive rod-iron handles. These boxes were then put into the wagon-box, and a lid with clamps of iron was locked down over it. The wagon was pushed like a hand-cart by two Custom-house porters, accompanied by an armed watchman, whose duty it was to see that the load of treasure was not interfered with by thieves. The little used-up wagon has carried in its time probably not less than $500,000,000, or about 4,500 tons weight in gold, and the dead weight and strain of the precious freight had rendered it rather

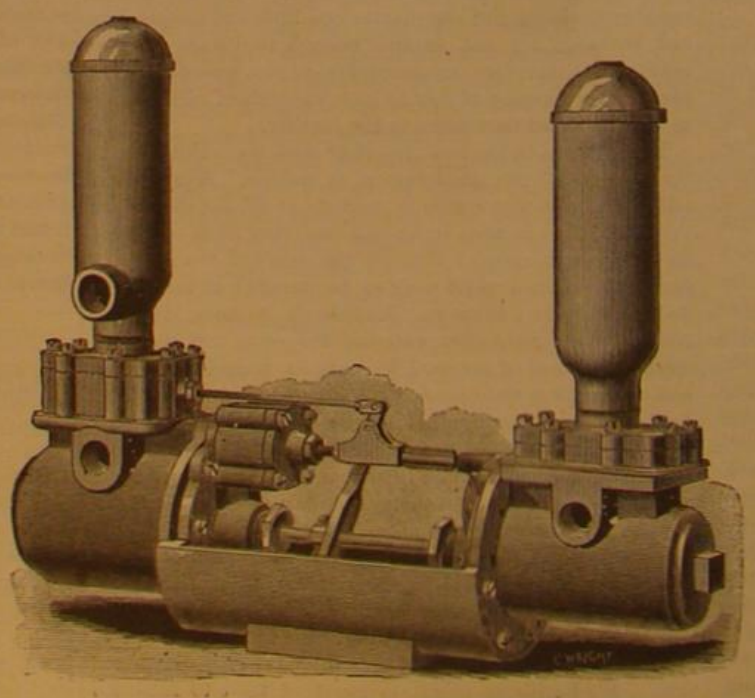


BENDING MACHINE.

rickety and unsafe. In its place a new wagon has been purchased, with solid wheels girt with iron tires half an inch thick, painted a deep blue color, and marked with the sovereign letters "U. S." in front.

When Men are at their Best.

Dr. Beard states that from an analysis of the lives of a thousand representative men in all the great branches of the human family, he made the discovery that the golden decade was between forty and fifty; the brazen between twenty and thirty; the iron between fifty and sixty. The superiority of youth and middle life over old age in original work appears all the greater when we consider the fact that all the positions of honor and prestige—professorships and public stations—are in the hands of the old. Reputation, like money and position, is mainly confined to the old. Men are not widely known until long after they have done the work that gave them their fame. Portraits of great men are delusions; statues are false! They are taken when men have become famous, which, on the average, is at least twenty-five years after they did the work which gave them their fame. Original work requires enthusiasm. If all the original work done by men under forty-five was annihilated, they would be reduced to barbarism. Men are at their best at that time when enthusiasm and experience are almost evenly balanced. This period, on the average, is from thirty-eight to forty. After this the law is that experience increases, but enthusiasm decreases. Of course there are exceptions.—*Christian Intelligencer.*



GASKILL'S HYDRAULIC PUMPING ENGINE.

MISCELLANEOUS INVENTIONS.

An improved saw tooth has been patented by Mr. Elisha S. Snyder, of Snyder's Mills, W. Va. This invention is designed to protect saws from all unnecessary wear; it consists in an expansible concavo-convex steel plate, which is inserted endwise between the ribbed edge of a slot cut in the periphery of a saw and the grooved edge of a false tooth which is keyed in the slot.

An improved vehicle spring brace has been patented by Mr. Zachriah T. Bush, of Stanton, Mich. This invention relates to that class of vehicles in which the springs are arranged at the sides instead of parallel with the axletrees. It consists in a brace of novel construction combined with the side springs and with reaches extending from the axletrees.

Mr. Louis E. De Grand-Val, of Jersey City, N. J., has patented a simple and efficient jar for the package and transportation of fresh milk, but which may also be used for other purposes; and the invention is embodied mainly in the device for clamping the cover thereon.

An improved life raft, which is made of very few parts, can be folded and disconnected for storage, or built up for use very easily, and is so constructed that either side will serve as a top, has been patented by Mr. Frederick S. Allen, of Cuttyhunk Island, Mass. The life raft is formed of two like frames, which are attached to empty casks by means of clamps, and thus form a double raft supported by three casks. A series of guide rods pass from one frame to the other and through a sliding floor, which can be drawn to either frame by means of ropes, thus permitting the raft to be thrown overboard without regard to its position, as the sliding floor is drawn to the upper frame as soon as the raft has been launched. Oars, masts, etc., are attached to the ends of the sliding floor. Bars or rods are pivoted to the ends of each of the frames, and are connected at their outer ends by ropes, thus forming railings when erected.

Mr. James Forsyth, of New York city, has patented a currycomb so constructed that it can be readily adjusted for combing the manes and tails of horses and scraping sweat, dust, and mud from the animals. The invention consists in a currycomb with a reversible comb upon its back, projecting arms to support the comb, and a spring catch for holding the reversible comb in either position.

Mr. William A. Roos, of New York city, has patented a simple and convenient attachment to a chair. The device is so contrived that a slight movement of a pedal will operate the fan.

An improved double-acting force pump has been patented by Mr. Andrew J. Hopkins, of Richmond, Ind. It is of the class of submerged force pumps in which a single double-acting cylinder is used. The object of the improvement is to provide a pump which shall be simple and efficient in its action, and at the same time so constructed as to avoid the inconveniences incident to freezing.

Messrs. William H. Leininger and Oliver H. P. Cornelius, of Salem, Oreg., have patented an improvement in whiffletrees. The invention consists of springs set about the drawing bolts in the ends of the double and single trees.

Mr. Joseph D. Paldi, of Brockway, Mich., has patented a cheap, simple, and efficient means for fastening two parts of a rope together, no matter whether this rope be of a fibrous character or made of wire. The invention consists in a strong flattened tube of wrought or malleable iron, through which the two parts of the rope are passed. In this tube are combined two metal wedges, which are driven in at opposite ends of the tube, so as to pass between the two sections of the rope and crowd it tightly against the sides of the tube, to firmly hold the two parts of the rope and the tube together, the wedges being so arranged that the pull on the two parts of the rope always tends to draw the wedges more tightly into the tube.

An improved window guard for the safety of persons engaged in cleaning or repairing windows, has been patented by Mr. George Neu, of Cincinnati, O. The invention consists in a bar having a swiveled fork attached to one end, and a screw passing into a fork attached to the other end, to lock this bar in the window frame, so that it can hold the person by means of a strap passing around the bar and attached to a belt passing around the person engaged with the window.

An improvement in rowing gear has been patented by Mr. Fred D. Smith, of New Carlisle, Ind. The object of this invention is to provide a device by means of which a boatman may pull a boat in the direction in which he is facing.

A mill especially designed for grinding feed, operating with a reciprocating motion, and adapted to be attached to the pump rod of a windmill, has been patented by Azel H. Bell, of Belle Plaine, Iowa.

An improvement in nose feed bags has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter. The invention relates to improved seams for uniting the sides and bottom of a nose bag, and also to a ventilator formed in the bottom of the bag and provided with a hinged cover to tightly close the bag when it is to be used for holding water or chop-feed.

THE KEELY MOTOR DECEPTION.

Three lectures on the Keely Motor were delivered in this city—May 16, 18, 20—at Chickering Hall, by Mr. O. M. Babcock, of Philadelphia, for the avowed and singular purpose, first, of showing to the New York public how grossly they have been defrauded by the Keely Motor Company; second, to show the hardship that the inventor of the "motor" now suffers in having lost or surrendered some fifty thousand dollars in money, being part of his share of the financial plunder originally derived from his stock; third, to explain the exact nature and practical operation of the motor, and thereby to let the people see for themselves that the thing is not a myth or a deception, as so many believe, but a real, genuine discovery, of remarkable, far-reaching, useful character.

It was in respect to the explanation of the practical working of the pretended motor that we were chiefly interested, and we accordingly sent our reporter to the several meetings. We regret to be obliged to say that all three of the performances were puerile and empty so far as the delivery of any actual information was concerned.

The first evening was almost wholly devoted to the recitation of a mass of indefinite charges of fraud alleged to have been practiced, from the very organization of the Keely Company, in 1871, down to the present time, by its managers. But the speaker did not venture to name any of the guilty individuals.

The second lecture was mainly a preface to the great and astounding revelations concerning the practical working of the motor. It consisted, however, only of a collection of extracts from the lingo with which Keely and his followers have always been accustomed to mystify their hearers. Here is a specimen from the evening's palaver:

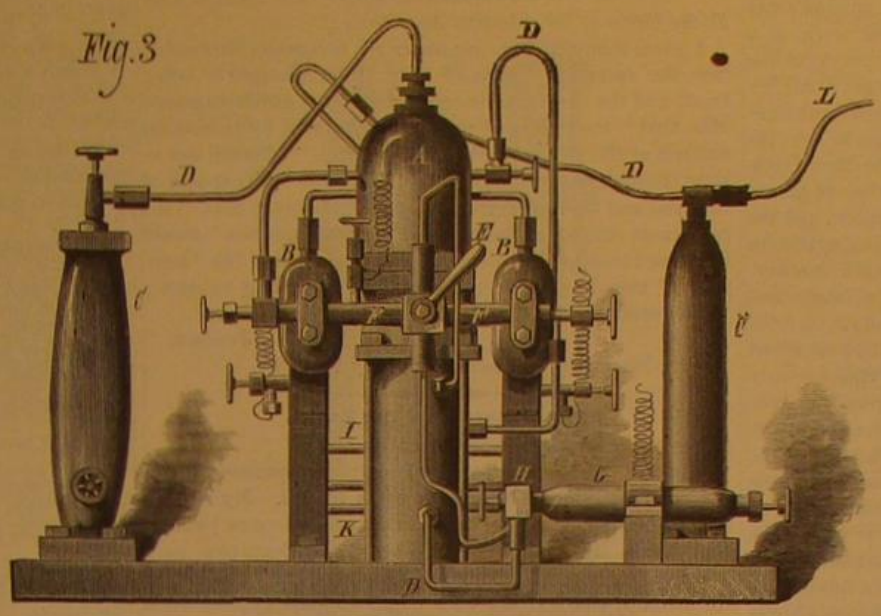
"Water moved earth, air moved water, ether moved air. Vibrations natural to air would disintegrate water, while air was broken into pieces if it were forced into vibrations common to ether in transmitting light. The compressibility of an elastic fluid was in the exact ratio of the tendency to expand. This was the secret of the Keely Motor."

There we have the general principles of the machine in a nutshell; and now we come to the third lecture, in which large diagrams of the motor were exhibited, with which the speaker pretended to explain the practical operation of the contrivance as follows, which is as near as possible a verbatim report:

Fig. 1 represents the first practical engine Mr. Keely made. He had built seven or eight engines before this was constructed, each being in turn rejected; and the one now in use (Fig. 4) was the tenth or eleventh. Fig. 2 represents the lever upon which the pressure was indicated. When a pressure of thirty thousand pounds was indicated on the lever, you had a pressure of ninety thousand pounds in the "stand-up tubes" in the "generator" (Fig. 3). That was the first time this fact, the speaker said, had ever been stated in public; and he thought that if the gentlemen who had witnessed the experiments had been told of it at the time, they would not have been anxious to remain in the room to the close of the exhibition.

Fig. 3 represents the "generator" in which the gas or ether was obtained, and was the fifth that had been constructed. It consisted of a "central column," A, having four chambers; two "side columns," BB, each having one chamber, with descending tubes connecting with the lower chambers of the central column; two "stand-up tubes," the "front stand-up tube," C, and the "back stand-up tube, C;" "copper leads or tubes," D, bringing all the chambers of the generator into connection; the "hand lever," E, attached to the starting bar, F, the bar communicating with all the chambers and leads. The chambers inside the apparatus contained water, and were filled to a definite height, slightly compressing air into the upper portion of each chamber, thus producing an air cushion, which operated to give an introductory impulse to the agitation of the water, which, being expelled downward, aided by the action of gravitation, passed through a complex device situated in the center of the central column (a "core" running perpendicularly from top to bottom), which dispersed the water into "tenuities," increasing as it proceeded downward through the stages of spray, mist, vapor, etc., into a highly elastic gas or ether. The turning of the hand lever, E, opened a "four-way" valve in the center of the "starting bar," and disturbed the equilibrium of the water, the opening of the valve producing what might be termed a "vibratory undulation" in the water throughout the entire apparatus. It was produced by the "impulsion" from the air cushions in the upper portion of the chambers, compressed slightly by the filling of the chambers with water. By means of the agitation thus produced, a minute globule of water was forced through the portion of the apparatus called the "expulsion tube" (the core of the central column), and dispersed from the "lower cell" at the base of the central column into an adjacent chamber called the "undulating" or "cord" tube, G, and through a copper lead into the adjacent chamber marked C, by means of the compressing cock, H, which could be operated and closed instantaneously. The globule of water, in its descent through the "central column" and "expulsion tube," expanded into vapor, and was forced successively into smaller chambers. It was met in its course downward by opposing currents from the side chambers, coming from the "molecular leads," I, and "atomic leads," K, and concentrated in a chamber at the bottom of the "central column," not larger than an ordinary walnut, and from

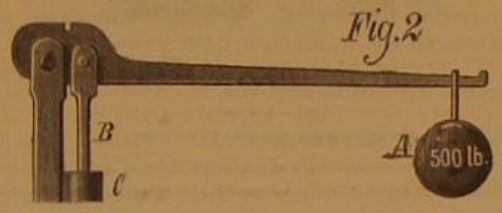
Fig. 3



THE KEELY MOTOR.

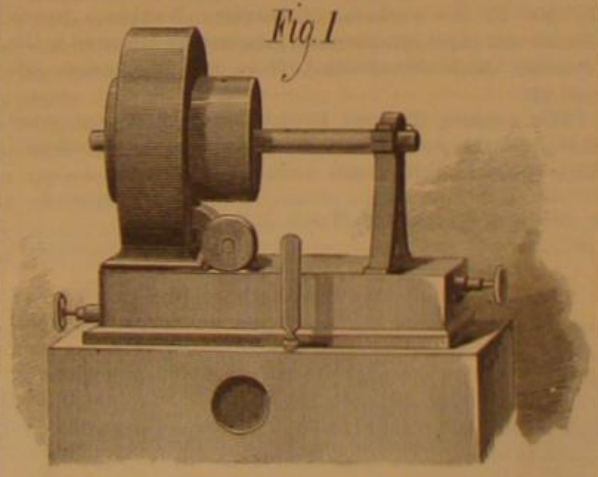
thence dispersed through a minute orifice into what was called the "undulating tube" or "cord tube," G. The moment that this expulsion took place from the lower cell into the "cord tube," it was closed by means of a compressing cock or "compressor," H, and the vapor in the "cord

Fig. 2



tube" was held intact. In order to repeat the filling of the "cord tube," the compressor had to be opened and closed again. The vapor in the "cord tube" then passed through the "front stand tube," C, being intensified in its action in the passage by means of a device which increased its tenu-

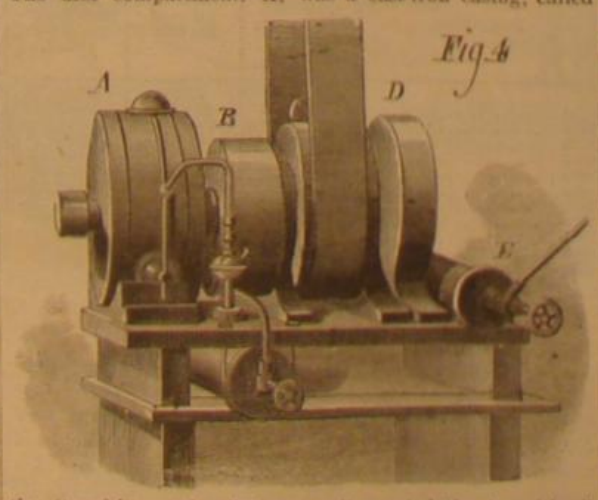
Fig. 1



ity as it passed upward. From the upper portion of the stand tube it was carried by the tube, L, to the engine.

Fig. 4 represents the engine as now constructed. It consisted of four compartments, A, B, C, D, upon a bed plate. The first compartment, A, was a cast-iron casing, called

Fig. 4



the "positive casing," because it carried the "positive" portion of the apparatus, named as follows: "suspension plate," "wave ring," 150 pins in a "descending vibratory scale," embracing six chords or notes, each chord or note broken up into twenty-five parts, *i. e.*, each pin varied one twenty fifth of a tone; also six tuning forks, a device called the "compound vitalizing medium," another the "vibratory elliptic," and another the "elliptic shaft," "six elliptic vibratory cells," a "positive wave plate," and "three vibratory transmitters." The second compartment contained what were denominated "triple vibratories" for transmitting "sympathies," and a "vibratory indicator." The third compartment, a pulley, C, upon which the belting run, contained a number of devices called "sextrum," "triple vibratory tubes," and a "vibratory bar" passing through the center. The fourth compartment was called the "spiraphone box," and contained the "spiraphone" and "wave plate." All the devices in the several compartments were within casings, and of course could not be seen in the cut. These several devices were constructed in sets of threes; and, in fact, the different portions of the whole apparatus seemed to be arranged in threes; there were only three movable parts, the valves; the negative tube had a capacity of three pints of water, as compared with the nine pints of the positive tube. They all seemed to be arranged in a sort of "rule of three." The power was transmitted by a belt running over the third compartment. The vapor passed from the generator (Fig. 3) to the engine (Fig. 4) and into what was called the "negative tube," upon the bedplate, adjacent to the spiraphone box, E. This "negative tube" had a capacity of three pints. This was connected with a tube near the center of the engine, under the bedplate, called the "positive tube," which had a capacity of nine pints. From the "positive tube" the vapor passed to the "positive" end of the engine through "copper leads," and there acted in succession upon the various devices in the four compartments—not by pressure, but by vibratory waves or "impulsions."

The generator occupied a space five feet long and high by two feet wide. The engine occupied a space four feet long by two feet wide and high. A fifty horse power engine would not occupy more than this amount of space, and an engine of two thousand horse power could be contained in a room ten feet square. Being rotary in motion, it required no extra room for the movements of its parts; and water and air being the only materials consumed, the cost of running was practically nothing. If the generator were sunk in water it would displace a quantity of water equal to about three hundred times the amount required to fill it; from this the audience could understand how small were the chambers within as compared with the walls. One quart of water would fill all the tubes and chambers. Mr. Keely had produced a pressure upon the tubes alone of fifty-four thousand pounds to the square inch. When you compared this pressure with the eighty or ninety pounds pressure of the steam engine you could appreciate some of the difficulties Mr. Keely had had to contend with in constructing an apparatus strong enough to withstand such enormous force.

The lecturer was asked if it was not possible to construct a machine that would run at a much less pressure than 54,000 lbs. to the inch, and so avoid the dangers and difficulties of so enormous a power as that stated. The reply was that a small pressure machine might be easily made, but what Mr. Keely wanted was to find out the extreme limits of the capacity of his discovery.

Having thus given the "full explanation" of the Keely motor, as publicly delivered by Mr. Keely's chosen representative and bosom companion, the man, according to his own statement, of most authority in the knowledge of the thing, next to Mr. Keely himself, we leave it to our readers to ascertain whether they know any more about it than they did in the beginning. For ourselves we confess that we do not.

New Method of Inlaying Wood.

A new method of inlaying wood has been contrived by a furniture manufacturing house in England. The process is as follows: A veneer of the same wood as that which the design to be inlaid consists—say sycamore—is glued entirely over the surface of any hard wood, such as American walnut, and allowed to dry thoroughly. The design is then cut out of a zinc plate about one-twentieth of an inch in thickness, and placed upon the veneer. The whole is now subjected to the action of steam, and made to travel between two powerful cast iron rollers of eight inches in diameter by two feet long, two above and two below, which may be brought within any distance of each other by screws. The enormous pressure to which the zinc plate is subjected forces it completely into the veneer, and the veneer into the solid wood beneath it, while the zinc curls up out of the matrix it has thus formed and comes away easily. All that now remains to be done is to plane down the veneer left untouched by the zinc until a thin shaving is taken off the portion forced into the walnut, when the surface being perfectly smooth, the operation will be completed. It might be supposed that the result of this forcible compression of the two woods would leave a ragged edge, but this is not the case, the joint being so singularly perfect as to be unappreciable to the touch; indeed, the inlaid wood fits more accurately than by the process of fitting, matching, and filling up with glue, as is practiced in the ordinary mode of inlaying.

Manuscripts on which the Bible Revision is Based.

In a sermon on the revision of the Bible, Rev. Dr. Rylance, of St. Mark's Church, this city, made the following interesting statement respecting the existing early manuscripts of the New Testament. The learned doctor speaks also approvingly of the new version, remarking that the revision was necessary in order that the common people as well as the learned might understand exactly on what ground they stood. Hitherto it has been thought that every word of the English version of the Bible was inspired; this belief is passing away as people become educated and know that no work of a translator can be absolutely perfect. The autographs of the Apostles have long since faded and disappeared. All we have to depend upon for our translations are copies, ancient versions, translations, and the quotations made by the Fathers of the Church. The manuscripts of the New Testament are of two kinds—the uncial, the oldest class of manuscripts, written in capitals and without punctuation, and the "cursive" manuscripts, so called from their being written in a running hand that began to be used in the tenth century. Those of the old class were written between the fourth and tenth centuries, the others after the tenth century.

Of the old there are 130 in existence; of the new about 1,500. The very old and very valuable manuscripts are only five. Of these the Alexandrian Codex was originally discovered at Alexandria, and was sent to King Charles I., in 1628. It is now in the British Museum. Nothing is known of the origin of this, but it is usually assigned to the middle of the fifth century. It is much mutilated, twenty-four chapters of the first Gospel, two of the fourth, and eight of one of the Epistles being missing. The next is the Vatican manuscript, supposed to have been written in the fourth century. A copy of this was never made till 1868, when a *fac simile* was issued. The condition of this is much more perfect. The third manuscript is that in the National Library at Paris, whither it was brought by Catharine de' Medici. This had been overwritten—that is, the parchment had been used for other writings; but, spite of that, the original has been deciphered. It is assigned to the early part of the fifth century. The fourth manuscript is that now at Cambridge. This is the least valuable, as it is much mutilated. It belongs to the sixth century. The manuscript found in 1844 in the Convent of St. Catharine on Mount Sinai by Tischendorf, and copied by him in 1859, is the most valuable of the five, as it contains the New Testament complete. This is supposed to have been written in the fourth century. None of these most valuable authorities were consulted in any of the English versions of the Bible, even in making that of King James' time. The Latin Vulgate, the plentiful cursive manuscripts, and the translations were used. Errors like the Doxology at the end of the Lord's Prayer had crept into the translations, even into the Syrian, which was as old as the second century. The Latin Vulgate was probably an excellent translation, as it must have been made within a few years of the death of St. John. The changes that have just been made have only been made when the weight of authority left no doubt of their necessity. The text is not a question of taste, of like and dislike, but of historic testimony. I expect to see the corrected version win its way into the confidence and the respect of the English speaking people.

Government Examinations of Gun Inventions.

By the act making appropriations for "fortifications and other works of defense, and for the armament thereof, for the fiscal year ending June 30, 1882, and for other purposes," approved March 3, 1881, the President is authorized to select a board, to consist of one engineer officer, two ordnance officers, and two officers of artillery, whose duty it shall be to make examination of all inventions of heavy ordnance and improvements of heavy ordnance and projectiles that may be presented to them, including guns now being constructed or converted under direction of the Ordnance Bureau; and said board shall make a detailed report to the Secretary of War, for transmission to Congress, of such examination, with such recommendation as to which inventions are worthy of actual test, and the estimated cost of such test, and the sum of $25,000, or so much thereof as may be necessary, is hereby appropriated for such purpose."

In conformity with this act the War Department has issued an order for a board of officers to assemble at the Armory Building, New York city, July 13, for the purpose of making examinations of all inventions referred to in the law, and making a detailed report of such examinations, with recommendations as to what inventions are worthy of actual test and the estimated cost of such test. The following is the detail for the board: Brevet Major-General George W. Getty, Colonel Third Artillery; Colonels Z. B. Tower, Corps of Engineers, and J. G. Benton, Ordnance Department; Majors A. R. Buffington, Ordnance Department, and John Mendenhall, First Artillery. Second Lieutenant Frank E. Hobbs, Second Artillery, will report to the president of the board for duty as recorder. The Chief of Ordnance, at Washington, will furnish the board with all the information on the subject in his possession, and all persons interested in such inventions are invited to submit to the board plans, specifications, and models, the mode of construction, cost, etc.

Simple Illustration of Critical Pressure.

Herr Haass describes in the *Berliner Berichte* a simple method of illustrating the existence of the so-called "critical pressure" discovered by Carnelley. A small piece of mercuric chloride is placed in a glass tube which is closed at one end, and communicates at the other with a Bunsen pump. So long as the manometer registers less than about 400 mm. pressure it is not possible to melt the mercuric chloride by heating it; the salt passes at once from the solid to the gaseous state. But immediately the pressure rises above about 420 mm. the mercuric chloride melts.

Correspondence.

The Gamgee Motor.

To the Editor of the Scientific American:

A great many persons are under the erroneous impression that the ammonia engine of Prof. John Gamgee is being built, and the experiments conducted at the public expense; also, that "the lunacy of the author is shared by prominent officials at the Navy Yard in Washington." Permit me to state, through your valuable journal, that the total expense of material and labor is defrayed by Mr. Gamgee; that "the prominent officials at the Navy Yard in Washington" would be pleased to chronicle the successful operation of the "zero-motor," but, like other skeptics, we are willing to wait a "few weeks until all is ready."

JUSTICE.

U. S. Navy Yard, Washington, May 21, 1881.

Non-Rotation of the Earth.

To the Editor of the Scientific American:

You will doubtless think that I am presumptuous when I tell you that I do not believe the earth rotates. My reasons for not believing that the earth turns around every twenty-four hours are simply these: When two objects pass each other, going in opposite directions, they pass *very* quickly, as for instance a bird flying west ought to pass objects upon the earth much more rapidly than when it flies east. But this is not the case. A bird passes no more rapidly going west then when it flies east; a ball thrown against a house in a westerly direction does not rebound any more than when thrown east.

You may send a balloon up above your head and let it stand twenty-four hours, and at the expiration of the twenty-four hours the balloon will be directly over your head. I have studied the reasons given in astronomy and find nothing to refute my observations. Hoping, if I am wrong, you will write to me and set me right, I am yours, etc.,

T. A. KIRKLAND.

Franconia, Pickens County, Ala.

Compound Stern-Wheeler.

To the Editor of the Scientific American:

In your issue of the 15th January last, you have an article headed "Steamboats for South American Rivers." After describing the hull, boiler, and engines of steamer referred to, you state: "They are probably the first compound engines ever fitted to stern-wheel steamers." I now beg to inform you that in 1866 I had a stern-wheel steamer made, in which was put a pair of compound engines made in 1864 by Mr. F. H. Wenham, of London. Wenham's patent double and triple cylinder steam engines are described in the *Practical Mechanic's Journal*, Nov. 1st, 1863, pages 220 and 221.

This steamer, Tadorna Radjah, has been at work ever since, and is probably the most economical and efficient little steamer on this coast.

WM. PETTIGREW.

Brisbane, Queensland, March, 1881.

Oleomargarine and the Butter Trade.

The strongest objection raised against the manufacture and sale of oleomargarine has been that it would ruin the profitable export trade in butter. The alleged danger has been insisted on with much emphasis during the past winter in the Legislature at Albany. The official reports of the United States Bureau of Statistics show, on the contrary, that the quantity of butter exported from year to year steadily and very rapidly increases, while the average price received shows no fluctuations which are not explainable on other grounds than the competition of oleomargarine. The official figures are as below:

Fiscal Year.	Quantities exported in pounds.	Value of Exports.	Average price in currency per pound.
1870	2,019,288	$592,229	——
1872	7,746,261	1,498,872	19 3/5
1873	4,518,844	952,919	22 1/5
1874	4,367,983	1,092,381	25
1875	6,300,827	1,506,906	24 7/8
1876	4,644,894	1,109,496	23 7/8
1877	21,527,342	4,424,616	20 5/8
1878	21,837,117	3,931,822	18
1879	38,248,016	5,421,205	14 1/8
1880	39,236,658	6,690,687	17 1/2
1881 (8 months)	25,793,131	5,214,663	20 1/8

Postal Cards.

The contract for supplying the Post Office Department with postal cards during the four years beginning the first of next July has been awarded to Woolworth & Graham, of No. 76 Duane street, this city, who are the manufacturers under the contract now existing. The first contract for postal cards was made in 1873, providing that one cent cards should be supplied for four years at the rate of $1.39 7/8 per 1,000 cards. The price under the second contract, which will end the 30th of next June, has been 69 56-100 cents per 1,000 cards. Under the new contract the rate per 1,000 cards will be 54 43-100 cents. While the contract from July 1, 1873, to June 30, 1877, was pending, the number of cards issued was 550,619,500. Under the contract for the four years' term which will expire June 30, 1881, the number issued will reach about 990,000,000. The number required during the next four years will be, it is estimated, 2,000,000,000.

A representative of the *Evening Post*, in an interview with the person in charge of the postal card department, is informed that more postal cards are used in this country than in any other, and probably at least half of them were employed for business purposes, such as advertisements, notices of meetings, etc. Immense quantities of them were taken by the Post Office in Chicago, which received more than any other city except New York, and he said that the sales of one cent postal cards at the New York office now averaged about 100,000 a day. The domestic cards were disposed of chiefly in lots of from 1,000 to 10,000, fully three-quarters of all which were sold being used by business firms, companies, associations, etc. Lots of 5,000 were very commonly taken, those of 25,000 were not infrequent, and even 50,000 had been sold in a single installment. Reference to the books of the office showed that 25,377,150 one cent cards were sold in this city during 1879, and 28,082,800 during 1880, making the total for the two years 53,459,950. The increase in 1880 over 1879 was 2,705,650.

Comet I. 1881.

Thus far comets have played a small part among the portents of this momentous year. Four months have passed without one trailing wanderer in the celestial depths. That inveterate comet seeker, Professor Swift, succeeded on the first day of May in picking up an infinitesimal member of the family, too small to be seen in anything less than a powerful telescope. No other observer has thus far had a peep at the stranger, and there seems to be little probability of its growth into one of those monstrous prodigies, spanning the heavens, that a few centuries ago were such frightful omens of evil to those who witnessed them. The comet that made its appearance May morning will probably do little harm to our planet. It seems to be a bearer of good fortune, instead of a prophet of disaster, for the discoverer will win a prize of two hundred dollars, as well as a gold medal. Comets must hurry their footsteps to make this a comet year. More than one-third of the "great year," 1881, as astrologers call it, has already slipped away, with only one tiny comet recorded on its annals. Prizes of two hundred dollars each are in readiness for seven more comets to be discovered before the year fulfills its course. These astronomical tidbits are therefore more earnestly desired by comet seekers than they are dreaded by those whose superstitious fears regard them as heralds of destruction. The nineteenth century chronicles the advent of two superb comets, that of 1858 or Donati's comet, and that of 1861. According to the law of averages, we can hardly expect again visits from such distinguished members of the family before the century closes. But we shall see as time passes what the future has in store, for nothing is more uncertain than the advent of these mysterious strangers, and one may suddenly beam upon our vision when we least expect it. There are but two things to fear, a great comet plunging headlong into the sun, or one coming into collision with the earth. The probabilities that these events may occur are of the slightest kind, and need not give the least anxiety.—*Providence Journal.*

Grinding Chilled Car Wheels.

The following statements in regard to the economy of grinding the chilled treads of car wheels are officially certified to by officers of the motive power and machinery departments of the roads named.

During the year 1880, the number of wheels ground at the Sacremento shops of the Central Pacific road was 3,400, of which 510 were new wheels. Of the 2,890 old wheels ground, ninety per cent were more or less flattened. The cost of grinding is estimated as follows:

Labor in running the Gowan machines	$1,347.13
Emery wheels	1,075.34
Repairs of machines, and lubrication	438.00
Power	250.00
Royalty, 50 cents per wheel	1,700.00
Interest on cost of four machines	320.00
Yearly depreciation of same	400.00
Add for contingencies 10 per cent	555.05
Total cost	$6,083.52

The cost of replacing with new wheels the 90 per cent or 2,601 flattened wheels that were worthless except as scrap (including interest on 1,300 new wheels to be kept in stock, and deducting value of old wheels as scrap at $8.50 each), is estimated at $24,578.77, from which deduct $4,653.19, or $1.78·9 per wheel, for grinding the 2,601 wheels, leaves $19,925.58 as the total saving by the use of the machines.

A New Method for the Analysis of Oils.

The author treats a measured quantity of oil with a measured quantity of standard caustic alkali. Ten c.c. of oil measured with a pipette were heated in a boiling water bath for an hour with 20 c. c. of a solution of potassa, which would neutralize 123 c. c. of sulphuric acid at 98 grms.=1000 c. c. At the end of this heating the linseed oils mentioned in the previous memoir all yielded a cake of soap solid or very firm when hot, always solid when cold, and easily separated by mere draining. The alkaline solution is very differently acted upon by different samples. It still neutralizes smaller quantities of acid, differing in case of every sample.—*E. J. Maumene.*

RECENT INVENTIONS

Mr. Jeppe Jeppesen, of Provo City, Utah Ter., has patented an improved machine for dressing both sides of boards at once, for dressing the edges at any angle desired, for tonguing and grooving, cutting mouldings, and other varieties of work in wood. The inventor makes use of two endless chains of links, fitted with cutters, combined with an adjustable bed, above and below which the chains are fitted to move in adjustable guides. A feed bed and feeding device are combined with circular saws, for carrying the material to the cutters and squaring the ends at the same time. The links of the chains are of peculiar construction, each being a plane having cutters adapted for doing the work required.

Mr. Bernard H. Hilmes, of Altamont, Ill., has patented a screw-cutting machine or implement, the dies of which are reversible and so held and operated that after the formation of the thread the bolt may be removed from between the dies without the necessity of unscrewing the bolt or turning the machine back.

An improvement in biscuit machines has been patented by Mr. Daniel M. Holmes, of Cincinnati, O. The object of this invention is to crimp the sheets of dough upon the under side or upon both sides before the sheets are cut into cakes. The invention consists in a biscuit machine with two crimping rollers placed at different levels, and in such positions that their faces can be brought into contact with each other, or nearly so, and a smooth roller placed above the upper crimping roller, so that a sheet of dough will be crimped upon both sides or upon the lower side, according as it is passed between the two crimping rollers or between the upper crimping roller and the smooth roller.

An improvement in thrashing machines has been patented by Mr. James C. Keith, of Battle Creek, Mich. The object of this invention is to prevent winding of the straw upon the thrashing cylinder when the machine is being used where the straw is long and flexible. It consists in a novel construction and arrangement of a revolving comb and stationary but adjustable comb shield combined with the thrashing cylinder, so that any straw which may be disposed to wind upon the cylinder is arrested and combed out and thrown into the separator.

In making coffeepots the lip or spout has usually been constructed separately from the body and attached thereto by means of solder. This method involves skilled labor, and is also expensive, and the attachment is in a measure insecure, besides detracting from the appearance of the vessel. Messrs. Gibson T. Ayer and Benjamin W. Taylor, of Delaware, Ky., have patented an improved coffeepot, in which the body and spout of a coffeepot are made from one piece of sheet metal without stretching, spinning, or swaging the metal for that purpose.

Messrs. S. M. Wilkes and W. H. Hyer, of Staunton, Va., have patented a bed lounge having a seat or bottom which is adapted for reversal, so that it may be conveniently and quickly adjusted with the mattress side uppermost, thus temporarily converting the lounge into a bed. The head of the bed or bottom is swiveled to a bifurcated support formed of a metal rod whose ends are pivoted in the sides of the frame of the lounge, so that by drawing the seat back from the head of the lounge it will be raised on the support, and may then be reversed.

An improved anti-chafing gear for horses and mules has been patented by Mr. Wheelock Winspear, of Mount Pisgah, Ohio. The invention consists of an endless band, of leather or other suitable substance, shaped to fit upon the shoulders and neck of the animal, beneath the collar, and held in place by attached straps that buckle to the surcingle.

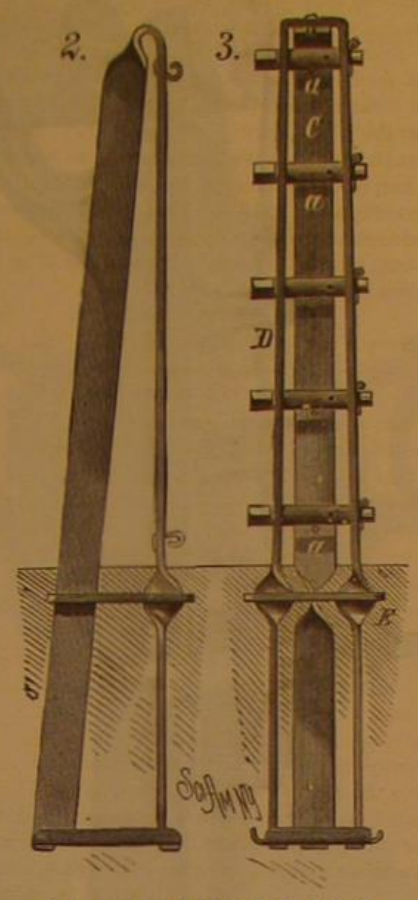
An improved instrument for taking observations at sea, either at day or night, to determine the ship's position, has been patented by Mr. Charles M. Hellberg, of Jersey City, N. J. The invention consists of a frame having an arc of 180°, suitably and adjustably mounted, in combination with a day and night binocular telescope and reflecting glasses, the instrument being designed as a substitute for the ordinary sextant or quadrant.

Mr. Charles J. Gustaveson, of Salt Lake City, Utah, has patented an improved spur having simple strap connection, so that a heavy strap may be employed that may be readily connected or disconnected from the foot. The improvement consists in securing a pointed hook or horn upon the end of the rim in a peculiar manner, that may be readily inserted into unslit perforations through the heavy leather.

Mr. Joseph P. Smithers, of Brooklyn, N. Y., has patented an improved electric lamp. This invention relates mainly to carbon-point lamps, but a portion of it is also applicable to incandescent lamps. The invention aims chiefly to provide an electric lamp of the former class with such regulating mechanism as will be sensitive to slight changes in the carbon points, and cause them to approach or separate, as their condition may require, by frequent but infinitesimal motions, so as to maintain the relative positions of the points uniform, and consequently render the light absolutely steady.

NEW IRON FENCE.

The fence shown in the annexed engraving is light, strong, and equally well adapted to the requirements of town or country. When used on farms the panels will generally be composed of long stretches of wire, but for gardens and city places the panels are shorter, and diagonal wires are stretched across them to render them more showy and ornamental. In a farm fence the posts may be set and then horizontal wires may be run to inclose a given area, and if after a time it is found desirable, two more horizontal wires may be added, and the fence may finally receive diagonal wires if it is found necessary or desirable. It will thus be seen that the fence may be completed by degrees, and by the extension of the system of diagonal wires the fence may be made as close as necessary for the confinement of the smaller animals.



PANEL AND TERMINAL POSTS.

The principal feature of the fence is the post, which is made in two forms, one for the ends or corners, another for the panel. In both of these forms the post is made with the smallest quantity of material consistent with the requirements, and the metal is so disposed as to insure great strength and rigidity

Fig. 1

REICHENEKER'S METALLIC FENCE.

A glance at the engravings will give an idea of the construction of the post and the manner of setting it.

The corner post consists of two metal bars, each bent midway of their length to form the two sides of a rectangular shaft. These bars thus bent are placed together, the top of one coming beneath the top of the other, and the sides of the one partially closing the sides of the other, so that when secured together at their tops the two united form a rectangular post having corner openings through most of their height. The portion C of the post (Fig. 3) is perforated at *a* for the reception of the wires, and the part D is provided with transverse rotating tighteners having their bearings in the side bars as shown. The bars forming the posts are provided with half-twists just below the ground line of the posts, and at this point is placed a knee plate, E, which is slotted for each arm of the post. Each arm of the post is first given a quarter twist to the right, and then, by slightly compressing the lower ends of the four arms, the slotted plate may be slipped upon them and pushed up until the twists in the arms have been reached. When releasing the arms will expand and bind the knee plate, G, in place. Each arm of the post is then given another quarter turn to the right below the knee plate, which brings their faces back in line with the upper portions of the arms and securely locks the knee plate in place, thus dispensing entirely with the use of bolts or screws to secure them.

The lower ends of the arms of the post are provided with nibs, and a slotted foot plate is secured to the foot of the post by passing the nibs through the slots and clinching them on the under side.

The tighteners (shown in detail in Fig. 1) are provided at one end with a post for the wrench or key by which they are wound to tighten the wires. Near the other end of the tightener a square portion is formed, which enters a square opening in that side of the bar; and at the extreme end of each tightener is a cylindrical portion having a perforation through which a key is passed to lock the square portion in its rectangular opening in the arm of the post. When it becomes necessary to tighten the wire the key must be withdrawn and the tightener pushed inwardly from that end until the square portion leaves the rectangular opening in the post, when the tightener may be turned until the wire is sufficiently taut, when the tightener is pushed back to its normal position.

After what has been said in regard to the corner post, the construction of the panel post, shown in Fig. 2, will be readily understood.

Of course either plain or barbed wire may be stretched on the posts, and the metal ribbons, either plain or twisted, may be applied with equal facility.

This improved fence was recently patented by Mr. William C. Reicheneker, of Denver, Col. Further information may be obtained by addressing the inventor, at present at Kansas City, Mo.

Capacity of Cathedrals and Churches.

In Forbes' "Tourists" the capacity of the larger European churches and cathedrals is given as below: St. Peter's Church, Rome, holds 54,000 people; St. Paul's, London, 35,000; St. Sophia's, Constantinople, 33,000; the Florence Cathedral, 24,300; St. Petronius, Bologna, 24,000; St. Paul's, Rome, 32,000; St. John Lateran, 22,000; Notre Dame, Paris, 20,000; the Pisa Cathedral, 13,000; St. Stephen's, Vienna, 12,400; St. Dominico's, Bologna, 12,000; St. Peter's, Bologna, 11,500; the Cathedral of Vienna; 11,000; St. Mark, Venice, 7,000; the Milan Cathedral, 7,000. These figures, it will be remembered, do not refer to seating capacity.

The "Cry of Tin."

If a piece of tin be bent, it emits a sound; this, being regarded as a property peculiar to tin, has been termed the "cry of tin." This phenomenon is explained by the peculiar crystalline structure of the metal. Reasoning that if this explanation be the true one, then other metals, obviously crystalline in structure, should also exhibit the phenomenon, Mr. J. C. Douglas, who records his observations in the *Chemical News*, heated a piece of rolled zinc for a few minutes to a temperature somewhat below its melting point, when the metal became much less tough, and its fracture decidedly crystalline. On bending a piece so treated, it emitted a sound weaker than that emitted by tin, but of the same nature. Cast zinc cannot be bent readily; but if pinched between the teeth or with pliers, it emits the sound distinctly. The conclusion, therefore, is that the cry of tin is due to crystalline structure, and may be emitted by zinc and probably by other metals when crystalline in structure. The practical application is, that by the sound a metal emits "we may draw conclusions as to its texture, and hence its fitness for certain purposes, or, by the sound emitted by a beam when bent, we may draw conclusions as to its safety, the microphone or other appliance being called in to aid us where the sounds are exceedingly weak."

The Floods of the Missouri.

The spring floods of the Missouri River were severer than usual, owing to the vast amount of snow to be melted, and the high water was made more than ordinarily disastrous by the frequent ice jams. For some weeks the local papers were filled with more or less exaggerated reports of destruction and loss of life. The hazards of life were undoubtedly many, but fortunately very few people were actually drowned. The commander of the military department embracing that region, General Terry, promptly sent Captain Claque, Commissary of Subsistence, to investigate the losses and provide for the relief of sufferers. In his report Captain Claque says that from the mouth of the Big Sioux River to Yankton, the bottom land on both sides of the river was covered with water its entire width, and looked like an inland sea, with occasional huge drifts of black ice somewhat resembling lava beds. Such sudden and merciless destruction is seldom witnessed in a lifetime. On the Dakota side alone it is estimated that about 225,000 acres of fertile land were submerged. Some idea of the destruction may be conceived when it is known that here was one of the oldest and most prosperous settlements in Dakota, said to average a family to about every 20 acres, and having a railroad transverse its length for about 50 miles, passing through six thrifty villages, now all submerged with water or entirely washed away, Elk Point Station suffering the least on account of its elevation. It may safely be said that no one living on this bottom was left free from serious loss, many having their all swept away—lands, houses, grain, and stock. On the Nebraska side the destruction was much less, as the bottom was not so thickly settled, and did not contain so much land. The most wonderful thing in this whole catastrophe is the small loss of human life.

Wool Sorters' Disease.

For some time past considerable discussion has arisen in the manufacturing districts of England over a malady called wool sorters' disease. Mr. Roberts, the medical officer of health for the district of the Keighley Local Board, treats at considerable length in his annual report for 1880 of the nature and preventives of this disease. In summing up from the report it is recommended that the following precautions be taken without fail by wool sorters: "(1) Wool sorters not to sort dangerous wools when they have any sore places or cracks on their hands or fingers; (2) to be careful not to wipe or rub their faces with their hands while sorting, especially if they have any cracks or pimples on the face or lips; (3) to wash their hands before eating, and to take neither food nor drink into the room where the wool is being sorted." The sorting room, he adds, ought to be well ventilated, to be swept regularly, and to have the walls and ceilings whitewashed twice a year.

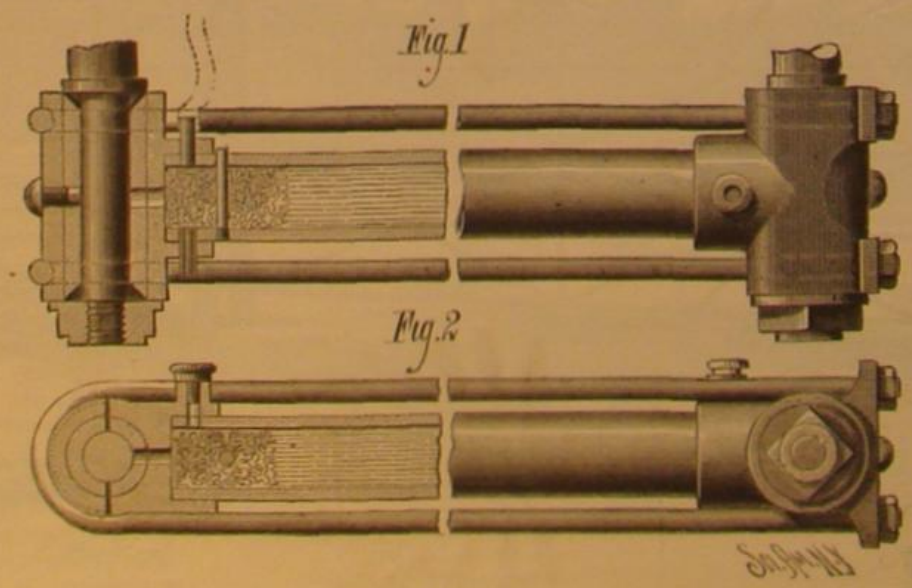
Seats for Shop Women.

The Legislature of New York has passed a bill requiring employers to provide seats for women in their employ. The absence of any seating contrivance likely to prove convenient and usable in the narrow spaces between shelves and counters is more likely to make the new law practically inoperative than any indisposition on the part of employers to deny rest to the saleswomen, for whose relief the law is chiefly intended. Why cannot some bright shop girl utilize the experience she has painfully acquired behind the counter and contrive a seat that will meet the requirements of the case? The market is ready, and the profit might be considerable.

IMPROVED CONNECTING ROD.

The engraving represents an improved connecting rod lately patented by Mr. Jacob J. Anthony, of Sharon Springs, N. Y., and designed for all varieties of machinery in which connecting rods are used. It consists of a straight tube forming an oil chamber, and having on each end a journal box communicating with the interior of the tube. The caps of the journal boxes are held in position by straps extending parallel with the tube on opposite sides of it. In each end of the tube is placed a quantity of fibrous material which acts as a strainer and prevents any impurities that may be suspended in the oil from entering the journals. The fibrous packing is held in place by a pin passing transversely through the connecting rod, and oil is introduced through a hole closed by a screw plug.

When this connecting rod is used vertically an oil cup is placed in the cap of the upper box. This rod has the advantage of being very light and yet strong and free from vibrations, while it is at the same time self-lubricating.



LUBRICATING CONNECTING ROD.

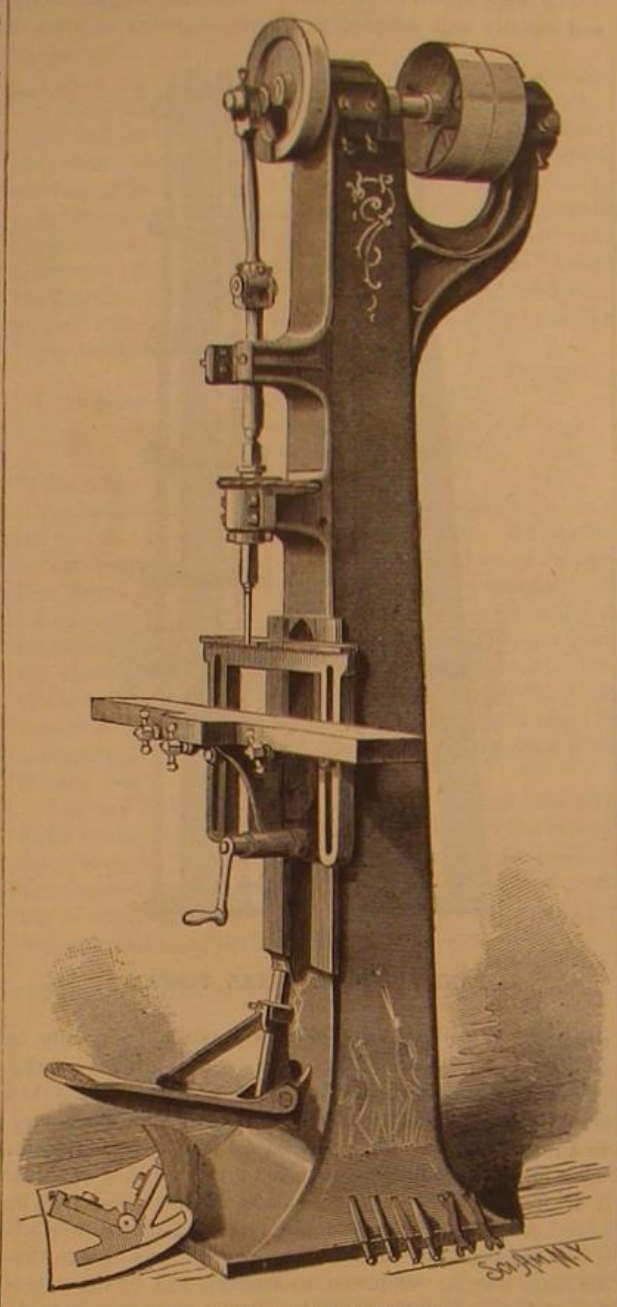
Lead Pipes Corroded by Lime.

It is a common practice with plumbers and house builders to embed lead pipes in lime mortars and cements. A writer in the London *Globe* says that when in contact with lime, lead pipes are rapidly corroded, in some cases so as to become porous and brittle within a space of fifteen or sixteen months. Obviously the careful testing of pipes in such position is in order; and if the facts are as stated, the exposure of lead pipes to lime should be carefully avoided.

NEW STYLE POWER MORTISER.

The annexed engraving shows a power mortiser for mortising doors, sash blinds, furniture, etc. The frame is cast in one solid piece, and the machine is built in the most substantial manner, and can be run at a higher rate of speed than other machines for doing the same work.

In all other mortising machines the cap of the box on crank shaft has to withstand the full effects of the blow of the chisel, thus bringing all the strain upon the caps of the box, causing a great deal of wear and lost motion. In the machine illustrated the solid iron frame is extended over the crank shaft, and the patent sliding caps—shown separately in the small detail view—are placed beneath, and the wear can be taken up by simply setting up the caps. This is an important improvement and will be readily understood. The machine also has the patent three-part box on the vertical spindle.



NEW POWER MORTISER.

The bed can be used for straight mortising in the usual manner, and is capable of being tilted to any angle for radial mortising. It is provided with the belt friction reverse known as the "Smith reverse," which reverses the chisel instantaneously, whether working or at rest. This reverse motion is acknowledged to be the best in use.

The shafts are all of the best cast steel, and the bearings are made very long. The high rate of speed at which this machine is run permits of doing a large amount of work in a given time.

The several improvements on this mortiser make it very valuable and desirable. The manufacturers of this machine call especial attention to their patent three-part sliding cap box, as shown in the detail cut. This box requires no liners, and the side as well as top wear can be taken up by setting down the governing screw.

Rowley & Hermance, the well known manufacturers of woodworking machinery, Williamsport, Pa., are makers of this machine.

Henry Chisholm.

In the death of Henry Chisholm, May 10, Cleveland, Ohio, lost a useful citizen and the iron trade one of its most deserving and capable pioneers. Mr. Chisholm was born in Scotland in 1822, and at the age of twenty emigrated to Montreal, Canada. In 1850 he removed to Cleveland to build a breakwater for the late terminus of the Cleveland and Pittsburg Railroad Company. For several years he was engaged upon the improvement of the Cleveland docks and piers. In 1857 he turned his attention to the manufacture of iron, forming the company of Chisholm, Jones & Co., setting up a rolling mill. Two years later the company which he founded set up the first blast furnace in that part of Ohio, and in the years immediately following several other furnaces and mills were established by this firm at Chicago and in Indiana.

In 1864 the firm of Stone, Chisholm & Jones organized the Cleveland Rolling Mill Company, and the year after they constructed the second Bessemer steel works in the United States. In 1871 Mr. Chisholm organized the Union Rolling Mill Company, of Chicago, and in connection with his Chicago partners erected another rolling mill at Decatur, Ill. These enterprises, the outgrowth of the original establishment in Cleveland in 1857, gave employment directly to 2,500 men. Mr. Chisholm was much esteemed by his neighbors and employes.

Arsenic Sulphide as a Poison, and its Import in Judicial Investigations.

The question was raised whether in a certain dish of cabbage containing arsenic sulphide, there was poison enough to prove fatal to a man. From a number of experiments the author concludes that arsenic sulphide, whether prepared in the moist way, or the orpiment of commerce used by painters, forms, in contact with putrescent organic matter, arsenious and small quantities of arsenic acid. In cases of poisoning with arsenic sulphide these oxidation products appear sooner or later according to circumstances. Hence, if articles of food, vomited matter, etc., are only sent for chemical examination after the interval of weeks, or perhaps months, the expert cannot give a definite answer to the question whether the poison was sufficient in quantity to prove fatal to a man.—*J. Ossikovsky.*

ENGINEERING INVENTIONS.

An improvement in that class of devices which are designed to be applied to boilers for automatic extinguishment of the boiler fires when the water in the boiler evaporates to a point below the low water line, has been patented by Antonio A. Amuedo, of Algiers, La.

Mr. Reuben Jones, of Mountville, Ga., has patented an improvement in horse powers which consists in the peculiar construction of the driving wheel, carrying an endless rope, whereby the latter is prevented from slipping on the driving wheel.

Mr. Thomas Trimble, of Albia, Iowa, has patented a removable platform and arm loop, to be used on freight cars to prevent accident to life while coupling the cars together. The invention consists in a light narrow platform removably attached to the outer end of a freight car, and a suitable loop for the brakeman's arm secured to the platform.

An improvement in dumping cars, patented by Mr. David E. Small, of York, Pa., consists in the peculiar construction of the plate for connecting the tilting body of the car to the truck, the plate being made with elevated side supports, which raise the pivotal point of the car body sufficiently high to enable it to be tilted without striking the truck too soon, and the supports have an offset at one side of its fulcrum, which catches and sustains the car body when in a horizontal position.

An improved automatic valve operator for tanks has been patented by Messrs. Alexander Jones, Charles Collins, and Hartwig A. Cohen, of New York city. The object of this invention is to provide a device for preventing the waste of liquids caused by the overflowing of tanks on account of the carelessness of the attendants or the inefficiency of the devices for indicating the exact quantity of liquid in the tank.

Mr. John F. Smith, of Erie, Pa., has patented an improved nut lock particularly adapted to bolts for connecting the ends of railroad rails, but capable of being applied to bolts

and nuts generally; and the invention belongs to that class of nut locks wherein a ratchet block or spring stop is employed between the inner face of the nut and its contact surface, and engages with grooves upon the said inner face of the nut to admit of the free movement of the nut in one direction and prevent it from moving in the other direction.

The Yellow Pine of the South.

The average height of the yellow pine, says a southern writer, in the virgin forest is from 60 to 70 feet, with a diameter of 12 to 18 inches for two-thirds of its height. It is of slow growth, particularly at the later periods of its life. According to the number of annual rings, trees of the above dimensions must have reached an age of 60 to 70 years. The reproduction of a tree from the seed, furnishing an equal supply of timber, would at this rate take two generations. It is a poor seeder, as the younger Michaux observed. In unfruitful years, a forest of hundreds of miles may be ransacked without finding a single cone, and these, according to my observations, are far more frequent than fruitful ones. In its struggle for existence in our days, the odds of a survival of its kind among the arborescent vegetation that disputes its ground are greatly against it. Taken from the flat and moist lands, and it is replaced almost exclusively by the pond and old-field pine; the hilly, broken, dry upland, denuded of the grand old pine forest, is with surprising rapidity covered by a dense and scrubby growth of blackjack, turkey oak, scarlet, and upland willow oak, above which seldom a young pine raises its head, crowned with its large white-fringed terminal bud.

Full of resinous juices through all stages of its life, the young trees are not as able to withstand the raging fires that annually devastate the woods as the less resinous species and the deciduous-leaved trees; besides that, being of much slower growth, this noble tree is doomed to extinction if not protected by the aid of man. On tracts sheltered from the invasion of fire, groves of young trees from 15 to 25 feet high, can be observed around Mobile, testifying that its existence for the future can in some measure be secured if protected from these destructive influences, unnecessarily caused by man. The utmost efforts by an enlightened community should be made through active and efficient State legislation without further delay, to guard against the calamity of a total destruction of such a magnificent estate intrusted to the hands of our people. Besides its contributions to the manifold necessities of the agriculturist, the builder in naval architecture, the construction of railroads, the arts, medicine, and the innumerable smaller demands of domestic economy, and the varied industries of the world, the influences of this great belt upon the climatic conditions and the salubrity of the Southern coast, are even of more far-reaching importance to the interest of the community at large, extending far out of its confines. Rearing its horizontally outspreading limbs high up into the atmospheric ocean, their branches densely clothed with the long, slender leaves, the forests of these trees present to the canopy of heaven, for many hundreds of square miles, an unbroken sheet of perpetually active vegetation, whose forces at such an altitude affect a constant attraction of the fleeting clouds, causing them to deposit their life-giving and supporting humidity in grateful showers over a large area with wonderful regularity during all seasons. To this fact is due the delightful climate of this part of our country, equalizing its temperature, particularly in tempering the rigors of the long summers of a region near the tropics.

During the great progress of meteorological science of late years, the fact has been established that in this exercise upon the conditions of the atmosphere, as regards the precipitation of its moisture, the pine trees stand unrivaled among all other trees of the forest. Robbed of this protection, the hills and the plains of the Gulf region, now blooming and clothed with the richest verdure, would be arid and parched, presenting as forbidding and austere an aspect as those of the denuded coast of Africa along the Mediterranean Sea, devoid of productive power and unfit for the habitation of civilized man. The efforts of nature are ever directed to recuperation in its aims to insure the existence of different forms of the living organisms from generation to generation.

To secure to our posterity the blessings enjoyed by us in its bounty in assisting these efforts as directed by her laws is a stern duty imposed upon us. Its discharge in the prevention of a wanton destruction of our forests and the adoption of measures regulated by the light of science, common sense, and the proper regard to the future, should engage the attention of every intelligent and patriotic citizen, appealing particularly to the owners of the soil. Of little importance to agriculture and industry are the other species of pines found in this region. Of considerably smaller dimensions than the yellow pine, and of a soft and sappy wood, they have, as timber trees, but a small value.—*N. W. Lumberman.*

ENGLISH SOFT PORCELAIN.

In England no regular hard porcelain is made, but a soft porcelain of great beauty is produced from kaolin, phosphate of lime, and calcined silex. The principal works are situated at Chelsea. The export of these English porcelains is considerable, and it is a curious fact that they are largely imported into China, where they are highly esteemed.

ENGLISH SOFT PORCELAIN VASE.

Our engraving shows a richly ornamented vase in soft porcelain from the works at Chelsea.

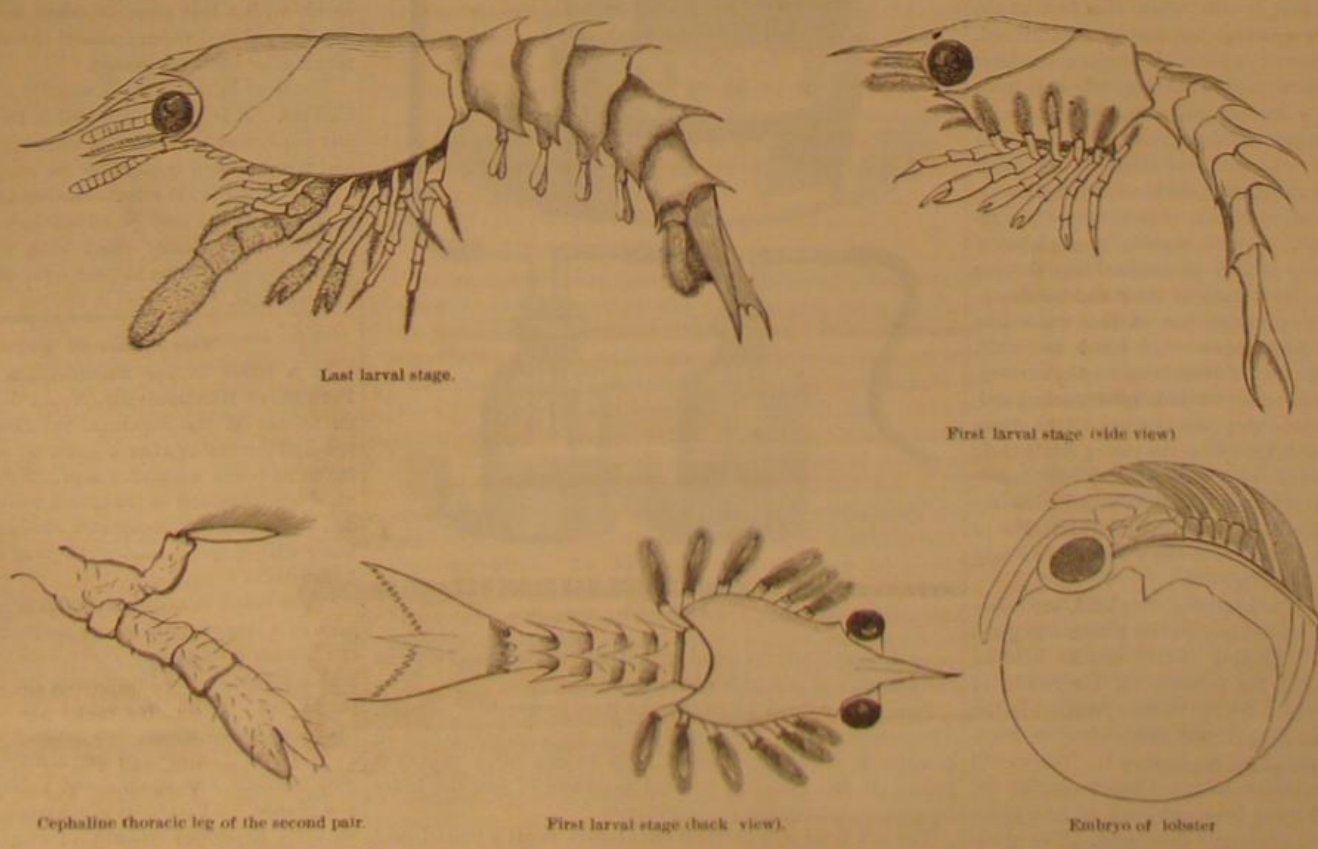
LOBSTERS.

BY A. W. ROBERTS.

Previous to the establishment of the oil works at Hunter's Point and Greenpoint, the lobsters caught at Hell Gate were considered to be the finest that came to the New York markets. But the few caught now are so strongly impregnated with sludge, acid, and coal tar, that it is next to impossible to eat them. There is no doubt that the blastings at Hell Gate destroyed immense quantities of lobsters; so great a dread have lobsters of thunder that they will cast off their large claws when a loud clap occurs or when a gun is fired. In olden times captains of vessels often extorted blackmail from lobster fishermen by threatening to fire cannon over their fishing grounds, knowing full well that the concussion would cause the lobsters to cast their claws, thereby destroying their value. Our common lobster (*Homorous Americanus*) belongs to the order of long-tailed crustaceans (*Macroura*), which includes the crayfish, prawns, and shrimps. As an article of food the lobster is the most important of all crustaceans, and dates back to the early ages of the world. Latium was famous for its lobsters, and Athenæus, whose cook book is the oldest in the world, mentions Apicius, who spent much of his time at this place on account of its lobsters.

Fifty years ago large quantities were taken on the reef of rocks that extended from Castle Garden to Pier 4, North River, and also on the reefs off Governor's Island; now only a few are taken in the neighborhood of Fort Lafayette, our markets being supplied from Maine, Nova Scotia, and Massachusetts, the lobsters reaching here alive in "well" smacks. Large quantities are sent to New York from Boston, all ready cooked, during the winter season. On the Maine and Nova Scotia coasts thousands of girls, women, and boys, are employed in the canning of lobsters. On the first floor of these canning establishments are brick furnaces, in which are placed large copper boilers filled with sea water kept at boiling heat. As fast as the lobsters are received fresh from the fishermen they are plunged into the hot water for a few minutes, after which they are distributed on long benches covered with zinc. The women and girls then break them up and extract the solid meat from the tails and large claws, the only parts used in filling the cans, which are then placed in shallow boilers to expel the air before sealing them up, after which they are taken to the second floor to be labeled and packed in boxes capable of holding four dozen cans; these sell at four dollars per box. The number of lobsters boiled per day varies from one thousand to three thousand. The American canned lobster goes to all parts of the civilized world.

The usual way of catching lobsters is in what are known as "pots." The "lobster pot" is made of a variety of materials, laths, netting, and wicker work. On the Eastern coast nearly all the pots are made of laths, forming a long semicircular cage; at each end is a door, which lifts up when the lobster presses against it; after he has passed in the door drops back into its place, and the lobster is imprisoned, as the door cannot be raised from the inside; others have a funnel-shaped netting of rope. The pots are weighted with stones and fastened on set lines, which are buoyed at each end to mark their positions. A smart fisherman can fish one hundred and fifty pots on a single line, but it is very hard and laborious work lifting and hauling up from the deep water into the boat so many heavily weighted pots; each pot has to be rebaited and emptied of its lobsters, also cleared of all seaweed and drift. The pots are baited with what are known as "evil" fish, such as stinging rays, skate, bonkers, etc., which cost the fishermen a few cents per hundred weight. After the lobsters are caught they are placed in large stationary cars provided with a hopper on the top, the lobsters are thrown into the hopper and pass into the car, where they remain until the "well" smack returns from New York for a fresh load. Lobsters are in season all the year round, but are the fattest from April to October. It is a mistake that any part of the lobster is poisonous; although the "lady," which is the stomach of the lobster, is very tough and indigestible, it is not poisonous. The bluish vein situated along the back and tail is to be avoided, as it often causes sickness. Lobsters are prepared for the table in many ways, the flesh is boiled, fried, pickled, scalloped, and is used for soups, salads, sauces, croquettes, pies, and pastry, but the most delicious of all is a fried "shedder" lobster. A "shedder" is a lobster who is within one or two days' time of casting its shell, which is removed artificially from the lobster before cooking. The shell of a lobster is composed of an unyielding calcareous substance, which, without doubt, is a most excellent defense for a *full grown* lobster, but it leaves no room for growth. To overcome this, all crustaceans possess the power of shedding their shells at certain seasons of the year, after which a new shell is formed; this again is cast off, and so continually until the animal has attained its full growth. Not only is the shelly coat of the body and limbs cast off, but also the following portions of the body: The foot-stalks of the eyes, external cornea of the eyes, internal thoracic bones, membrane of the ear, membranous covering of the lungs, tendons of all the claws, lining of the stomach, and the stomachic teeth. There can be but little to wonder at that a lobster often experiences great difficulty in shedding



Last larval stage.

First larval stage (side view)

Cephaline thoracic leg of the second pair.

First larval stage (back view).

Embryo of lobster

its old coat, when so many organs are involved. Sometimes the legs are torn off or badly lacerated in drawing them through the narrow joints, and when successfully accomplished the lobster is the most helpless and defenseless of all living creatures; the limbs, being soft and pliant, are incapable of offering the slightest defense. For some days previous to casting, the lobster begins to excavate a cavity under a rock; as soon as the cavity is of sufficient size he closes the entrance by pushing from the inside with his large claws a number of stones, through which enough water passes in and out for a constant supply of oxygen. He now rests for three days, refusing all food, and preparations are going on for forming a new shell. The membrane which lined the shell has become more dense, and has collected a quantity of liquid material for the consolidation of the new shell. These materials are mixed with a large quantity of coloring matter. As soon as the shell is cast off, the membrane is suddenly expanded by the pressure from within, and by the rapid growth of the soft parts the lobster soon acquires a much larger size than that of his cast-off shell. Lobsters are of a very quarrelsome disposition, and it often happens that when they fight they snap off one another's claws; in such cases the injured member is amputated to the next perfect joint, from which, in a short space of time, a new limb makes its appearance, at first very small, but constantly increasing in size. This new limb being soft and tender, all the defensive qualities of the lobster are displayed in protecting it from enemies, till next shedding time, when it comes forth a hard claw, much smaller in size than the rest, but which, in the course of several sheddings (if the lobster is young) attains its full size. It is, for this reason, a common circumstance to find a lobster with one very large claw and one small one. The amputating of the injured limb is for a very wise purpose. The blood vessels are but slightly contractile, and a wound inflicted on the most fleshy part of the claw would continue to bleed freely. By amputation at the joint the surface of the wound is reduced to a very small space, which heals quickly. A few years ago the enterprising (but not over-scientific) fishermen of the New England coast expended considerable money uselessly in constructing establishments wherein to breed lobsters. No breeding establishment in which it was necessary to have a free passage of the sea water in and out, on the rise and fall of each tide, could possibly answer for raising young lobsters, for the reason that they are so minute after leaving the egg as to be known as very interesting objects for the microscope. Again they are free swimming animals in their early stages, and what makes it still worse is that they are surface swimmers when passing through the larval stages. Most fishermen believe that after the young lobsters leave the egg they fasten on to the curiously silk-fringed appendages attached to the under side of the abdomen (erroneously called the "tail") until they are strong enough to shift for themselves. Another general belief was, that when the young lobster left the egg he was in form and color the same as the parent.

But thanks to Professor S. I. Smith, who has made a special study of the development of the lobster, there is no longer an excuse for the general ignorance on the subject that has existed. Professor Smith divides the larval condition of our native lobster into three stages. There are probably two succeeding stages before the adult form is attained. One is described by Professor Smith, while the first of the two he supposes to have existed, but has not discovered. After this the animal ceases to swim on the surface, and later in the summer it seeks the bottom of the sea, where it feeds on the young of various marine animals, the larvæ of crustacea, etc. When much crowded in captivity the larvæ will feed on its own kind. In the first stage of the adult form, when the animal is about three-fifths of an inch long, it still differs from the adult so much that it would be regarded as a different genus. In this stage the young lobsters move very rapidly by means of their abdominal legs, darting backwards when disturbed by means of their abdominal appendages, and frequently jumping out of the water like shrimps, which in their movements they much resemble. They appear to live a large part of their time on the surface, and are often seen swimming about with other surface animals. Professor Smith thinks they pass through all the stages he figures in a single season. How long the young retain their free swimming habits after arriving at the lobster-like form is not known. Specimens three inches long have acquired nearly all the characters of the adult. Of all the larval stages of other genera of crustacea there are none which are closely allied to the early stages of the lobster.

In the neighborhood of Southampton, England, are several storage ponds capable of holding 50,000 lobsters in good condition for a month. Fishing (well) smacks holding 10,000 lobsters each collect the lobsters off the coasts of Scotland, Ireland, and France for the storage ponds. In the reign of George II. a close season was established in Scotland, extending from June 1 to September 1. There still exists a fine of five pounds for taking lobsters during the close season, but its not having been enforced of late years the number of lobsters has gradually decreased. The quantity of lobsters taken on the Irish coast is less now than 20,000 per annum. A law exists in England regulating the length of salable lobsters to eight inches, and the penalty of exposing them for sale under eight inches is confiscation.

The number of lobsters shipped from the coast of Norway to London amounts to over a million a year, for which the sum of $100,000 is paid. The English lobster companies have agents along the entire coast of Norway to buy up all the lobsters caught, which bring at Billingsgate from 18s. to 20s. per dozen. The number of lobsters sold in England has averaged 3,000,000 per annum.

In the State of Rhode Island lobster fishermen are prohibited by law to "lift" their lobster pots from Friday night to Monday morning.

In the State of Maine there exists a close season which covers the period of time in which the female is carrying her eggs and the release of the larvæ from the egg.

The law of New York State, which is based on that of Massachusetts, has been mailed to every lobster fisherman in New York State by the fish dealers of New York city:

DEAR SIR: The Legislature of the State of New York has passed a law, which has been signed by the Governor, prohibiting the sale of small lobsters, as follows:

AN ACT PROVIDING FOR THE PRESERVATION OF LOBSTERS.

Be it enacted in Legislature assembled, and by authority of the same as follows:

SEC. 1.—Whoever sells or offers for sale, or has in his or her possession, with intent to sell, either directly or indirectly, any lobsters less than ten and one-half inches (10½) in length, measurement to be taken from one extremity of the body to the other, exclusive of claws or feelers, shall for every such lobster be fined to an amount not less than five dollars ($5), and in all prosecutions under this act the possession of any lobster not of the length hereinbefore required, shall be *prima facie* evidence to convict.

SEC. 2.—All forfeitures accruing under the act shall be paid one-half to the person making the complaint and one-half to the city or town where the offense is committed.

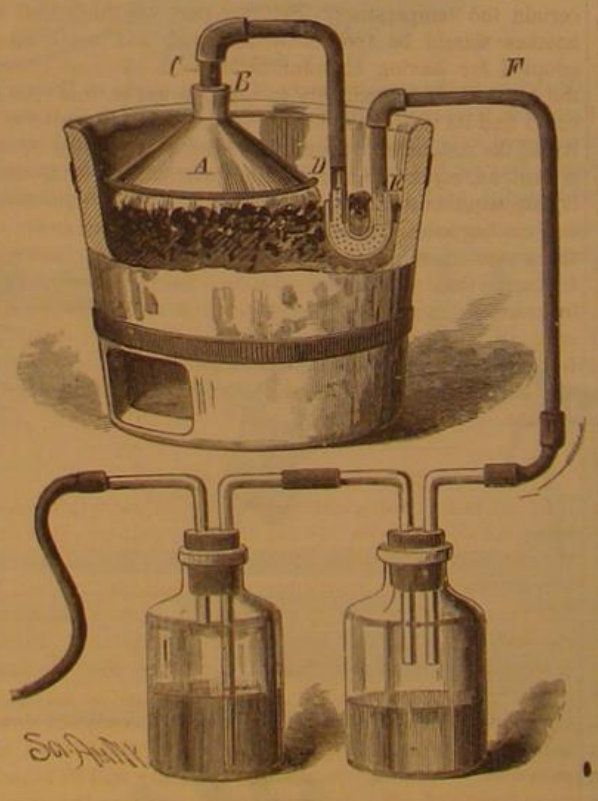
SEC. 3.—This act shall take effect on the first day of June, 1880.

You will therefore please see that there are none of less size than allowed by law—10½ inches in length—in any of your shipments to us.

To show how prolific lobsters are, it is stated that no less than 12,000 eggs were counted in a single female. The eggs are carried by the female under the abdomen, and are fastened and entangled to the silk-fringed appendages previously mentioned. As the outer layers of eggs become ripe the mother constantly stirs them with her small hind claws, either to clear them of sediment or parasites or else to aid the larvæ in breaking through the shell. The "coral" formed in cooked lobster is the roe or egg masses of the female lobster. As to the sight of the lobster it may well be good, for he is possessed of compound eyes like those of insects, only the lenses are square instead of hexagonal. The lobster often freaks both in colors and the form of the large claws. When in charge of the Aquarium I had several specimens of deep blue and a beautiful light blue lobsters, also three of a bright crimson, and many with double large claws.

OXYGEN FROM BLEACHING POWDER.

Hitherto oxygen when required in anything like a pure or undiluted state—as for the lime light, oxyhydrogen blowpipe, etc.—has been obtained almost exclusively from potassium chlorate by heating that salt to decomposition in the presence of peroxide of manganese.



APPARATUS FOR MAKING OXYGEN GAS FROM BLEACHING POWDER.

Pure potassium yields nearly one-third its weight of oxygen. The commercial is never chemically pure, however, and in practice it rarely yields more than twenty-three gallons a pound (at 60° Fah. and normal pressure) of gas, the latter frequently containing much chlorine.

The salt costs at wholesale twenty-five cents a pound, and requires to be mixed with about one-quarter its weight of peroxide of manganese, costing eight cents a pound, thus making the cost of the gas for materials alone about nine cents a cubic foot.

Where economy is considered, common bleaching powder or chlorinated lime can be made to profitably take the place of the more expensive salt as a source of oxygen.

An average sample of bleaching powder (fresh) contains at least twenty-six per cent of calcium hypochlorite. This substance when heated to the boiling point of water splits up into calcium chloride and calcium chlorate. If the heat is increased to low redness the chlorate is decomposed into calcium chloride and oxygen.

During the elevation of temperature some hypochlorous acid is apt to pass off; but if the apparatus is so arranged that the gas is forced to pass over or through a small quantity of heated lime it is arrested, decomposed, and the oxygen liberated—oxygen and steam only passing over.

In a series of late experiments with an apparatus similar to that described below, the yield in oxygen per pound of common commercial bleaching powder, costing one and three-quarter cents, averaged four gallons, making the cost of materials for oxygen from this source about three and one-quarter cents per cubic foot, as compared with nine cents where potassium chlorate is used.

The gas after passing through the wash bottles is perfectly odorless and nearly pure.

Where the gas is required in small quantities, a few cubic feet at a time, the following simple and inexpensive apparatus answers very well:

The retort, A, is made of common sheet iron, doubly lapped and riveted. The short neck, B, is slightly flaring so as to admit of the luting in of a piece of inch steam pipe. This pipe, C, is connected by a screw cap or elbow with a longer piece of similar pipe bent somewhat and extending downward two or three inches below the bottom of the retort, where it is joined by a U cap at its lower end with a third piece of iron pipe extending upward above the bottom line of the retort. A fourth piece of pipe is connected with this latter at right angles for convenience of attachment to condenser and wash bottle. The space from D to E in the tube is loosely filled with fragments of quicklime, each somewhat larger than a pea.

Two or three pounds of the chlorinated lime having been put into the retort, the pipe, B, is loosely inserted in the neck and the joint made tight with a stiff luting of clay or plaster of Paris. The retort is then placed on a charcoal or other moderate fire, the portion of the pipe containing the lime being in the fire. Connection is made with the condenser and wash bottle as soon as steam begins to come over, and as soon as the air in the apparatus has been displaced connection is made by rubber tubing with the gas bag or reservoir.

The moisture in the heated substance first passes off together with some gaseous matter, the latter being decomposed by the lime; then as the temperature rises and approaches low redness oxygen is rapidly disengaged, and if the fire is good ten minutes' heating will suffice to exhaust the charge.

The stop cock at bag or reservoir having been closed the retort may be slipped out, another similar one already charged put in its place, and the operation repeated if desired.

The chloride of lime should not be too moist when placed in the retort, or the charge greater than will loosely cover the bottom of the vessel to a depth of one and one-half inches.

If a sudden pressure greater than the delivery pipe can relieve is developed in the retort the luted joint acts as a safety valve.

The sheet iron retorts do not, of course, last very long under such treatment. If the pipes are well washed on the inside with a thin paste of ocher and water and allowed to dry the gas and vapors passed through will not affect them much after the first charge.

The lime in the tubes is usually sufficient for two or three charges. It is better to renew it frequently, as it is gradually converted into calcium chloride, which melts on heating and when cooled requires to be washed out.

On a larger scale retorts similar in form to those used in making coal gas may be advantageously employed, the large delivery tube, partly filled with fragments of quicklime, being arranged so as to pass over the fire and be kept at a low red heat.

The Crater of Popocatapetl.

In a letter to the Philadelphia *Record*, Mr. Nathan E. Perkins, of Merchantville, N. J., describes at great length an ascent of the Mexican volcano Popocatapetl, having reached the crater after a toilsome climb and descended as far as he could without a rope. From this position a good view was obtained of the crater walls; the bottom was hidden by ascending smoke and steam. The lower walls were hung with large masses of sulphur interspersed with icicles hundreds of feet long.

"The crater is about one mile across, and has the appearance of a large funnel whose sides are but little inclined, and the bottom not visible. There seem to be three distinct rings, which divide it into four zones, the largest being that nearest the mouth. From the summit, the City of Mexico, although over 100 miles away, was plainly visible, and, surrounded by lakes, as it is, seemed like a magnificent gem set around with pearls. The whole great Valley of Mexico can be seen at a glance. At our feet lay Ameca, over 30 miles distant, with its luxurious growth of tropical plants and orange groves and banana plantations, and on the right Puebla and the old cities of Chilulo and Tascalla, with their 365 churches and spires. The distant mountain of Orizaba, nearly 200 miles away, the snowy peaks of Melencha, the White Lady, and several others in the distance, stood arrayed before me. I felt fully repaid for my toil in having climbed the highest mountain in North America, whose summit is about 18,000 feet above the sea level."

AGRICULTURAL INVENTIONS.

Mr. William D. Ferguson, of Blue Mound, Ill., has patented an improvement in check-row corn planters of that class in which the seed-dropping slide receives motion from a rope stretched across the field, so constructed that they can be operated to drop the seed at uniform distances apart by means of a smooth rope.

Mr. Solomon P. Baughman, of Herring, O., has patented a simple device for regulating the depth of the furrow made by the plow. It consists of a clevis whose inclination is adjusted by a jointed screw on the plow beam.

A combined plant setter and fertilizer distributer has been patented by Mary I. Goldsmith, of The Plains, Va. The object of this invention is to facilitate the operation of setting tobacco and other plants, and applying fertilizers thereto.

Mr. John W. Witt, of Grenola, Kan., has patented attachments for connecting plows to sulkies which are so constructed as to be used with a right-hand plow and a left-hand plow, and which will allow the plow to work with entire freedom and to be raised and lowered as circumstances may require.

Mr. Henry Parker, of Gananoque, Ontario, Canada, has patented an improved potato digger so constructed as to raise the potatoes and soil from the ground, separate them, and deposit the potatoes upon the top of the ground at the side of the digger.

Mr. Lovell A. Richards, of Grayson, Cal., has patented an improved feeder for thrashing machines, so constructed as to feed the stalks of grain to the thrashing cylinder regularly and continuously, and to prevent the machine from being choked or jarred by irregular feeding.

Mr. Julius Hartmann, of New York city, has patented an improved reversible plow which is constructed so that it can be reversed at the end of the furrow, can be adjusted in height as may be necessary, and is provided with a carriage that can be adjusted in width to suit the furrows.

In potato diggers as commonly constructed scoops and vibrating screens have been used, but they have generally been only partially successful in separating the potatoes from the dirt, in consequence of the great accumulation upon the apron, which not only hinders the separation, but adds to the weight and draught of the machine. Mr. Henry Arnold, of Peru, N. Y., has patented a potato digger in which any accumulation of soil upon the screen or apron is prevented by commencing the separation at the moment the potatoes and dirt are taken up.

The Pressure of Wind.

In a paper before the American Society of Civil Engineers, Mr. C. Shaler Smith gives the results of many years' observations of wind pressure and its effects. He has personally visited the tracks of destructive storms as soon as possible after their occurrence, for the purpose of determining the maximum force and the width of the path of the storm in every instance. The most violent storm in Mr. Smith's records was at East St. Louis, in 1871, when the wind overturned a locomotive, the maximum force developed in so doing being no less than 93 lb. per square foot. At St. Charles, in 1877, a jail was destroyed, the wind force required being 84·3 lb. per square foot. At Marshfield (Mo.), in 1880, a brick mansion was leveled, the force required being 58 lb. per square foot. Below these extraordinary pressures there were sundry cases of trains blown off rails, and bridges, etc., blown down by gales of wind of from 24 lb. to 31 lb. per square foot. Mr. Smith observes that in all his examples he has taken the minimum force required to do the observed damage, and has considered this as the maximum force of the wind, although, of course, it may have been much higher. Some of the hurricanes were very destructive, the one at Marshfield having cut down everything along a path 46 miles long and 1,800 feet wide, killing 250 people. Mr. Smith has formed the conclusion that notwithstanding these examples, 30 lb. per square foot is sufficient wind pressure to allow for in a working specification. As reasons for this conclusion, Mr. Smith expresses doubts as to whether a direct wind or gale ever exceeds this pressure. Whirlwinds may exceed it, but the width of the pathway of maximum effort in these is usually very narrow. Mr. Smith has only found one example, already quoted, wherein the path of pressures over 30 lb. per square foot exceeded 60 feet wide. This pressure is in itself very unusual, and, referring more particularly to railway bridges, it is stated that a loaded passenger train will leave the rails at this pressure of wind, and consequently not much could be gained by making the bridge strong enough to resist a storm which would blow a train off it.

Clocks in the Earthquake.

The most curious circumstance connected with yesterday morning's earthquake was the stoppage of all of the pendulum clocks hanging against eastern walls, showing that the vibration was north and south. Clocks hanging against other walls were not affected. In the jewelry store of Charles Haas there is a calendar clock, which on Saturday night was about five hours fast. It was impossible to put the hands back without disarranging the gearing, and the only way in which it could be regulated was to turn the hands forward until they marked the right time. As this process required about 15 minutes, and was exceedingly tedious, Mr. Haas, when he left at 9 o'clock, stopped the pendulum, intending to regulate the clock on the following day. The earthquake saved him the trouble. When he came to his store yesterday morning the timepiece was ticking away like a pawnbroker, and what is still more remarkable, it was correct to a second. The town clock is propelled by a pulley and tackle, and consequently such a mild convulsion as that of yesterday morning did not disturb the serenity of its equanimity. The final cataclysm will probably set the old Janus-faced chronometer back a few moments, but earthquakes never will. No material damage was effected by the trembler, as far as we can learn, except the shattering of a few nerves and the loss of sleep attendant upon the excitement. The plastering of ceilings in several houses was badly cracked, crockery thrown from shelves, chimneys toppled from lamps, besides numberless unimportant occurrences of a similar character. At the jail, Officer Fields thought, upon awakening from a sound sleep, that the prisoners were trying to break out. The prisoners thought somebody was trying to break in.—*Stockton (Cal.) Independent, April* 11.

Explosion of Gas on Coal Ships.

There can scarcely be a doubt that many of the coal-laden vessels that annually leave our ports and are no more heard of are destroyed by explosions of gas. Therefore the caution which lately emanated from the Marine Department of the Board of Trade, and which appeared in our columns, pointed out the necessary measures that should be taken for preventing explosions of coal gas, as recommended by the Royal Commission appointed to inquire into the spontaneous combustion of coal in ships, should not pass unnoticed as such warnings usually do. But there are other considerations in connection with coal cargoes that shippers and captains should be acquainted with. There are some descriptions of coal that give off a great deal more gas than others, and consequently require more attention on a voyage. Soft, bituminous coal on its transmission from the colliery to a port, and then thrown down the hold of a vessel, is much broken, and getting to something nearly akin to slack, gives off the gas freely, while such would not be the case were the coal hard and in large lumps. Some vessels having cargoes of soft coal are more dangerous than a colliery, for, while the latter is ventilated by copious volumes of fresh air being sent to dilute the gases, the coal on board a ship is kept from the air, the hatches being fastened down as if they were for that express purpose. After being kept in that state it may be for weeks, something is required, the hatches are taken off, and the object is sought for with a light, at which the gas at once fires, dealing destruction around, so that not a vestige of the vessel may be left to tell of the catastrophe. There is also the spontaneous combustion of coal to guard against, and in respect to which we believe not much attention is paid, while some descriptions are liable to take heat and fire the same as is the case with hay-stacks at times.

One of the means recommended by the commission for ascertaining the state of a hold of a vessel having a heavy tonnage of coal was the use of the thermometer, so as to ascertain the temperature. For our part we think that the hatches should be frequently removed, and some means adopted for having communication with the coal lying at the top and intermediately to the bottom, so that the gas could find its way to the atmosphere, which it would do if it had the means and was not confined. But where the gas is pent up, especially as is the case where the coal is small, it only requires the means of escape and a naked light to lead to a conflagration that would soon destroy a vessel and everything connected with it. Ventilation is not more necessary in a mine than on board a coal-laden ship, so far as the cargo is concerned, and this should be strictly laid down by rules on the part of owners, for the danger resulting from the gas in coal, either from explosions or spontaneous combustion, are either not sufficiently known or sufficiently guarded against.—*Colliery Guardian.*

Testing Malts for Acidity.

At the risk of being charged with repeating in this column what has already been several times urged, we again draw the attention of brewers to this subject. The existence of abnormal acidity in malt is not only injurious in itself, but this very excess of acidity undoubtedly hastens changes in the resulting wort and beer, which tend to their ultimate destruction as drinkable fluids. From the commencement of the malting season till the warmer weather of spring sets in, the development of acidity in malts proceeds but slowly, but after April, and especially in malts which have been stored for some time, the amount of acidity will be found to have increased. To determine with accuracy the absolute quantity of acid in a sample of malt is an operation attended with some difficulty, and requires the skill and appliances of a practical chemist; but a valuable comparative test for acidity can be made by any brewer with but few appliances, and with but little knowledge of chemical manipulation. We say comparative test in contradistinction to an absolute test, because the former will really give the brewer all the information he requires; he wants to compare one malt with another, and he is generally able to fix his own standard of excellence. Therefore in testing malts for acidity (and the remark applies equally to other qualities) all that is necessary for the brewer to do is to submit them all to precisely the same treatment. Two infusions of the malt are prepared, one with cold water and the other at the average mashing temperature, say 160° Fah.; all samples to be tested must be treated in exactly the same manner as regards quantities, time, and temperature, and they are then passed through a filter paper, and the acidity determined in each by means of a standard alkaline solution, using delicate litmus papers as the indicator. It is not well to operate upon too small a quantity, and in practice 1,000 grammes to a liter of water will be found convenient. Every sample of malt must be crushed to the same state of fineness, and for this purpose an ordinary coffee mill answers admirably. The water used in making the infusions should be pure distilled water, unless a water of very constant composition, such as is supplied to London, is at hand.

The standard alkaline solution is best made with ammonia, and can be of any desired strength, but of course very dilute; it may be titrated so that every cubic centimeter corresponds to 0·01 per cent of lactic acid, but any other strength will do equally well, as the tests we suggest are only for the purpose of comparing samples of malt one with another. The acidity of the cold infusion gives the actual amount of acid existing in the malt, but that of the hot infusion gives, in addition, the amount of acid developed during the mashing process. From the experience derived in the examination of many hundred samples of malt, we are able to assert that the presence of an excessive amount of acidity in the hot infusion is an almost sure sign of unsoundness in the malt. The difference in the acidities of the cold and hot infusions ought never to exceed one-fourth of the acidity of the cold infusion; thus, supposing a malt gives a cold infusion requiring 20 cubic centimeters of the standard solution to exactly neutralize it, the hot infusion ought not to require more than 25 c. c. This method of comparative testing may also be extended to the color and gravity of the resulting worts, and much useful information as to the quality of the malt can thus be obtained.—*Brewers' Guardian.*

Overworking the Undeveloped Brain.

"Overwork," properly so-called, can only occur when the organ upon which the stress of the labor falls is as yet immature, and, therefore, in process of development. When an organ has reached the maturity of its growth it can only work up to the level of its capacity or faculty for work! Fatigue may produce exhaustion, but that exhaustion will come soon enough to save the organ. Repeated "efforts" may, under abnormal conditions, follow each other too rapidly to allow of recuperation in the intervals of actual exertion, and as the starting point will, in each successive instance, be lower than the previous state, there may be a gradual abasement; but even this process should not seriously injure a healthy and well developed organ. In short, a great deal of nonsense has been said and written about the "overwork" of *mature* brains, and there are grounds for believing that an excuse has been sought for idleness, or indulgence in a valetudinarian habit, in the popular outcry on this subject which awhile ago attracted much attention. Nevertheless there can be no room to question the extreme peril of "overwork" to growing children and youths with *undeveloped* brains.

The excessive use of an immature organ arrests its development by diverting the energy which should be appropriated to its growth, and consuming it in work. What happens to horses which are allowed to run races too early happens to boys and girls who are overworked at school. The competitive system as applied to youths has produced a most ruinous effect on the mental constitution which this generation has to hand down to the next, and particularly the next-but-one ensuing. School work should be purely and exclusively directed to development. "Cramming" the young for examination purposes [college students at this time of year take heed.—ED.] is like compelling an infant in arms to sit up before the muscles of its back are strong enough to support it in the upright position, or to sustain the weight of its body on its legs by standing while as yet the limbs are unable to bear the burden imposed on them. A crooked spine or weak or contorted legs is the inevitable penalty of such folly. Another blunder is committed when one of the organs of the body—to wit, the brain—is worked at the expense of other parts of the organism, in face of the fact that the measure of general health is proportioned to the integrity of development, and the functional activity of the body as a whole in the harmony of its component systems. No one organ can be developed at the expense of the rest without a corresponding weakening of the whole.—*Lancet.*

Vanadium Ink.

Berzelius found that by treating an infusion of galls by a solution of vanadate of ammonia, in place of sulphate of iron, he could produce an ink of remarkably good quality. At the time of his discovery, in 1831, it was of no practical interest, because the vanadates were very costly. At the present time their cost has been so much reduced that his recipe can be employed for ordinary inks, which have the additional advantage of presenting great resistance to most reagents and destructive materials. Gum arabic can be dispensed with, and the chance of moulding or alteration thus reduced.—*Chron. Industr.*

To Harden Finishing Varnish.

A newly varnished carriage is liable to spot. To prevent this, some wash the carriage two or three times in clean cold water, applied with a sponge instead of using a hose; this will help harden the surface, and prevent it, to some extent, from being injured by the mud or water getting splashed on the job. Never let mud dry on the surface, and then wash off expecting to see no spots on the varnish. You will certainly be disappointed, and the only way to remedy the evil will be to have it revarnished. Soft water is better than hard water for the washing of carriages, as the lime which is in the hard water is very liable to injure the varnish.

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. A. R. asks if either gun or powder is injured by leaving the gun loaded, the gun being the ordinary iron barrel. A. If the gun is not perfectly clean (freed from the remains of burnt powder) and well oiled it is not well to leave the charge in any length of time. 2. I want a simple test for cistern water to tell whether or not there is sewer poison in it. A. Dissolve in a pint of distilled water half an ounce of pure tannic acid and filter the solution through filter paper into a clean bottle. Dissolve in another pint of distilled water a quarter of an ounce of pure permanganate of potash, and filter into a clean bottle as before. Draw off two separate pints of the well water in clean clear glass bottles; add to one about two fluid ounces of the tannin solution, put a new stopper in the bottle, and set it aside for forty-eight hours. To the other sample add a few drops of the permanganate solution (just enough to impart a distinct pink tinge), and note the color fade out at once or on standing half an hour. Add to another sample of the cistern water a few drops of a filtered solution of a quarter of an ounce of pure nitrate of silver in a gill of distilled water, and note whether a white precipitate or an opalescent cloudiness forms immediately or on standing half an hour in the dark. If an appreciable quantity of sewage is present in the water the tannin will occasion a flocculent or curdy precipitate, at first a mere cloud, which finally settles to the bottom as a distinct precipitate. In the permanganate test the color imparted will soon fade out if it does not do so at once. The white precipitate or cloud forming on the addition of silver nitrate also indicates the presence of contaminating substances, especially if the other tests are positive. If the tannin and permanganate reactions indicated are marked the water is unfit for potable purposes.

(2) F. B. asks: How can I keep a tent made of thin cotton cloth from mildewing without coloring the cloth? A. Saturate the cloth first with a solution of soap and then with a strong aqueous solution of lead acetate or alum. Let it partially dry, then rinse with clean water.

(3) A. V. R. asks: Can you tell me of glue to use for cigarettes? I have used flour paste, but it is not quick enough. The glue must not discolor the paper, and when dry must not show. Could you inform me what is used by the manufacturers of cigarettes? A. Thick starch paste free from lumps and containing a trace of clove oil to keep it sweet answers admirably.

(4) H. C. F. asks for a receipt for packing eggs in summer to keep for winter. A. Dip the eggs in a solution of 2 oz. gum arabic in a pint of cold water, let them dry and pack in powdered well burned charcoal.

(5) C. H. H. asks how to make potash water glass? A. Potash water glass is prepared by intimately mixing two parts, by weight, of pure white silicious sand or clear quartz, and six parts of anhydrous carbonate of potash, all ground to a very fine powder, and melting the mixture in a large clay crucible at a bright red heat. Carbonic acid gas is given off rapidly, and as soon as this ceases and the mass is in a state of calm fusion it is poured out on an iron plate to cool. This glass dissolves readily in boiling water, and on cooling the solution a sirupy liquid is obtained. This is the potash water-glass referred to.

(6) C. J. H. asks (1) how aniline is prepared and shaped which is used with the indelible writing pencils. A. A mixture of chalk and kaolin is made into a stiff paste with a strong aqueous solution of aniline violet (or other soluble aniline dye) containing a little gum dextrine, pressed into shape and slowly dried. 2. How to make brass, such as is used for cheap rings and sleeve buttons, that will keep its luster and not make the fingers and cuffs black? A. We know of no practical way. 3. How celluloid is prepared and put on linen such as is used for waterproof collars and cuffs? A. Celluloid is composed of nitrocellulose or soluble cotton combined with camphor by means of strong pressure and heat, under which conditions it is quite plastic.

(7) A. K. asks: 1. Does water ever get too cold to freeze? If so, under what circumstances does it pass the freezing point without congealing? A. At a temperature of about 32° Fah. pure water congeals under all circumstances. 2. Is the sugar that is in the maple sap taken from the ground, or is it manufactured from the material taken from the ground by the organs of the tree? A. A portion of the substances of which maple sugar is composed is derived from the soil, and a larger portion from the air. The sap is formed by chemical reactions within the tree. 3. Will evaporation be more rapid if a lid be placed over vessel while boiling? A. No; the contrary.

(8) J. D. S. asks how to make brick burn a dark color. I have been using coal dust, which does not prove satisfactory. I have an amount of fire clay among the clay, which, when moulded, burns a very light color. A. Spray the clay while mixing with a small quantity of a solution of 1 lb. common green copperas in 4 gallons of water. Or use as a cheap substitute for this, ordinary acetate of iron liquor.

(9) J. S. H. writes: I have a large marble slab, with two large hair oil stains on same. What can I use to take out the oil or to make it all oil? Have tried several oils but with no effect? It has been on for six years, and has soaked through. What is a cheap way to fix it? A. Make dry slaked lime into a paste with one ounce of washing soda dissolved in half a pint of hot water. Rub this into the spots and let it remain on over night. Then wash off with clean water. Repeat if necessary.

(10) C. W. K. asks how to remove common black ink from parchment. A. Moisten the spots first with a strong solution of oxalic acid, then with a clear saturated aqueous solution of fresh chloride of lime (bleaching). Absorb excess of the liquids from the paper as quickly as possible, with a clean piece of blotting paper. Repeat the treatment if necessary, and dry thoroughly between blotting pads under pressure.

(11) C. L. asks: Can you tell me how to dissolve rubber so as to make rubber stamps? A. The rubber is not dissolved. See "How to Make Rubber Stamps," SUPPLEMENT, No. 83.

(12) H. E. writes: I have some receipts for making colored fires; among them are some articles termed meal powder and Chertier's copper. What are these substances? A. The first is gunpowder reduced to a fine flour; the second, fine copper filings made into a paste with an equal weight of finely powdered potassium chlorate and enough hot water, then thoroughly dried.

(13) W. W. asks about what steam pressure a mercury flask will stand. Will it be safe to put 40 to 50 lb. pressure in them? A. It will be safe at three times 40 or 50 lb.

(14) "Subscriber" asks: What would be the cheapest and best style to make a boiler for an engine 1½ inch cylinder, 3 inch stroke; whether upright or horizontal, and of what material? Also, would oil lamp or lamps give out sufficient heat, and what part of a horse would the above be? A. A vertical tubular boiler of iron. Petroleum or kerosene lamps might be arranged to heat it. Engine would be half horse power to one horse power, according to steam pressure and velocity at which it is run; 2 inches by 4 inches cylinder would be about double the power.

(15) C. E. T. asks: Is there any difference between the power required to punch a hole in iron one inch in diameter and one inch thick, and the power required to punch a hole two inches in diameter and one-half inch thick? A. According to the result of experiments, the power required for punching iron plates is directly as the area of the boundary of the hole, or as the circumference multiplied by the thickness.

(16) J. D. S. writes: My engineer and I are in dispute on the following points, and appeal to you for an opinion. We wish to draw water from a stream to the sugar house, four hundred yards distant. Have a Blake pump, and will use a three-inch iron pipe for the suction. From the level of the water to the pump is 20 feet perpendicular. From the level of the water to the top of bank, near the stream, is 22 feet. Now, will it be better to lay the pipe with a gradual fall throughout, from the pump to the water, or to make a perpendicular lift at the stream which will carry it over the bank, and then fall gradually back toward the pump, which is two feet lower than the top of the bank near the stream? My engineer says it should be put with the fall from pump to water, and use thin check valves in the length of the pipe. I hold the contrary opinion, and especially that more than one check valve is worse than useless, as it is only an additional weight for the pump to lift. He insists that he can, by laying a pipe as he says, and with several check valves, make a pump raise water forty feet perpendicularly with ease. A. If the pipe is tight, it makes little difference which plan is adopted. Your engineer is "all wrong" in saying that he can lift the water 40 feet by using a number of check valves. A multiplicity of check valves increases the difficulty.

(17) J. R. D. asks: 1. What is the best lubricant for two wood surfaces? A. Pure refined tallow or lard, with a little blacklead. 2. What is the formula for finding the theoretical horse power of a given head of water? A. One horse power is 33,000 lb. lifted 1 foot high per minute. For water power multiply the weight of water falling over the dam per minute by the amount of fall and divide by 33,000, the result is the theoretical horse power. When applied to water wheels the net power is from 60 to 80 per cent, according to the kind and perfection of the wheel.

(18) G. E. asks: How can I make the so-called liquid slating for blackboards? A. Shellac, 1 lb; borax, ¼ lb.; water, 4½ gallons. Heat the water to boiling, add the borax, and when this is dissolved gradually add the borax, and continue the boiling until the latter is dissolved; then introduce lampblack, 2 oz.; silicate of soda (a sirupy solution), 8 oz.; fine silica, 1½ lb. Stir well together and add enough hot water to reduce it to the proper consistence for use.

(19) S. C. D. asks if brass pipe for conducting water for domestic use would be safe; would water so conducted and at times standing in brass conducting pipes, be perfectly free from any poisonous or injurious properties, and positively safe to use? A. Brass is not a proper material for pipes conveying potable water. Water that has remained in such pipes for any length of time is not fit to drink or for cooking. Use iron or wood pipes.

(20) M. R. P. writes: I am painting with oil colors on gold and silver leaf. To preserve the brightness of the painting some kind of varnish is necessary. What kind can I use so as not to damage the gold or silver leaf? A. Photographer's clear plain collodion answers very well.

(21) W. H. B. asks: Is there anything that will neutralize the oxide of iron in glass sand, which in melting renders the glass dark colored and full of sand or small blisters? A. The introduction of a little oxide of manganese will improve though it will not eradicate the color. Fine glass cannot be made from such sand.

(22) G. M. P. asks: What is the proportion of coal to the amount of glass melted in the manufacture of glass table ware? A. In the old method of melting glass it required 1½ pounds of coal to melt a pound of glass; in Germany, where coal is expensive, the glass manufacturers claim to be able to melt a pound of glass with a pound of coal. There are glass melting furnaces running successfully in Pittsburg, which melt seven pounds of white glass for table ware with one pound of coal.

(23) E. W. M. asks: What is the nutritive value of fish as food as compared with other articles of flesh diet? A. According to Professor Atwater: Taking medium beef at 100, we should have, as the nutritive value of like weights of fish free from bone: Medium beef, 100; fresh milk, 23·8; skimmed milk, 18·5; butter, 124; cheese, 155; hens' eggs, 72; codfish, fresh, 68; flounders, 65; halibut, 88; lake trout, 91; eels, 95; shad, 99; salmon, 104; salt mackerel, 110; dried codfish, 346.

(24) R. H. asks: Are there any coal mines successfully worked under the sea? A. A number of English coal mines are being worked under the ocean. In Northumberland the net available quantity of coal under the sea is estimated at 403,000,000 tons, and on the Durham coast under the sea, including a breadth of three and a half miles with an area of seventy-one square miles, 734,500,000 tons. The latter mine is in a vein of an aggregate thickness of thirty feet, distributed in six seams.

(25) T. A. W. asks how much lap there is on the steam and exhaust valves of the Corliss engine; also, if there is any way of setting the valves except to take off the cylinder heads. A. The lap is different in the different sizes of engines and engines running at different velocities. You can set the valves by having the position of the openings and the section of the valve marked at some proper place on the outside.

(26) W. L. asks why the screw propeller is used in preference to the paddlewheel for ocean navigation. A. Because: 1. The machinery weighs less and occupies less room than for paddlewheels. 2. Its propelling power is not so much affected by the varying draught of water. 3. Its propelling effect is not reduced in a sea way and by the rolling of the ship, as is the case with paddle wheels. 4. It is much less liable to damage from heavy seas.

(27) J. B. asks if an engine of the following dimensions is well proportioned: Cylinder 7x20, with a two-flue boiler. What is the horse power of such engine and what sized boiler is required? A. Your proportions are very good, unless you wish to run at a high velocity, then a shorter stroke will be better. The engine, will develop about 23 horse power at 120 revolutions per minute. Boiler 38 inches diameter by 24 feet long, 2 flues 12 inches diameter. Of the speed of the engine is less than 120, a smaller boiler will answer.

(28) W. E. F. L. asks: What is the cheapest way to magnetize small steel bars to saturation? The bars are from 2 to 3 oz. in weight. A. You will find full information on this subject on page 379 (36), SCIENTIFIC AMERICAN, for December 11, 1880, vol. xlii.

(29) W. B. R. asks how to soften hard cast iron so that it can be filed and fitted easily. The castings we want to use are so thin that heating breaks them. A. The metal may be superficially softened by packing the pieces in dry oxide of iron or powdered hematite iron ore in an iron box, heating the whole to redness and keeping up the heat for twenty-four hours or more. The contents of the box must be allowed to cool down slowly

(30) T. M. inquires as to the action of glue on porcelain, when allowed to dry in a porcelain evaporating dish. The glue causes the glazing to crack and flake off. I placed some glue in a glass vessel, and found that when it solidified and contracted it caused the glass to flake. If this is a common case I have failed to notice it before. Is it due to mechanical action alone? A. The flaking of porcelain and glass surfaces by glue in drying has been frequently noted. The only requisite is that the glue be strong and hot and the vessel clean. It is due to mechanical action.—Your minerals were reported under appropriate headings in a recent issue.

(31) C. H. asks for a good work on amalgamating and milling. We are running over silver plated copper plates, using cyanide of potassium to clean with, but cannot get the plates in good order, the quicksilver running off. What should we use to prevent this? A. Consult Percy's "Metallurgy of Gold and Silver." Address the book dealers who advertise in this paper. Wash the plates with a strong hot aqueous solution of caustic potash. Rinse off thoroughly with water, then try the mercury, with a little dilute nitric acid if necessary, at first.

(32) J. H. asks: 1. Is it lawful for any one to make a patented article, without permission from the owner of the patent, providing the person makes it for his own use solely, and not to sell? A. Any one may make a patented article for experimental purposes, but not for actual use. See "Rights of Investigators," page 128, vol. xxxix. 2. What would be proper size, bore of cylinder, and stroke for engine of steam launch, 33 feet keel, 8 feet beam, to make seven miles an hour? A. 7 to 8 inch cylinder by 8 inch stroke. 3. The amount of pipe necessary to make a coil boiler for such an engine? A. There should be pipe enough in coil boiler to give not less than 300 feet surface.

(33) W. F. K. writes: I have a small stream of spring water about 20 inches square, or rather 20 square inches as it runs, that is 10 inches wide and 2 inches deep, could raise the head to 20 feet high. Would like to know the best water wheel to get, and what would be the greatest amount of power that could be got out of the water under a 20 foot head? A. We cannot tell anything about the power, as you do not give the quantity of water per unit of time. A turbine is the best wheel for you. Address dealers who advertise in our columns.

(34) M. F. J. asks: 1. Can a reliable watch be affected or made to go faster, on account of its owner taking shocks from a small induction coil? A. No. 2. Can an induction coil be compared to a dynamic machine for lights? A. No, it would be impossible to substitute one for the other. An induction coil is not adapted to electric light purposes.

(35) W. C. B. writes: I have tried to put up an acoustic telephone, from office to dwelling, distance about 200 feet, and cannot get it working satisfactory. There seems to be too much vibration or buzzing noise in the diaphragm, as though the words spoken could not get out fast enough. Will you please state through correspondence column, SCIENTIFIC AMERICAN, where the fault lies? My boxes are 6x6x6 inches, with drumhead diaphragm 6 inches square, forming a slight cone, with a cover over the front and around hole of 4⅝ inches in that cover, forming a small chamber in front of diaphragm of about half an inch. Back of diaphragm I have packed cotton to partly take away that vibration. I use common iron wire insulated with string (wire is about one-thirty-second of an inch thick), forming four right angles. Wire is moderately taut and does not touch anywhere but the diaphragm and strings to form the angles. There seems to be no difficulty as to quantity of noise; we can hear that very plainly 20 feet away from box; only as to distinctness, we have experimented every way, and cannot strike the right thing. A. Your diaphragm is too large. Make it from 2 to 2½ inches in diameter, of thin sheet iron (ferrotype plate) or tin, and turn your corners with an angle less acute than a right angle; that is, use two or three suspenders at the corners instead of one.

(36) Dr. N. J. S. writes: When sheets, handkerchiefs, and other linen or cotton fabrics are soiled with vaseline, and afterwards washed in soap suds or boiled in lye, the stain disappears. When the articles are ironed, however, the heat causes the stain, which looks like a grease spot, to reappear. Neat patients complain that their bed linen and clothing is thereby rendered unfit for use. What is the remedy? A. The best way is to put the stained pieces to soak for ten or fifteen minutes in a quantity of deodorized benzine (a common commercial article) sufficient to completely cover them. Wring out and hang up the pieces for about ten minutes, when they will have dried sufficiently to put in the soap suds.

(37) J. A. D. writes: I have a Niagara pump, 4 inches suction and 2 inches discharge, and I cannot make it pump hot water. It pumps cold water all right. Can it be made to pump hot water? The valves and rings are all metal. The heater is an old boiler (with the flues taken out and the ends closed up), 24 feet long, 40 inches diameter, and the exhaust goes through it. Cold water is pumped into the heater with a Blake pump. The heater sits 4 feet above the pump, and it is to supply seven boilers 25 feet long, 40 inches dameter, with two flues carrying 90 lb. of steam. As soon as the water gets hot in the heater, after running half an hour it pounds bad and blows out the packing from the water cylinder. I took off the air chamber, and it worked a little better, but not much. A. The hot water produces a vapor in the pump which prevents the valves from acting, especially if there are large vacant spaces in the pump; it would work better if the tank were 10 or 12 feet or more above the pump instead of 4 feet; any good force pump will pump hot water if the supply of water is a good height above the pump. Write the manufacturers of your pump.

(38) H. O. asks how to charge horseshoe and bar magnets. A. The quickest and best way to magnetize steel bars is to place them centrally in a suitable coil, and then connect the helix with the wires from a dynamo-electric machine or powerful battery for a few seconds, remembering to break the current before removing the magnet from the coil. If the source of the current is a dynamo machine, the coil should be about 2½ inches long, and should consist of ten or twelve layers of No. 12 magnet wire. If a battery is used, a coil 1½ inches long, composed of fourteen or sixteen layers of No. 16 magnet wire, will be the best. The internal diameter of the coil should be only large enough to admit the bars easily. A battery of six Grenet elements, each having an effective zinc surface of 30 square inches connected in series, will do the work very well on small magnets; such, for instance, as are used in telephones. Where a number of magnets are to be made at one time the bars may be passed in a continuous line through the coil, always keeping three bars in contact end to end, adding one above the coil before taking one off below. In this manner sixty bar magnets have been strongly charged in ten minutes. Horseshoe magnets cannot be charged so readily. There are two or three ways of charging them. One way is to place them in contact with the poles of a very strong electro-magnet, removing them after breaking the current; another method is to place each limb of the magnet in a coil adapted to the current to be used; and still another method is to employ a single coil, inserting one pole of the magnet into the coil in one direction, thus breaking the current, and inserting the other pole into the coil from the opposite direction. It is well to remember that the magnet will be very much impaired if the current is not broken before removing it from the coil. The secret of success in charging magnets is to have a strong current. It is impossible to make magnets satisfactorily without this all-important requisite. As to the quality of steel best adapted to this purpose, machinery steel, hardened and not tempered, answers admirably. For horseshoe magnets German spring steel is the best. Tool steel answers well if hardened and drawn to a straw color. The steel receives its maximum charge almost instantly. It is useless to allow it to remain under the influence of the magnetizing current more than a few seconds.

(39) E. R. T. asks how to make pure oxygen gas. A. Mix pure crystallized potassium chlorate with about one-quarter its weight of pure black oxide of manganese, and heat the mixture in a copper retort, with large delivery tube, until the gas begins to come over. Conduct the gas through a large empty bottle (to avoid accident by back pressure), then through a strong solution of iron sulphate (copperas), and then through an iron tube several feet in length, filled loosely with fresh quicklime in granular lumps (free from dust). Collect in a rubber bag. An ordinary mouthpiece answers well enough if the air from the lungs is expelled through the nostrils, or so as not to contaminate the contents of the bag. The heat should be continued under the retort with caution to avoid too rapid a disengagement of the oxygen until no more gas comes over.

(40) O. E. C. asks for a receipt for whitewash for out-of-door work. A. For brickwork exposed to damp take one-half peck well burned quicklime, fresh from the kiln, slake with hot water, enough to reduce it to a paste, and pass it through a fine sieve; add a gallon of clean white salt which has been dissolved in a small quantity of boiling water, and a thin smooth paste, also hot, made from 1 pound fine rice flour; also one-quarter pound best white glue, made in the water bath. Mix together, stir well, and one-quarter pound best Spanish whiting in 5 quarts boiling water, stir, cover over to retain heat and exclude dust, and let it stand a week. Heat to boiling, stir, and apply hot. The above proportions will cover 40 square yards. 2. Also the best way to refine cider for family use? A. See pp. 394 (7) and (15), vol. 39, and 399 (24) and 28 (46), vol. 38, SCIENTIFIC AMERICAN.

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

F. C. R.—Iron pyrites—sulphide of iron—contains traces of gold.—A. M.—A variety of bituminous coal containing much sulphur.—E. S. H.—1, Encrinites or stone lilies. 2. Niagara limestone. 3. Fibrous talc. —R. McA.—A variety of fine silicious clay.

COMMUNICATIONS RECEIVED.

On the Mound Builders. By W. O. C.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

May 10, 1881,

AND EACH BEARING THAT DATE

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of an 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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Cards, exhibition, E. S. Boynton, Bridgeport, Conn.
Car wheels, E. L. Taylor, Philadelphia, Pa.
Electric light (2), T. A. Edison, Menlo Park, N. J.
Harvester, S. D. Maddin, St. Paul, Minn.
Lacing hooks, G. W. Prentice, Providence, R. I.
Middlings purifier, Christian Bros., Minneapolis, Minn.
Ore crusher, P. W. Gates, Chicago, Ill.
Ores, desulphurizing, F. W. Wiesebrock, New York city.
Paper folding machine, W. C. Cross, Boston, Mass.
Refrigerator, pneumatic, M. J. Klein, New York city.
Rotary engine, H. Thibault *et al.*, San Francisco, Cal.
Separators, J. Sternberg, Boulder, Col.
Springs, car, B. S. Clark *et al.*, New York city.
Sugar, manufacture of, A. Brear, Saugatuck, Conn.
Terra cotta blocks, manuf. of, A. Reeve, Camden, N. J.
Zinc pigment, white, J. Cawley, Newark, N. J.

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Siphons.

At a recent meeting of the Polytechnic Association of the American Institute the president, Mr. T. D. Stetson, detailed some experiments which he had recently made.

The ordinary siphon, consisting of a simple bent tube, acts by the difference of length of the two columns of liquid. There is a tendency to form a vacuum at the top of the tube. The superior gravity of the longest raises the shorter column by the atmospheric pressure. The partial vacuum results in the liberation of the small quantity of air always contained in the water, and the formation of what is known as an air trap.

In attempting to avoid this difficulty by the use of a large vessel or air receiver some curious results were obtained.

The first object was to make a self-emptying air chamber. The plan adopted to accomplish this result was to carry both pipes into the air chamber, and take one to the very top, where it was turned over in such a way as to make a fall of water through the air space when the siphon was in operation. This plan would in all probability be successful in a perfectly constructed apparatus. In order, however, to observe the operation, Mr. Stetson had made the air chamber of glass, and he found himself unable to preserve a perfectly tight joint sufficiently long to determine the question definitely.

A siphon having a large chamber at the bend, into which one pipe enters at a much higher level than the other, he found developed, with just sufficient air inclosed, the very unexpected property of acting like a check valve. It opposes a greater resistance to the passage of water in one direction than in the other—the difference in resistance depending on the difference of area between the water surface in the chamber and that in the pipe entering at the highest level. In draining marshes on a large or small scale, in draining any area subject to tidal fluctuations or fluctuations from freshets, especially in connecting a cellar drain with the sewer where the sewer is liable to rise and make a back-flow under extraordinary circumstances, this offers a valuable means for opposing the return flow of the water. By properly proportioning the chamber to the pipe, the excess of head necessary to force the water through the wrong way could be made almost anything we please.

Mr. Sutton said that siphons are very interesting pieces of apparatus and work very curiously. In the early days in California, where capital was abundant but the means limited, siphons were often used to drain mines in the gravel, especially when they came to the bed rock, and tunnels would be necessary to drain the water off in the ordinary way from a rock basin. In such cases the siphons were used to take the water over the "rim of the bed rock."

These siphons almost always stopped working after a little, from an accumulation of air in the bend. They always stopped, in fact, save when they were put in by experienced men. The speaker then detailed an instance where he put in a siphon going over a rim of rock some 150 feet in length. The outside end was of iron pipe, but the inside end was rubber hose. As the works were carried further in, some 250 feet of rubber hose was added; the head being very small, there was but slight tendency to collapse. At each end a stop valve was placed, and at the highest point there was an air chamber. This was formed of an empty whisky cask, which was a thing easily got and adapted to the purpose. The cask and siphon were filled through a tunnel at the top, the valve on the top of the cask was then closed and the others opened, and the siphon would commence to work. It was necessary to have two valves, one at each end of the pipe, because at that time they could not buy in San Francisco a pump capable of filling the pipe. At night the whole was shut off, and in the morning it was started long enough before work began to properly reduce the water level. The air chamber would fill with air in about two hours, but just before it was supposed to be filled the valves were shut and the barrel filled up again with water through the tunnel.

ATTRACTIVE SUBURBAN RESIDENCES.

Very much has been done by our architects and builders during recent years to develop artistic individuality and home-like attractiveness in the construction and surroundings of suburban residences of the more expensive sort. Yet it is still too much the fashion to carry into semi-rural neighborhoods, where ground space is reasonably cheap, the unbroken blocks of houses characteristic of the city, and made necessary there by the high cost of land.

The outskirts of our cities, where garden and lawn spaces are not luxuries beyond the means of the moderately well-to-do, show a serious lack of dwellings intermediate in character between the city block and the detached residence, though the need of such homes must be wide and urgent. When the average business man seeks a home at a distance from the center of traffic, he does not want to find it in a row of houses which might as well have been planned for and set up in the heart of the city. Though unable to own or hire a detached house, he is not unwilling to pay for a reasonable amount of land not built upon, provided it is properly used to enhance the beauty and healthfulness of his home. For such reasons we are inclined to think that there is a large opportunity for capitalists and speculative builders to make good investments in dwellings of the class described, in many suburban localities made accessible to the business men of New York and other cities, by the increasing means of rapid transit everywhere prevailing.

The accompanying illustration, showing the elevation and grounds of a section of three villas, from a block of nine residences in Hanover, Germany, gives a good idea of what the suburban homes we have in mind might look like.

The second engraving shows the plans of the main floors, and the artistic manner in which the grounds are laid out. With such changes of plan as would be required to adapt them to the needs of American households, such dwellings, we believe, would sell readily or rent to desirable tenants at rates that would make them as profitable to the builder or owner as delightful to the occupants. In size the houses are well suited for the majority of well-to-do American families, such for example as make up a large part of the population of Brooklyn; and their architectural beauty speaks for itself. The cost of the houses need not be great;

[*Continued on page* 402.]

SUGGESTIONS IN ARCHITECTURE.—GROUP OF ORNAMENTAL VILLAS AND GROUNDS.

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PRINTING INK.

A few years ago the preparation of printing ink was considered a part of the printer's trade; now there are very few printers who have more than a remote idea as to the composition or preparation of the inks they use.

The manufacture of such inks has of late years developed into a distinct industry, employing hundreds of thousands of dollars capital, and turning out hundreds of tons of ink annually.

The basis of all ordinary printing inks, from the cheap poster and news to the finer lithographic and plate inks, is a varnish, prepared from oils, chiefly linseed, although nut oil is sometimes used, and rosin oil frequently introduced in the cheaper grades.

Where linseed oil is used this *varnish* is practically anhydride of linoleic acid, the fatty constituents of the oil—glycerine, palmatine, etc.—having been volatilized by heat. For the better class of inks old oil is preferred. It is usually purified by heating it for several hours by injected steam or otherwise, with oil of vitriol (sulphuric acid) diluted with about three times its weight of water. The acid solution having been drawn off the oil is washed by agitation with boiling water, and, after standing to allow the latter to separate, is run off into storing vessels. From these the oil is transferred to iron caldrons provided with stirring apparatus and covers. A moderate fire in a small furnace beneath gradually heats the oil, which only half fills the vessel (to prevent accident by foaming) and the stirring apparatus is set in motion. The moisture in the oil is gradually dissipated, and as the temperature approaches 570° Fah., an inflammable vapor or smoke begins to escape from the boiling oil; a scrap of burning paper secured in the cleft of a long stick is thrust into the smoke, which is thereby ignited. The fire below is drawn and smothered; the oil, or rather the gases given off by the oil, are allowed to blaze, the combustion being kept within bounds by partly covering the pot if necessary. Samples of the oil are taken out from time to time and tested by cooling a few drops on a plate of glass or tile. When the drops thus chilled glaze over quickly and draw out into strings of about half an inch between the fingers, the flame is extinguished by putting the cover tightly over the pot. The oil is then again heated over a moderate fire to the boiling point, and the heat and stirring kept up for several hours, small quantities of drier being introduced by some manufacturers.

Varnishes of several degrees of thickness—from greater or less boiling—are prepared in this way to satisfy the requirements of the different kinds or grades of ink, and to modify their consistence to suit the climate where used, thinner ink being required in cold than in warm climates.

For black letter-press ink the color and character are usually imparted to the varnish by the incorporation with it of lampblack or carbon black, Prussian blue, indigo, resin, and soap. The proportion of these vary according to the purpose for which the ink is intended. The following will serve as an illustration of the composition of a good letter-press ink: Varnish (prepared as above), 1 gallon; resin, 4 pounds; brown resin soap, 1¼ pounds; purified lampblack, 5 pounds; Prussian blue and indigo, each 1¾ ounces.

In compounding the ink the resin is finely powdered and gradually stirred into the varnish, made hot enough to melt and dissolve it. The soap, previously cut into thin slices, dried, and rubbed into fine crumbs, is next introduced, a very little at a time, as the moisture it still retains is apt to occasion a violent commotion as it is driven out by contact with the hot varnish. The addition of soap to printing ink increases the sharpness of the print and tends to prevent smearing or clouding of the work. The mixture, after cooling somewhat, is poured over the lampblack, and finely powdered blue pigments placed in the bottom of a suitable vessel, and the whole is well stirred together and then ground in a paint mill until reduced to a very fine, smooth, and uniform paste.

The quality of such inks depends largely upon the thoroughness with which the pigments are incorporated with the paste by grinding.

Lithographic inks are simply very fine printing inks made somewhat more fluid than required for letter-press or cut work. The ink used for engraved or plate work is usually a heavy printing ink made with ivory black, or ivory and carbon blacks, instead of lampblack.

Colored printing inks are made from fine, clear linseed oil, boiled into a varnish as above described, and appropriate pigments. The pigments used are carmine, lakes, vermilion, red lead, Indian and Venetian reds, chrome yellow, chrome orange or red sienna, gallstone, Roman and yellow ochers, verdigris, indigo, Prussian blue, Antwerp blue, ultramarine, luster, umber, sepia, and various mixtures of these.

A very fine printing ink may be prepared without burning, and the risks attending boiling oil may be avoided, by using the following receipt: Balsam of capivi, 9 ounces; resin soap, dry, 3 ounces; lampblack, purified, 3 ounces; Prussian blue, 1¼ ounces; Indian red, ¾ ounce; creosote, 3 drops. Grind all together on a stone slab, with a muller, to a very smooth and uniform paste. Any of the colors above enumerated may be substituted for the lampblack and other pigments in the above formula to produce colored inks.

In Germany an ink, prepared as follows, has been used, and is said to yield a very clear and fine impression when properly prepared: Venice turpentine, 2¼ ounces; soap, in thick paste, 2½ ounces; olein, rectified, 1 ounce; carbon black, 1¼ ounces; Paris blue, ¼ ounce; oxalic acid, ⅛ ounce; water, ¼ ounce.

The three last ingredients are mixed into a paste. The turpentine and olein are mixed at a gentle heat, the soap and carbon then introduced, and, after cooling, the blue paste is added, the whole being ground beneath a muller to a very fine and smooth paste.

The following are patented inks: Colophonic tar, 14 pounds; lampblack, 3 pounds; indigo, 8 ounces; Indian red, 4 ounces; yellow resin soap, 1 pound.

The colophonic tar referred to is the residuum from the distillation of rosin for rosin oil.

Linseed oil, 40 gallons; litharge, 4 pounds; lead acetate, 2 pounds.

The oil is heated to about 600° Fah., for from forty-eight to sixty-five hours according to quality of varnish required, the lead salts being added as driers. To each gallon of this varnish, 4 pounds of gum copal is added and dissolved. For common news ink the proportions are as follows: Of the above varnish, 15 pounds; rosin, 10 pounds; soap, brown resin, 2 pounds; lampblack, 5½ pounds.

A fine ink, suitable for use with rubber type, is prepared from nigrosine, soluble, 1 ounce; glycerine, pure, 4½ ounces; soap, white curd, ¼ ounce; water, *q. s.*

The nigrosine, finely powdered, is mixed into a stiff paste with the water, hot, and after standing a few hours this is mixed with the glycerine and soap, and the paste rubbed down with a muller on a hot stone slab.

For colored inks of this description the nigrosine may be substituted by almost any of the soluble coal tar dyes.

THE PROBLEM OF HEALTHY WATER.

Much complaint has arisen within the last two months, in this city, about the quality of the Croton water. It was alleged that it had a fishy taste that was far from agreeable, and apprehensions were expressed that it might be unfit for use. The Board of Health promptly had it analyzed and published the results. They were reassuring, and the public were told that they could drink all they desired with impunity. While this assertion was made on the strength of the analysis, it was fortified by the fact that no disease had been traced to the Croton, although it had been complained of for several weeks before the publication of the analysis. The timely investigation seems to have quieted the alarm, and in this way probably considerable good was done. Whether it proved anything concerning the water is another question.

A chemist or scientific man who takes the position of a non-alarmist where he can at all conscientiously do so, does much better than one who raises the cry of danger on a small provocation. This last has been done recently at the meetings of a certain social science association in the matter of adulteration. A certain person gave a formidable category of substances used for the purpose. It did not matter to him that some of the adulterants were more expensive than the original substances; he put them down in his list just the same.

But the question we are thinking of is whether the analysis proved that the Croton water was good. Water analysis is simple enough in its practice, but what is the verdict as to its value? Where it is necessary to know if water can be used for a steam boiler the determination of its solid mineral constituents can be made close enough without trouble. Even in this determination of the total mineral matters there are difficulties as yet unsolved. After the water is evaporated to dryness the organic matter is disposed of by ignition. In this ignition, however, some of the nitrates and carbonates present will be decomposed, and cannot be restored to precisely their original state. No question on its face seems simpler and is so hard in reality. Still, it can be done closely enough for practical purposes.

A reliable determination of the character of the organic matter, which was the vital point in our case, is unknown. All authorities admit its difficulty. Those who have their own methods uphold them, but still consider it an intricate question. The total nitrogen and albuminoid nitrogen found by the methods used by Dr. Waller are of value to a limited extent only. Water of a most dangerous character might pass the ordeal of such an analysis much better than a safe fluid. The above tests in this case had a certain comparative value, as they were made in a regular series of Croton water analyses. It is from this point of view that they appear best. We do not doubt that on inquiry it would be found that it was their comparative value that the analyst would most insist on. It is easily conceivable that a water from the same source might acquire an additional amount of dangerous impurity and suffer a greater loss of innocuous organic substance at the same time. In such a case it would analyze better. It would have less organic matter and less nitrogen of both types. Yet it would be more dangerous, and the comparative value of the analysis would be *nil*.

The dreaded impurities are the fermentable substances and living organisms, or rather germs. Some years ago a simple test for urea, founded on its fermentation, appeared in our scientific journals. It was suggested as useful to distinguish contaminations of water with coal gas liquor and sewage respectively. Both these substances produce or contain ammonia, so that a test to distinguish the origin of that ammonia was very desirable. Here is a hint of what would be a grand achievement in water analysis; a reliable and practicable determination of the fermentable constituents. By the use of different reagents they might be distinguished from each other, just as the ammoniacal contamination due to gas liquor was distinguished from that due to

sewage in the case just mentioned. Any animal or vegetable forms, too, might be classified into harmless and harmful ones. This would be the basis of a germ analysis.

The first of these suggestions may be carried out in the future, but so far it has not been realized. It is fraught with difficulties, among others the dilution in the water, and the easy destruction in laboratory operations of the substance.

The microscopic examination can, however, be even now conducted with some intelligibility, and might be made to yield valuable results.

Some authorities claim that a simple determination of oxygen required to oxidize the organic matter is enough. Others say the total organic matter is the essential thing. Some prescribe an analysis by combustion of the organic matter; others a determination of the two nitrogens or ammonias, total and albuminoid, in the wet way. "Where doctors disagree who shall decide?" says the proverb.

The problem is stated. A real valid method for the analysis of water is the want. The disagreement of experts among themselves proves that all must be dealing in uncertainties. Chemists would like nothing better than to see the vexed questions of their profession settled. They do not like uncertainties. They all wish to be positivists in science. In all the field of analytical chemistry there is hardly a more puzzling question than the above.

GEORGE STEPHENSON.

The centenary of the birth of George Stephenson, "the father of railways," was celebrated in England, June 9.

Stephenson was born at Wylam, eight miles from Newcastle-on-Tyne. His father was fireman at the near by colliery engine house. His mother was the daughter of a dyer. At eight years of age Stephenson herded cattle for a neighbor for a shilling a week, part of his duty being to shut the gates of the tramway from the pit, when the wagons passed, to keep the cows from straying. One of his early amusements was the modeling of an engine and winding machine like the one his father tended. At fourteen he was made assistant fireman, earning one shilling a day. Three years after he jumped his father's position and became engine man. At this time he could neither read nor write, but he knew his engine and critically studied its construction and working. About this period an old Scotch schoolmaster helped him to overcome the mystery of letters. At twenty-one he married, and after the birth of his son Robert, a year later, he removed to West Moor Colliery, Killingworth, where his wife soon died. For distraction in his bereavement he went to Montrose, Scotland, to superintend the working of a Boulton and Watts engine. He found the engine out of gear and the works choked, but soon had matters straightened and the machinery in proper working order. A year later his father was blinded by an accident; he was drawn in the militia for the Continental wars, and his prospects looked dark enough. To relieve his father's destitution and purchase exemption from army service used up his scanty savings, and he seriously contemplated emigration as his only chance for success in life.

The question of steam transit was becoming prominent during the early years of the century, and naturally enlisted the attention of Stephenson. The early locomotive makers contemplated engines for hauling wagons over common roads only; but Stephenson—thanks, no doubt, to his early observation of the advantages of rails while gate closer and cattle herder—foresaw that the road of the future must be a railroad, and planned his first locomotive accordingly.

In the fall of 1822 he constructed for the Hetton Colliery Company a short railroad, upon which, on the 18th of November, his locomotive hauled a load of sixty-four tons at the rate of four miles an hour. This demonstration of the feasibility of railways led at once to the Darlington and Stockton railway project, which won for Stephenson in Parliament and elsewhere the reputation of being a maniac leader of lunatics and fools. In spite of opposition the road was opened for traffic September 27, 1825, with Stephenson as engine driver.

The subsequent battle of the railway for leave to be, and of the locomotive for toleration after the railway was grudgingly accepted, is familiar history. No man ever fought a grander fight against popular and professional prejudice and ignorance, or developed in the fight a manlier character. His mental capacity rose with every great emergency, while his native shrewdness and solid sense ever kept him from undertaking the really impossible or impracticable, however extravagant or absurd his projects may have seemed to men of smaller capacity. What he knew he knew by personal mastery, not by hearsay; and without presumption or arrogance he was able by sterling intellectual power and sure-sightedness, backed by the hardest of hard work, to demonstrate the correctness of his ideas and to accomplish undertakings which involved the severest problems of railway engineering.

The moral of his life is clear, and should be pondered by every young mechanic. There is no condition in life, however hard or humble, which may not furnish the stepping stones to the most successful career. Had Stephenson been surrounded by wealth and educational privileges in early life, he might still have become a great man; but lacking his special experience as tramway gate tender and engine tender, dreary and discouraging as it may have seemed at the time, it is hardly possible that he would ever have been the pioneer of one of the most important and influential social and industrial movements of the race.

TWO RECENT BOILER EXPLOSIONS.

We give on another page an illustrated report of the recent explosion in New York harbor of the boiler of the steam tug Jacob Brandow on the 2d of June. The engineer, William R. Card, lost his life, and his son, John Card, the fireman, was badly scalded. The cause of the catastrophe is plainly shown in the report of our expert, namely, bad construction of the water leg of the boiler, from which leakage and corrosion ensued.

The boiler explosion which took place at the dye works of Messrs. Gaffney & Co., Philadelphia, on the 1st of June, resulting in the death of three persons and the destruction of buildings, has caused considerable comment among steam engineers. This boiler was one of a nest of three, was of the ordinary cylindrical type, 30 feet long, 36 inches diameter, with flat cast iron heads, having a large central man hole in the front head. The Hartford Boiler Inspection and Insurance Company had examined the boiler not long prior to the explosion, and pronounced it perfectly safe for the work and pressure required.

From the evidence before the coroner's jury it would seem the safety valves were set to blow off at 60 lb., and usually did blow at about that pressure, or not exceeding 62 lb. But precisely what the pressure was at the time of the explosion does not appear. The explosion lifted the boiler from its place and sent it like a rocket over into the next block, where it landed without particular injury to its shell.

The front cast iron head was found broken into several pieces, the lines of fracture radiating from the man hole. This seems to indicate that it was the weakness of the cast iron head that caused the mischief.

The testimony of several experts was introduced before the coroner's jury, showing that flat cast iron heads, although extensively used, are necessarily unsafe and dangerous, as they are apt to have hidden flaws; and one of the experts, Mr. Le Van, expressed the opinion that the two remaining boilers, which are of similar construction, are liable to blow up at any moment for the same reason, namely, cast iron heads. On this evidence the jury went the whole figure, and censured the Hartford Inspection Company in the strongest terms, declaring that its agents were negligent and incompetent when they inspected and certified that this boiler was safe.

We have in type for our next number a full report of this explosion, with engravings taken from photographs, which will very fully set forth the nature of the catastrophe, and perhaps afford some useful suggestions for the guidance of engineers and inspectors.

CONCENTRATING OR STORING UP ELECTRICITY.

Several years ago M. G. Planté, of France, made a secondary electrical battery, in which the electrical power of several ordinary cells could be concentrated or stored up within one cell, and the electrical force so gathered could be used when wanted. This battery consisted of two electrodes made of sheet lead, separated by strings of rubber, and placed in dilute sulphuric acid.

To charge this battery its poles were connected with an ordinary Bunsen or Daniell cell. During the operation of charging, one of the electrodes oxidizes, a brown coating of peroxide of lead soon showing itself thereon, and the metallic appearance disappears entirely; the other electrode also changes in appearance, its surface becoming covered with a powdery gray coating. When thus charged the secondary battery was capable of delivering an electric current of very much greater force than an ordinary cell of same size. This secondary battery is capable of charge and discharge indefinitely. M. Faure has lately improved upon the Planté battery, by painting the lead sheets with red lead. Simple as the improvement is, the resulting effects are quite remarkable, the storing capacity and delivery of the battery being greatly increased. The chemical action that takes place is substantially the same as in the original Planté battery.

It is stated that one of M. Faure's secondary batteries, weighing 165 pounds, is capable of delivering a force equal to one horse power during a period of one hour. If this is so it would bring the weight of an electromotor and battery of one horse power within a gross weight of 200 pounds, and suggests, as one of the possibilities of the new discovery, the production of a carriage propelled by electricity, convenient and economical in use.

For the benefit of those who desire to try this interesting electrical contrivance, we give on another page an illustration in explanation of some recent impromptu experiments on the subject lately made in our office. Any intelligent person who has at hand a few sheets of lead may readily construct the new battery.

Professor Sir William Thomson, of Glasgow University, who has lately experimented with these new batteries, mentions the use of one of the cells, weighing 18 pounds, which Professor George Buchanan took with him in his carriage and successfully employed in removing a tumor from a child's tongue by heating a platinum wire. To have accomplished the same effect by the ordinary electrical means would have required the setting up of several voltaic cells, and involved much inconvenience. Professor Thomson anticipates that this method of storing electricity will have many practical uses. He speaks as follows:

"The largest useful application is waiting just now for the Faure battery, and I hope that a very minimum time will be allowed to pass until the battery supplied for this application is to do for electric light what a water cistern in a house does for an inconstant water supply. A little battery of seven boxes suffices to give the incandescence in the Swan or Edison lights to the extent of one hundred candles for six hours without any perceptible diminution of brilliancy. Thus, instead of needing a gas engine or steam engine to be kept at work as long as the light is wanted, with the liability of the light failing at any moment through the slipping of the belt or any other breakdown or stoppage of the machinery, and instead of the wasteful inactivity during the hours of the day or night when the light is not needed, the engine may be kept going all day and stopped at night, or it may be kept going day and night, which undoubtedly will be the most economical plan when the electric light comes into general enough use.

"Another very important application of the accumulator is for the electric lighting of steamships. A dynamo-electric machine of very moderate magnitude and expense, driven by a belt from a drum on the main shaft, working through the twenty-four hours, will keep a Faure accumulator full, and thus, notwithstanding the irregularities of the speed of the engine at sea, or the occasional stoppages, the supply of electricity will always be ready to feed the Swan or Edison lamps in the engine rooms and cabins, or arc lights for the mast-head, and red and green side lamps, with more certainty and regularity than have yet been achieved in the gas supply for any house on *terra firma*."

American Science Association.

The Thirtieth Annual Meeting of the American Association for the Advancement of Science will be held in Cincinnati, beginning August 17. It is expected that the changes in the constitution proposed at Boston last year will be ratified, and the association reorganized in eight sections of equal standing, each having its own presiding officer, secretary, and committee. The proposed divisions are:

Section A—Physics; Section B—Astronomy and Pure Mathematics; Section C—Chemistry, including its applications to Agriculture and the Arts; Section D—Mechanical Science; Section E—Geology and Geography; Section F—Biology; Section G—Anthropology; Section H—Economic Science and Statistics. Also, I—A Permanent Subsection of Microscopy.

Arrangements are to be made for excursions of the anthropological section to some of the prehistoric mounds and relics in Ohio, including Fort Ancient, at Madisonville. The headquarters of the association and the offices of the local committee will be at Music Hall.

Through Railway Connection Under New York.

A company has been organized to connect by a tunnel railway the Hudson River Tunnel and the railroads which enter the city from the north and east by way of the Fourth Avenue improvement. The route will be from the outlet of the Hudson River Tunnel, under Wooster Street and University Place, to Fourteenth Street, thence by a curve under that street to Fourth Avenue, under which it will run to Forty-second Street. It is to be a double track road at least eighteen feet below the surface. The object is to carry freight and ultimately passengers under the city to New Jersey, so that cars may run direct from Boston or Montreal to New Orleans, Charleston, and other Southern cities without the annoyance and delay of a New York transfer.

Asbestos in the Black Hills.

Among the new discoveries made within the past few months is a large body of asbestos. This was discovered by Mr. T. B. Leavenworth, about six miles from Deadwood City. The croppings can be traced for nearly three hundred feet, while a large body of it has already been unearthed. Tests have been made which prove that this body of asbestos is equal to any yet discovered in America. It may be that this mineral will not come into immediate use, adds the *Pioneer*, but the day is not far distant when it will become an article of export from the Hills.

New Remedy for Baldness.

In cases of confirmed baldness the new remedy proposed is to remove the scalp, bit by bit, and substitute, by skin grafting, pieces of healthy scalp, taken from the heads of young persons. The success which has heretofore attended operations of this nature in cases of scalp wounds gives a promising outlook for this new mode of curing baldness; and perhaps the day is not far distant when the shining pates of our venerable fathers will bloom with the flowing locks of youth.

The Largest Grain Elevator.

The new elevator just completed near South Ferry, Brooklyn, is described as the largest in the country. It has been over a year in building, and has cost nearly $2,000,000. It has a storage capacity of 2,500,000 bushels, besides superior transfer facilities and dockage for half a dozen vessels, which can load at one time. The machinery is contained in an independent engine house and three enormous towers. The warehouse proper consists of a large number of separate fireproof stores.

MR. WILLIAM CLARK, who died at Philadelphia last week, in the 91st year of his age, was one of the oldest manufacturers of mathematical and nautical instruments in the country. He was born in England, and came to this country in 1820. Two of Mr. Clark's sons are engaged in the mathematical department of the Coast Survey Office at Washington.

ATTRACTIVE SUBURBAN RESIDENCES.

[*Continued from first page.*]

and the present price of building plots in good localities in Brooklyn is such as to justify the devotion of the space allowed for architectural effects and ornamental grounds. We call to mind the brow of the hill near Prospect Park, overlooking the Bay of New York, as a site particularly well adapted for this style of houses; and there is no end of equally suitable places in the upper part of New York and along the Hudson River.

All the buildings in the block from which our illustration was taken are in the same style of architecture, "Italian Renaissance," but no two are exactly alike. The designer, Professor H. Köhler, wisely abstaining from profuse or elaborate ornamentation, has secured a charming architectural effect by the elegant proportions and graceful arrangement of the parts of each and all the buildings.

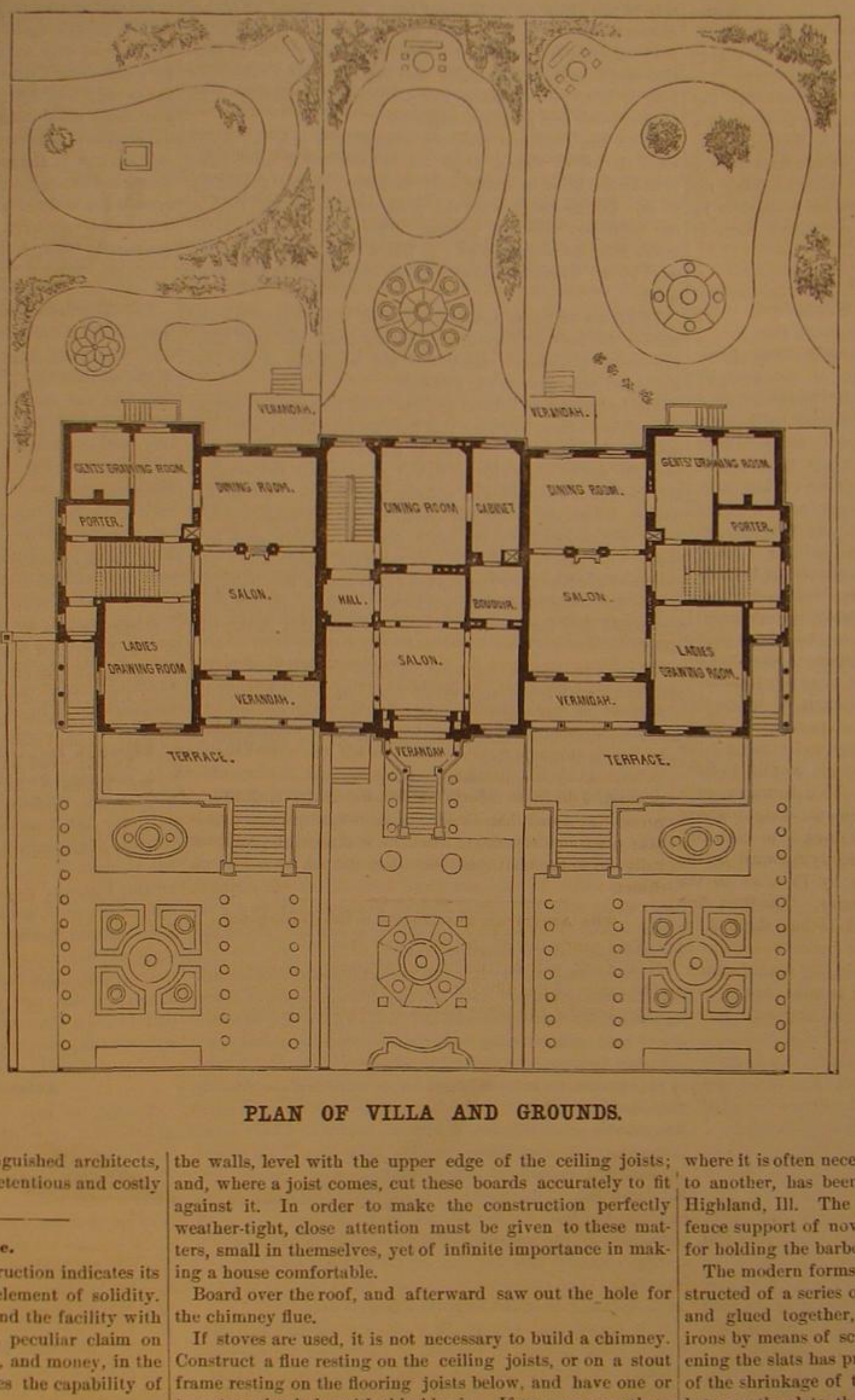
The houses shown are of brick covered with cement, painted of old ivory color, the sills, lintels, cornices, columns, etc., being of freestone. The crestings, capitals, rosettes, vases, balusters, medallions, and statuary are of terra-cotta, closely resembling the freestone in color. The chimneys are also of terra-cotta, with small caps, as heavy chimneys would have marred the architectural effect.

Our manufacturers of terra-cotta ornaments and architectural fittings are now supplying artistic wares in such abundance and at such prices that builders are able to produce almost any effect desired at comparatively small expense.

The cost of buildings like those we have chosen for illustration, might doubtless be diminished without injury to the architectural effect by substituting terra-cotta for the freestone trimmings, to a greater extent than are used in the Hanoverian structures above described.

We hope to learn that some capitalist or builder has taken a hint from our illustrations, re-engraved from our German contemporary the *Zeitschrift des Architecten und Ingenieur Vereins zu Hannover*, and have commenced a block of buildings after the plan shown in the perspective view, with a spacious ornamental court yard in front, after the manner illustrated.

The iron railing, the reader will observe, is a pattern so chaste and ornamental that it almost comes under the head of art work, and so in the details of the entire structure a degree of harmony is observable which does not characterize the works of some of our most distinguished architects, whose talents are employed on more pretentious and costly houses.



PLAN OF VILLA AND GROUNDS.

The Balloon House.

The name given to this mode of construction indicates its lightness and total want of any heavy element of solidity. Yet it undoubtedly possesses strength, and the facility with which it can be put together gives it a peculiar claim on the man who desires to save time, labor, and money, in the erection of a ready home which possesses the capability of being rendered comfortable.

Frame together at the angles a stout sill, say four by six inches, which has been bored on the under side with an auger at six places (at the four corners and midway of the length). Set this sill on six stout cedar posts, driven four feet into the ground.

Next, nail up, at each of the four corners, a pair of boards abutting each other; and, to strengthen these, temporarily nail on the inner angle of each pair of board blocks at a couple of feet apart. This done, and the height of the house being decided upon, chalk that height on the upper ends of these corner boards just erected. Set a piece of scantling, three inches thick by four inches wide, along from corner to corner of end, and nail the upright boards to it. Do the same at the other end. Now connect these two end pieces by similar pieces across the front and rear, halved down and spiked on the end pieces at their angle of meeting. Proceed to board up the four sides, nailing them securely at bottom and top. Measure off for the location of doors and windows, and nail up boards where their frames are to be secured. When the flooring of the joists is all in place, and the boarding of the walls all up, then fit in and nail the window and door frames in their places.

Meantime the roof may be constructed. Run the ceiling joists out two feet beyond the walls, nailing them on to the front and rear pieces, and spike the rafters to the sides of them, at their ends; also spiking the rafters to one another at their tops. Or, better still, saw off and nail them to a ridge board set on edge from gable to gable. This plan will secure the perfect uniformity of the roof throughout. Also, instead of spiking the lower ends of the rafters to the projecting ceiling joists, nail flooring boarding across these joists, out to their ends, and saw off the ends of the rafters, so as to fit down on this boarding, and spike them firmly down through it into the ceiling joists. This plan will effectually inclose the eaves without any further trouble. In the other case, the eaves will require to be boarded up under the ceiling joists.

Saw off all the projecting ends of the upright boards of the walls, level with the upper edge of the ceiling joists; and, where a joist comes, cut these boards accurately to fit against it. In order to make the construction perfectly weather-tight, close attention must be given to these matters, small in themselves, yet of infinite importance in making a house comfortable.

Board over the roof, and afterward saw out the hole for the chimney flue.

If stoves are used, it is not necessary to build a chimney. Construct a flue resting on the ceiling joists, or on a stout frame resting on the flooring joists below, and have one or two stovepipe holes with thimbles in. If two, or even three stovepipes enter it, the size of the flue may be sixteen by twelve inches. If but one is to be provided for, eight inches by twelve will be sufficient. The frame on which this flue stands may be five or six feet high, and be inclosed so as to form a closet or locker. Cover all the external joints of the boarding with slips two inches wide and an inch and a quarter thick, planing off their outer corners. Cover the inner joints with rough slips, and these will answer for furring whereon to nail the lathing for plastering.

These slips on both sides of the inch boarding tend to stiffen it very much. On the exterior they abut against a baseboard below, and a fascia board above.

The roof is usually shingled on rough boarding, and the exterior may be painted and sanded. The strips or battens, as well as the trimmings around doors and windows, may be of a darker tint, or even be a direct contrast.

In order to make these balloon houses warmer, they should be lined with thick brown paper on the inside of the boarding before the inside furring is nailed on.

A material called building paper is largely manufactured for this purpose, and may be had in any quantity in all the cities of the Union.

It may be advisable, in this as in other cheap modes of construction, instead of building chimney flues, to use terra cotta drain pipes for that purpose. These can often be had in the nearest village, brought home, and put up, when bricks or bricklayers to build a flue may prove a serious, if not insurmountable, want. Where it becomes necessary to make a continuation, two of these drain pipes can be joined together by basswood splints secured with wire, and then coating this connection with mortar of wood ashes, clay, and sand.—*N. W. Lumberman.*

RECENT INVENTIONS.

An improved plow sulky has been patented by Mr. Henry Weber, Jr., of Grand Meadow, Minn. This sulky is provided with improved adjusting and controlling devices.

Messrs. John A. Moore and James W. Brown, of Woodville, Tenn., have patented a fire-escape which can be converted into a door shutter, window blind, or ladder at will; it consists of a hinged frame from which the lazy-tongs are suspended, and within which they may be closed up by suitable devices to form a blind or shutter, said fire-escape frame being hinged to a door or window frame so as to swing outward and inward, after the manner of an ordinary blind or shutter.

Mr. Millard F. Lemonnier, of Ida Grove, Iowa, has patented a sieve for thrashing machines so constructed as to cause the air blast from the fan blower to act more effectively to clean the grain than sieves constructed in the ordinary manner. It consists of a board three-fourths of an inch in thickness, having holes from three-eighths to four-eighths of an inch in diameter formed through it, and having inclined grooves formed in its lower side at the sides of the holes toward the fan blower, by which the air blast is guided into and deflected through the holes.

Alice B. Wood, of Beaver Dam, Wis., has patented a corn popper formed of two hemispheres of wire work or netting, which are hinged to each other and are provided with a device for locking them together. One of the hemispheres is attached to a rod passing longitudinally through a wooden cylindrical handle, and is provided with an arm at the end for turning the rod so as to revolve the ball containing the corn.

An improvement in shirts has been patented by Mr. Julius Herzog, of New York city. The invention consists in a chest-protecting shield combined with a dress shirt, as a permanent portion thereof, and in a manner not to interfere with the work of starching and ironing the shirt bosom, and also to allow of unequal shrinkage of the material.

A portable wire stock-fence, suitable for temporarily inclosing large tracts of land in grazing districts, where it is often necessary to remove cattle from one pasture to another, has been patented by Mr. Charles S. Giger, of Highland, Ill. The improvement consists in a removable fence support of novel and peculiar construction, adapted for holding the barbed wires of a stock fence in position.

The modern forms of school seats and seat backs are constructed of a series of slats tongued and grooved to match and glued together, and secured to cross pieces or hinge irons by means of screws or otherwise. This means of fastening the slats has proved unsatisfactory, chiefly on account of the shrinkage of the wood, which leaves widening gaps between the slats that cannot be conveniently closed. Mr. Asbury Moore, of Sidney, Ohio, has patented an improvement intended to remedy this defect. This inventor inserts a rigid iron rod through the slats at each end of the seat and back, and applies a screw nut to the ends of the rods, for drawing the slats closer together to compensate for shrinkage. The rods are likewise attached to iron ribs by means of iron ties of peculiar construction.

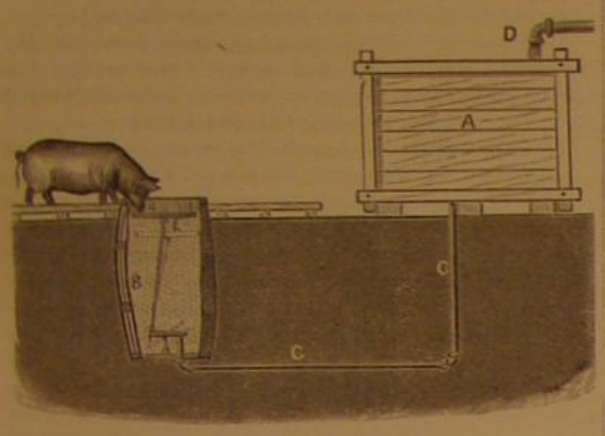
An improvement in metallic loops for holding a hame tug and trace together to prevent the buckle connecting the two from becoming disengaged, has been patented by Mr. Gerhard Freese, of Bloomington, Ill. It consists in a metal loop of quadrangular shape, slightly tapering or contracted at one end, and provided with lugs of peculiar arrangement on the inner sides for wedging and holding the tug.

Mr. Sylvester W. Sheldon, of New York city, has patented a barrel cover, so constructed as to be conveniently handled and kept in place upon a barrel while having their upper and lower sides level, so that they can be packed in small space for storage and transportation.

Mr. Thomas F. Dunn, of Saccarappa, Me., has patented a machine for making cotton batting, so constructed as to receive the cotton from two or more carding machines, press it into batting, and roll it into a lap or roll, with paper or other suitable material interposed between the layers of batting.

NOVEL DEVICE FOR WATERING ANIMALS.

The device shown in the annexed cut furnishes a constant supply of clean water and prevents waste, and is therefore well adapted for watering animals, and especially hogs. A barrel, B, is sunk into the ground, and is connected with a tank, A, or a pond or water main, by a subterranean pipe, C, which projects a few inches into the bottom of the barrel. A pivoted gate or valve rests upon the end of this pipe, and the other end of the valve is connected with a float, E, which is so arranged that when the barrel is filled the end of the pipe, C, is closed by the action of the float; but as the animal begins to drink the level of the water in the barrel decreases, the float, E, falls with the water, and opens the valve at the end of the pipe, C, admitting fresh water from the tank until the barrel is again filled.



DEVICE FOR WATERING ANIMALS.

STEAM TUGBOAT EXPLOSION.

BY S. N. HARTWELL.

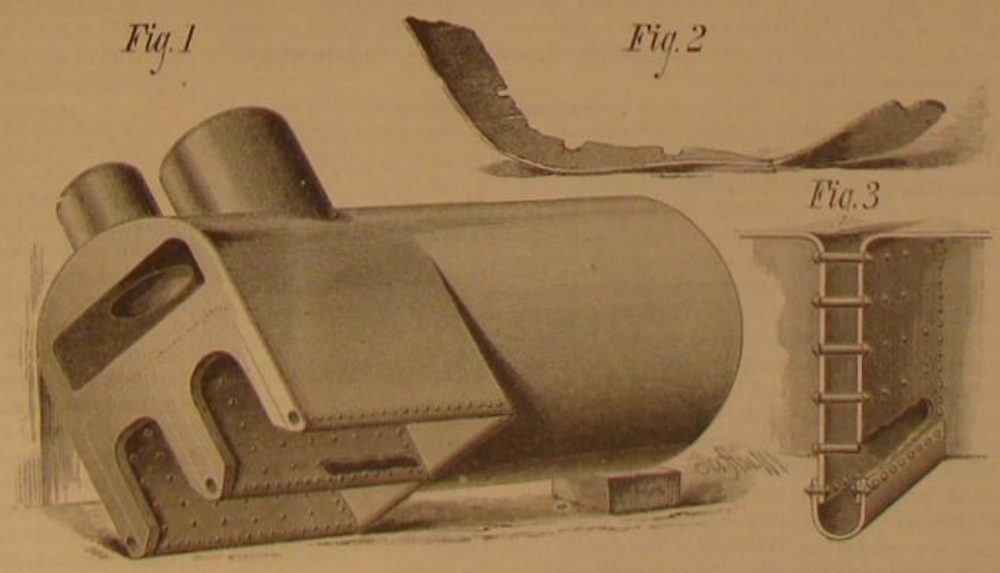
The sketches which I herewith submit are intended to illustrate the accident, if a blow-out may be so designated, that happened to the boiler of the steam tug Jacob Brandow, in the lower bay of New York, on the 2d of June. The perspective sketch (Fig. 1) represents the boiler lying on its side, which position has no reference to the effect of the blow-out, but it is so placed for the purpose of showing the location of the rupture and its relation to adjacent parts of the boiler. It will be seen that the boiler is of the double furnace tugboat type, a variation of the fire-box form common in the towing practice of this city and vicinity. Its principal dimensions are: Diameter, 7 feet; length, 15 feet; dome, 4 feet diameter by 5 feet high. Two furnaces, each 34½ by 72 inches horizontal measurement; height above grates, about 30 inches. There are 10 flues, 5 to each furnace, through which the gases pass directly forward to the smoke connection, whence they return by 75 tubes to the up-take (or front connection) and chimney. The flues first mentioned are to each furnace: one 12 inches, three 8 inches, and one 7 inches diameter. The boiler was made of five-sixteenth iron plates, by a reputable city manufacturer, in 1867, since when, about seventeen months ago, it was fitted with new furnace sides and put in thorough repair. The workmanship and material appear to be the best. No stamp indicating the tensile quality of the iron was observed, however, upon the plates. The steam pressure allowed by the government certificate is 65 pounds by the gauge; and there was one common lever safety valve, by which steam was supposed to escape when the limit of pressure was reached.

About 6:30 P.M. on the 2d of June, while steaming at the usual working pressure—something less than 65 lb.—a piece of one of the new sides blew out, apparently starting at the point *a*. Figs. 1 and 2, where the iron is now but about half its original thickness, namely 0·155 (originally 0·312). The sketch, Fig. 2, gives an idea of its proportion and present shape. At other points, as *b* and *c*, the thickness is respectively 0·185 and 0·165 inch. On the side, *c*, at the margin of the piece, is observed the peculiar defect called *star corrosion*, indicated by radiating lines at the stay holes. This condition is often found on the water side of stayed flat surfaces that have been subjected to a sufficient pressure to puff the plates between the stays, giving it the appearance (in less degree) of a mattress. This has the effect of opening the texture of the plate around the stay hole, which goes and comes as the pressure falls and rises; radial lines of corrosion are formed, deepening and widening toward the hole with each successive motion, till leaks and finally ruptures occur. When there is a considerable area of overloaded plate stayed insufficiently, one stay head pulls through, and the rest, being overpowered by a sudden accession of load, give way successively, and a sufficient body of water escapes, the reaction and expansion of which produces the phenomenon known as an explosion. In this case, however, the *star corrosion* may be considered as an indication rather than a cause of the weakness, for appearances indicate that the initial rupture was along the other margin of this piece, along the lap of the seam where a continuous groove had resulted from corrosion on the fire side of the plate, and having progressed faster, probably from unobserved leaks, gave way first. The sketch, Fig. 3, shows the construction of the parts on a larger scale. The leak that caused the corrosion of the fire side of the plate was probably only a sweating leak, which is the most dangerous because it is most likely to escape observation. If this had been a case of a dripping leak probably the surface below the seam would have suffered most, and perhaps have given way instead of that above the seam.

The effect of this blow-out was an opening of about half a square foot of area, through which the water was forced with terrific power, beginning at a theoretical velocity of about 100 feet per second and ending at something like half that, supposing that none of the free steam escaped from the steam room through the intervening water. Sixty cubic feet of water would thus escape in about two or three seconds, allowing for obstructions in the furnace, and everything movable would be driven before it, as was the case. The engineer, who was supposed to be in the fire room, made his way to the deck probably nearly dead, and was lost overboard. The fireman, his son, who was on the top of the boiler, in the act of shutting off the steam jet, was badly injured. The fire upon the starboard grates and coals in the fire room were blown against the woodwork abaft the engine and against the engine itself with a force sufficient to abrade the whitewash and paint with which these parts were ornamented. Government certificates and officers' licenses, that were duly posted according to law, were sadly defaced, but no serious damage was done to the boat, as would most likely have happened if the weak area had been of sufficient extent to have allowed of the instantaneous escape of the boiler contents.

The government certificate of inspection, which is the form approved February 11, 1880, expires on the 30th of July, 1881, indicating that about ten months had elapsed since the boiler was inspected. It shows, also, that the hull was built of wood in 1864, and that the boiler, *rebuilt* in 1880, was built in 1867, as stated above. Other memoranda in the certificate, are: one safety valve, one steam gauge, one low water gauge, one fusible plug, and three gauge cocks. The certificate was signed by Austin Joyce, Inspector of Hulls, and John K. Mathews, Inspector of Boilers.

Mr. William Tebo, the polite owner of the Brandow and a number of tugs beside her, offered every facility to the writer for obtaining the sketches and other memoranda embodied in this report, and being himself a practical engineer, indicated, by his personal attentions and sentiments expressed, a desire to inform his fellow engineers, through the press, just how it happened. A thorough reinspection is to take place in a few days, when he will promptly and cheerfully do to the boat just what the government inspectors direct.



BOILER EXPLOSION.

The American Institute's Semi-Centennial.

This year's fair of the American Institute, of the City of New York, will be the fiftieth of these useful exhibitions. The desire of the directors is to celebrate the occasion by an exceptionally full presentation of novel inventions, machinery, and industrial products. Their announcement of the "Semi-Centennial," on another page, we commend to the attention and co-operation of our inventors and manufacturers.

Telegraph Cables in Sewers.

An important experiment looking to the disuse of telegraph poles in cities is being made in Washington, D. C., by the Mutual Union Telegraph Company. Having received permission to run their wires through the common sewers of the city the company began the work of placing the wires June 6. The wires which are needed for the city service and for connection with lines outside the city are twisted cable form and covered with a non-conductor and waterproof coating. Outside the city limits these wires emerge from the sewers and join those placed upon poles. The cable made of the twisted wires is attached firmly to the arched roof or top of the sewer, and thus raised above all interference from water, except in case of floods. The cables are laid by men enveloped in rubber clothing and provided with safety lanterns, provision being made for conducting fresh air to the workmen by means of India-rubber tubes attached to their rubber suits. The wires are passed down through the man holes of the sewers.

VELOCIPEDE CARRIAGE.

The engraving shows a light and compact velocipede carriage of German invention, calculated for easy and comfortable riding and capable of carrying light baggage. The rider sits in an easy chair above the forward axle, and grasps the guiding handles attached to this axle. The feet rest upon pedals connected by rods with cranks on the rear axle. By the alternate movement of the pedals the carriage is propelled. A lantern is carried in front, and a canopy covers the head of the rider.

VELOCIPEDE CARRIAGE.

NEW INVENTIONS.

Mr. George W. Mason, of Sharon, Pa., has patented a composition of matter to be used for making artificial stone, and consisting of pitch made from gas-tar, cement, plaster of Paris, lime, ground cinders, ground ore, ground oyster shells, fine ashes, pulverized dry clay, dry sawdust, ground slate, ground stone, sand and pebbles, and molten brimstone.

An improved harvester guard finger has been patented by Mr. Elisha S. Snyder, of Snyder's Mills, West Va. The invention consists in a sectional guard finger constructed with two reversible plates, each having two cutting edges, the plates being arranged to engage with the sickle knives, and held in position by a removable top section provided with beveled edges, which may be utilized by inserting a sickle having inverted knives.

Mr. Charles A. Pennington, of Champaign, Ill., has patented an improvement in field corn huskers which consists in the peculiar construction of the revolving husking rolls, between which the cornstalks are forced and the ears husked, and in a revolving recessed wheel for feeding the stalks carrying the ears between the husking rolls. The machine is provided with a fender and guard for the stalks, for the purpose of holding and guiding them while the corn is being husked.

Mr. James H. Palm, of Lexington, O., has patented an improved device for raising and lowering the front end of a clevis pivoted to the forward end of a plow beam, whereby the plow can be made to plow deeper or shallower; it consists of a clevis having its opposite arms pivoted to a plow beam on each side near its forward end, and provided with a cross rod, to which a slotted tongue carrying a pin is hinged, the pin on the tongue engaging in a cam groove in a wheel provided with a crank shaft extending back parallel with the beam.

An improvement in shovel plow blades has been patented by Mr. Henry A. Ridley, of Newport, Ark. The object of this invention is to facilitate the enlargement and contraction of shovel-plow blades, as the character of the work to be done may require, and also to facilitate repairing the blades.

Mr. Jacob G. Walton, of Davilla, Texas, has patented an improved cotton planter having a vibrating agitator which is used in combination with a hopper.

THE tower clock of the First Presbyterian Church, Newark, N. J., lately stopped. The town time-keeper found in the wheels of the clock a tangled mass of hay, twine, grass, cotton, and feathers, amounting to nearly half a peck. A pair of birds had entered the tower through a hole in the dial and attempted to build a nest in the machinery of the clock. The slow revolution of the wheels tore their work to pieces, and they kept on reconstructing it until they stopped the wheels.

Rubber Nipples.

To enumerate different kinds of rubber nipples alone would be a weariness. Scores of kinds there are of all shapes, sizes, and colors, good, bad, and indifferent, and still new devices are daily added and the demand increases. Nipple making is among the most interesting of rubber specialties. When made by hand the operatives are always girls, as the work, though light and pleasant, need dexterous, rapid fingers.

The first step in the preparation of a first-class hand-made nipple is the material. It is commonly mixed sheet, either white, black, or maroon. "Lead gums" are but seldom used for black, because of their alleged poisonous qualities. The fine tracery of parallel lines that cover the surface of certain kinds of nipples, imparting a flesh-like grain, is called the "print," and is given to the mixed sheet before it is cut into nipple pieces.

A simple and inexpensive manner of producing this print is to have a metal plate upon the surface of which parallel grooves are marked. These grooves are clear cut and even, with no breaks, and of the same depth. From this rubber impression plates may be made, by placing a sheet of vulcanized rubber upon the metal plate, rubber side down, and curing in a steam press. The result will be a plate as good as the original, and capable of more wear and tear. Indeed, this new plate is, for practical use, far superior to the metal, for where the latter would unavoidably receive dents and abrasions which would soon obliterate the print, and in addition to this, would be so heavy as to be cumbersome in the extreme, the former may be hammered and knocked in all possible ways and yet show no abrasion, and, better still, is so light that it can be handled with the greatest ease.

After a sufficient number of impression plates have been prepared the mixed sheet for the nipples is cut into lengths that shall fit between the plates; each plate is wiped lightly with a brush dipped in talc, and a sheet of rubber is placed upon it. These sheets and impression plates are then placed in a compact pile and submitted to gentle pressure. In due time the unvulcanized mixed sheet takes from the impression plate the print, and after it is fully set it is ready to be cut into nipple pieces. When taken away from the pressure, the plates and mixed sheets seem to be one compact mass. They can, however, be separated if not left too long.

The condition of the print, although primarily depending upon the condition of the impression plate, may be materially injured by careless "stripping."

The printed sheets, after being stripped, if they have been stretched, are plunged into hot water, or otherwise heated, in order to shrink them, and then given to the nipple cutters. Several sheets may be cut at once, if brushed lightly with talc. The die should be very sharp, as otherwise the edge of the nipple piece will be rounded, and consequently harder to knit in the making.

The nipple pieces when cut are: for small nipples, nearly heart-shaped; for large, cone-shaped. In the former the seam extends from the bottom up one side and just over the crown, the other side being seamless; while in the latter the seam completely divides the nipple. Small nipples are therefore made in one piece, large nipples in two pieces. To cut large nipples two sheets are laid together with the print inside. The natural stickiness of the stock will hold these pieces together, which helps materially in the making up.

After the nipple pieces have been delivered to the makers, the next process is cementing. The pieces are neatly laid in piles, and then, by means of a small brush, painted with a cement made of mixed sheet dissolved in naphtha. They are then spread upon tin plates to dry. To facilitate the drying process, each nipple table has attached to it a small steam oven, so arranged that it may heat a number of tins, and yet cause little annoyance by its proximity to the makers.

The kit of tools for a nipple maker consists of a small slanting "case," in which are places for a certain number of nipple formers, two cement cups with brushes and "steeple tops," a small glass "naphtha well" set in the case, similar to an ink well, a naphtha brush, thumb cots for taking off nipples after being vulcanized—tin plates for drying—pans for packing, cleaning sponge, and set of nipple formers.

The small nipple formers are pear-shaped pieces of metal set upon iron pins. The large formers are simply hollow cones of metal or glass. The case has holes for small and "rests" for large formers. The rows are so arranged that their nearness to one another does not interfere with the most rapid work. By the side of each case is a rest for the tin, which is provided with a small adjustable clamp to hold it in position. Beneath this case are skeleton drawers, on which are set pans of talc for packing the nipples when finished.

After the nipple pieces, placed in the oven to dry, have become thoroughly warmed, and the solvent has so evaporated as to make the cement just right to knit well, the maker takes a former, dips it in the talc, places it in the center of a piece, draws the edges together, and, with a rapid pressing of the thumb nail against the two edges, closes effectually and neatly the gaping seam. The former with its half-made nipple is then returned to its place, and another former covered. In the same way the whole case is studded with pear-shaped rubber covered formers.

Next in order is the making of the flange at the lower end. For this purpose the cement brush is again brought into requisition, and the lower end cemented. When dry, the operator, with the right thumb, presses firmly on the lower edge with an upward motion. This turns it over a little, and, when continued around the stem, makes a small ring at the lower end of the nipple. A continuation of this brings out the flange. Large nipples are cemented, seamed, and flanged, and then turned inside out, as they were cut with the print within.

When finished, the nipples, formers, and all are packed in shallow pans half filled with talc. The packing in itself is quite an art, as there must be economy of space, and as a quick thrust must be given to each one, in order to force a little talc between the stems of the former and the nipple, to prevent the flange from adhering to the stem. When packed they are taken away to the heater, where, after being filled full of talc, the pan is loaded upon a car and run into the heater. The "chalk room," in which the nipple pans are filled, is provided with tables, under which are large bins. Below the level of the table tops are a set of sieves, and into these the pans of vulcanized nipples and talc are poured and sifted, each worker keeping her "heats" separate.

Taking the nipples off from the former is oftentimes very hard work. Especially is this true of small nipples. Then it is that the "cots" come in place and save many tender fingers from blistering. But after the knack of slipping them off has been learned, it is wonderfully easier. A short season of scouring in the cylinders is next in order, after which the nipples go to the potash boiler.

The punching of the holes in the crown of the nipple is done by hand. Small punchers are set in standards at each table. The nipple is placed upon the punch and hit firmly with a small wooden mallet. The rapidity with which many of the makers punch the nipples is surprising. For a finishing touch the girls take them again in hand, pack them in paper boxes, and the nipple is ready for market.

A curious part of the process of nipple making is the care the girls take of their finger nails. These before all other tools are a necessity. If brittle the utmost care in trimming is taken, and they are washed, scrubbed, and oiled with daily solicitude. A cracked nail is a calamity, as no seaming at all can be done until it is grown to the proper length.

Black nipples, after being washed frequently, have a grayish dirty tinge, which is removed by dipping them in a liquid black.

Nipples, instead of being always made by hand, as in the foregoing, are frequently "dipped;" that is, the former is plunged into a cement made of rubber dissolved in some solvent, and then dried. This being repeated until a suitable coating is obtained, when the flange is rolled as in other nipples. They are also made in moulds. Finger cots and other rubber articles of similar shape are cut, cemented, and made over formers in the same manner as nipples.—*Rubber Era.*

MISCELLANEOUS INVENTIONS.

Mr. William Slow, of New York city, has patented an improved strainer for the outlets of tubs and basins which can be removed from the washer of the outlet of a tank, tub, or basin, for the purpose of clearing it in case it becomes clogged. The invention consists in the combination with a washer having an internally-threaded neck, of a strainer having an externally threaded vertical flange capable of receiving a plug. It is readily removed by means of a small key or wrench furnished with it, when it can be cleaned and the waste pipe can be readily cleaned when the strainer is removed. The strainer may consist of an apertured plate, or of netting, or of two bars, as may be desired.

An improved tracheotome has been patented by Mr. Lewis J. Lyman, of Manhattan, Kan. The improvement relates to surgical instruments for use in opening the trachea in cases of membranous croup, or in any case when it is necessary to practice tracheotomy. The object of this invention is to provide for more easily effecting an entrance to the trachea than can be done by instruments heretofore in use, and for retaining the instrument in proper place after insertion. The invention consists in a blade of peculiar shape upon a spring arm fitted between two spring-holding arms that are formed with T-ends, and also in a catch for simultaneously securing and loosening the spring-arms.

Mr. Charles W. Posten, of Boone, Iowa, has patented an improved washing machine, which consists of a circular vessel formed of two cones united at their bases, and is provided with a shaft attached to the apex of each cone, and resting on suitable bearings in the sides of a tub or tank adapted to receive it. The double conical vessel has numerous perforations and indentations all over its surface.

An amusing toy bank for children has been patented by Mr. John Murray, of New York city. The invention consists in the combination, with the head that forms the body of the bank, of the tongue and the inclined and weighted pivoted bar carrying the tongue, whereby the weight of a penny placed upon the tongue will turn the pivoted bar and cause the tongue to pass into the head and drop the penny into the interior of the head.

An improved sash holder, patented by Mr. John H. Lynch, of Lowell, Mass., consists in a roller wheel pivoted in journals sliding horizontally in the lugs of a plate attached to the outer surface of one of the side rails of a sash, which wheel is pressed against the pulley stile of the window frame by a spring, and is provided on one of its sides with a ring of ratchet teeth, which engage with like teeth of a peripherically ratcheted wheel loosely mounted on the shaft of the rubber wheel, which ratchet wheel is acted upon by a spring pawl, that permits both the ratchet wheel and rubber wheel to rotate when the sash is being raised, but locks the ratchet wheel and the rubber wheel as soon as the sash is released, and thus holds it in place; but if force is exerted the rubber wheel is disengaged from the ratchet wheel and the rubber wheel can rotate, thus permitting the sash to descend.

An improved device for drying fruit and vegetables and evaporating liquids has been patented by Mr. John A. Warner, of Furnaceville, N. Y. The invention consists of two upright fixed cylinders placed concentrically one within the other, the outer cylinder having rollers fixed on its inner face in such a position as to form a disconnected spiral track for the outer ends of the evaporating trays, and the inner cylinder being provided around its outer face with a continuous spiral for the inner ends of the evaporating trays.

An improved draught equalizer has been patented by Mr. Albion Wheeler, of Ridgeway, Iowa. The invention consists of a novel arrangement of levers in combination with the tongue and stay or bed-rest of the machine.

An improvement in magnets for separating iron chips patented by Mr. George E. Bowers, of Fitchburg, Mass., consists of a magnet having a straight core and helices wound in opposite directions inclosed in a tube or hollow cylinder that is attached to one pole of the magnet, and also provided with a switch, whereby the direction of the current around a portion of the magnet can be reversed, so as to demagnetize the core and cylinder and thereby release the chips.

An improvement in storing compressed air or other gas in vessels has been patented by Mr. Alexander James, of Edinburgh, Scotland. The invention relates more particularly to a method and means for storing compressed air for motive power for locomotives or cars for railroads. The invention consists in a method of compressing air wherein the adhesive attraction of an absorbent material or materials is made to assist in reducing the volumes of gaseous bodies in confined spaces or inclosures.

Mr. Jabez Smith, of Sabula, Iowa, has patented a sling for throwing missiles, such as stones, bullets, etc., by hand, with considerable force. It consists in a band of rubber or other elastic material having a pocket to receive the missile in the middle, the ends of this elastic band or equivalent being attached to the ends of the prongs of a fork provided with a suitable handle.

An improved stove leg has been patented by Mr. William R. Fenerty, of Louisville, Ky. This invention consists in casting the lower edge of the stove with a downwardly-inclined flange having undercut projections on the inside thereof, in combination with the leg cast with a surrounding shoulder to support the weight of the stove, and with an upwardly inclined shank the side ends of which are beveled to correspond with the undercut projections, forming a dovetail therewith, the leg being also provided with a central stud for locking the leg to the flange of the stove.

An improved life-preserver has been patented by Mr. John Thompson, of Victoria, British Columbia, Canada. The invention consists of a series of floats so hinged to a belt that is to be fastened around the body that when not in use the floats hang perpendicularly from the belt, and when the device is in use the floats extend radially and at right angles from the belt and lock themselves in position.

An improved method of improving the appearance of furs, patented by Mr. Lucinius Havasy, of New York city, consists in attaching the tips or outer ends of feathers to the fur in such a manner that these feather tips will appear between the hairs of the fur, and will produce various effects, according to the position in which the fur is held.

Agricultural Notes.

LAWN GRASS.

The very best grass I have made use of for a lawn is unquestionably orchard grass. But then to make it effectual for this purpose no half-way measures should be practiced in preparing the ground, sowing the seed, and cutting the grass. The soil should be rich, in fine tilth, and free from weeds. The best preparation of it is to cultivate it in potatoes or some other hoed crop the preceding year. If this can be taken off in August, early or late, according to climate, the seed may be safely sown in that month, if not, leave it till the following spring, and then put it in as early as possible. Plow, harrown very fine, and level the ground. Then sow at least at the rate of four bushels per acre, so that the ground can be thickly stocked. If this is not done the grass forms tussocks, and these spoil the beauty of the lawn. Never sow clover or any other seed with this for a lawn, but one may do so with clover only for a field crop if desired, as both are ready at the same time to cut for hay, which, to have it tender and sucuulent, should be in the earliest of blossoming. After sowing brush the surface nicely and then roll. Cut the grass as often as it gets about four inches high. This keeps it from growing coarse, and makes a closer, firmer sod. This grass is the first to shoot up in the spring, and the last to turn brown in late autumn or during the winter. Ray grass, if treated in the above manner, comes next to orchard grass in making a superior lawn.—*Correspondence Country Gentleman.*

SOWING SEEDS.

In sowing grass and vegetable seeds remember Mr. Peter Henderson's caution about "firming the ground." By pressing the roots about the soil they germinate quicker and the young roots more readily take a firm hold upon the soil. The neglect of this process may cause the loss of the crop if the season should prove dry.

Correspondence.

The Wrongs of American Inventors.

To the Editor of the Scientific American:

I would respectfully direct your attention to the flagrant wrong done American inventors by foreign governments, in that any person can patent in those countries inventions of Americans, while our government protects these foreign inventors by refusing to grant a patent, only to the inventor himself.

Oftentimes the American inventor is poor, perhaps has spent years of time and all he could snatch from his daily pittance to get his American patent, and is too poor to patent at once his invention in foreign countries. The unscrupulous capitalist here or abroad, like a bird of prey, stands ready to seize the opportunity and reaps vast benefits, while the American receives nothing for his life-long efforts.

Every American inventor is bound by principles of self-protection to insist and demand that Congress shall right this matter and put the American on the same footing as the foreign inventor, and refuse to grant patents to foreign inventors until foreign governments shall by legal enactment destroy the custom of importing American inventions and despoiling poor American inventors. Let something be done in this matter to adjust this unfairness against the American.

GEORGE H. ENNIS.

Troy, N. Y., May, 1881.

[We think that if our correspondent will study the subject a little further he may reach a different conclusion: 1. In nearly all foreign countries the patent is granted only to the inventor—England is the chief exception. 2. With a little perseverance any inventor, even if poor, who holds a really good invention, can find partners who will be glad to pay the expenses of obtaining foreign patents. 3. We wish our correspondent would mention individually some of the unscrupulous capitalists he refers to. That many American inventions are manufactured abroad is true. But in general, where the inventor fails to share in the benefits, it is because he did not wish to take any steps to do so, but voluntarily abandoned the field to others. 4. The American inventor stands on the same footing as other inventors in nearly all countries where patents are granted. There is no unfairness, and the custom of "despoiling poor American inventors" is imaginary on the part of our correspondent.—EDS.]

The Tables of Regnault and Rankine.

To the Editor of the Scientific American:

On page 228 of the current volume of the SCIENTIFIC AMERICAN, in a brief memorandum referring to the last session of the American Society of Mechanical Engineers at Hartford, I am reported as stating that the tables of Regnault and of Rankine are not exact "under all conditions." The statement as printed does not at all convey the idea which it was intended to present.

My statement was in effect that Regnault's tables were the result of empirical (*i. e.*, experimental) work; that exactness was secured by extraordinary precaution in experiment and by graphically representing results, thus securing a correct statement of the law of variation of pressures with temperatures, and that formulas were then fitted to the case, which formulas very accurately represent that law. I further remarked than Rankine's formula so accurately states the law that its errors lie within the limits of the most exact observation.

I am correctly reported as endeavoring to impress upon engineers the importance of making their practice "depend upon observations derived from the actual conditions of the special cases in hand," as the SCIENTIFIC AMERICAN puts it.

R. H. THURSTON.

Hoboken, N. J., May 20, 1881.

Comet A 1881.

To the Editor of the Scientific American:

In the current issue of your valuable paper an article upon Swift's latest comet implies that no one else had seen the same, so far as known, but the discoverer. Permit me to say that I had the pleasure of securing two good observations of it on the mornings of May 3d and 4th (it being discovered on the morning of May 1st), and which at the time were the first observations reported to the discoverer, as he informed me, from other astronomers. Prof. Chandler, then at Portland, Maine, also secured observations of it and immediately issued an ephemeris. It was seen at the Harvard College Observatory, also at Dun Echt, Scotland. Yesterday I received from the president of the Boston Scientific Society observations and elements of the comet, made by M. Eugen Block, of the Observatory of Odessa, Russia.

Its position at discovery was 0 hour 0 minute R. A., 37° north declination. When first seen by me it was about 2° southeast of that point, which shows its direction and rate of motion. It is now invisible, but may become visible again upon the other side of the sun.

WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., June 7, 1881.

DETAILS of the destruction of the British gun boat Doterl in the Straits of Magellan show that the condensing boiler exploded, and that the shock exploded a quantity of gun cotton stored in the forward magazine.

MECHANICAL INVENTIONS.

Mr. John D. Smith, of Fayetteville, N. C., has patented a screw for a carpenter's bench vise, which consists of a cylindrical wooden body and a metal rod coiled spirally around it and partly embedded in its surface.

An improved spring power motor for working sewing and other small machines has been patented by Mr. Truman H. Baldwin, of Baraboo, Wis. This motor attachment is adapted for imparting about twenty thousand revolutions at each winding to the shaft on which the balance wheel is mounted, and the inventor claims the winding may be effected with comparative ease by means of the lever. The motor is compact in form, and may be quickly attached to or detached from the sewing machine.

An improvement in water wheels, patented by Mr. Thomas B. Van Pelt, of Carterville, Mo., consists in the peculiar construction of two or more water wheels mounted on the same horizontal shaft, and revolving in a flume provided with stationary counter buckets or inclined plates secured to the inner face of the cylindrical flume between the buckets, and guiding the water, after having acted on a water wheel, to the next.

Mr. Alonzo J. Simmons, of Raysville, Ind., has patented an attachment for furnace doors, which consists in the combination of a perforated steam pipe arranged within the furnace near the door opening and connected with the steam space of the boiler, and a valve to regulate the admission of steam to the perforated portion of the steam pipe, the steam pipe being arranged to direct a sheet of steam across the furnace door opening to prevent the cooling of the furnace by the entrance of cold air.

Cost of Public Buildings.

An experienced architect and surveyor, on the 19th of February, 1879, prepared and presented to General Meigs, Quartermaster-General, the estimate which follows of the cost of various public and private buildings in this country, the comparison being by cubic feet, external dimensions:

Buildings.	Cubic Feet.	Total Cost.	Cost per Cubic Foot. Cents.
Sub-Treasury and Post Office, Boston, Mass	2,671,338	$2,080,507	77.88
United States Branch Mint, San Francisco, Cal	1,680,795	1,500,000	89 24
Custom and Court House and Post Office, Cairo, Ill	444,376	271,081	61.00
Custom and Court House and Post Office, Columbia, S.C.	587,915	381,900	64.95
United States Building, Des Moines, Iowa	413,987	221,437	53.48
United States Building, Knoxville, Tenn	542,362	398,847	73.53
United States Building, Madison, Wis	541,483	329 389	60.83
United States Building, Ogdensburg, N. Y	447,585	216,576	48 38
United States Building, Omaha, Neb	654,703	334,000	51.01
United States Building, Portland, Me	524,886	392,215	14.72
German Bank, 14th street, Newport, R. I	600,000	475,000	79 1-6
Staats Zeitung, New York City	508,000	475,100	93 52
Western Union Telegraph, New York City	1,330,000	1,400,000	105.22
Masonic Temple, New York City	1,800.000	1,900,000	105.55
Centennial Building, Shepherd's, cor. 12th and Pa. ave., Washington, D. C	931,728	246,073	26.41
Add to this the United States National Museum, Fireproof Building at Washington, D. C	3,843,611	250,000	6½

Fireless Locomotives.

Improvements in detail have been made by M. Leon Francq, who lately read a paper on the subject before the French Association for the Advancement of Science, from which we glean the following particulars: The locomotive is provided with a tank containing water at a sufficiently high temperature (203° Cent., equal to 397° Fahr.) to produce the necessary quantity of steam for the journey. The water is heated at the starting point by means of a jet of steam at high pressure produced by a stationary boiler. As the boiling point increases with the pressure, it follows that, in a closed vessel, the greater the heat the higher the pressure attained. If the heating be effected by a jet of steam, as in the present case, the steam fills the space above the surface of the water, at the same time increasing the pressure. To apply this principle it is sufficient that the tank stand a pressure of from two to fifteen atmospheres (30 to 225 pounds per square inch). The steam from the stationary boiler fills three parts of the receiver and agitates the water sufficiently to distribute the heat uniformly. When an equilibrium of pressure between the boiler and the receiver is attained the cocks are turned off. The locomotive is then in running order, ebullition taking place directly communication is opened between the tank and the cylinders.

In practice the initial temperature may attain 200° Cent. (392° Fahr.), which corresponds to fifteen atmospheres or 225 pounds per square inch. The final pressure must be sufficient to take the train up the steepest gradient to be encountered. The tank or receiver is made of steel plates, and may contain over 1,800 liters (396 gallons). After leaving the receiver the steam passes into an intermediate chamber, which allows the steam to expand so as to enter the cylinders at a uniform pressure, independent of that in the tank or receiver. The exhaust steam is not utilized as in the ordinary locomotive, because there is no fire to urge, but escapes into an air condenser which is a closed cylindrical vessel traversed by more than 600 tubes open at both ends. The water of condensation passes into a tank, whence it is afterward withdrawn as feed water. The diameter of the cylinders is 23 centimeters (9 inches), and the length of stroke 25 centimeters (9⅞ inches), the working parts not differing from those of ordinary engines. The weight of the engine running light is 6¾ tons; and the tractive power is from 343 kilos (6¾ cwt.) to 1,031 kilos (1 ton), according to the pressure. In the event of an unusual resistance being encountered on the road it is sufficient to act, by a rod and lever, on the intermediate or equalizing chamber, so as to give a temporary increase of pressure on the pistons. At a speed of 12 kilometers (7½ miles) an hour, the wheels, which are 75 centimeters (1 foot 5½ inches) in diameter, make 86 revolutions a minute. With a stationary boiler of about 50 square meters (538 square feet) of heating surface, a working pressure may be maintained in the locomotive for seventeen or eighteen minutes. The consumption of fuel is found by experiment to be less for a given duty than is the case of ordinary locomotives. In a line of 10 kilometers (over 6 miles), the working expenses, including repairs and depreciation of stock, amounted to 45½ centimes per kilometer—say 7d. a mile run.

Nitric Acid.

This is one of the most important chemical agencies employed in the arts and manufacturing; agencies due to the property which it possesses of yielding very freely a notable proportion of its oxygen to substances having an affinity for the same, a property which renders it one of the most energetic of oxidizing agents. On this account, as well as because of its cheapness, its use for oxidizing purposes in the laboratory is very extensive.

Its property of energetically dissolving many of the common metals renders it useful in etching steel, copper, bronze, and the like. In the manufacture of sulphuric acid, it is introduced for the purpose of effecting the oxidation of the sulphurous acid given off in the burning of sulphur, or roasting of pyrites, to sulphuric acid. It has the property of yielding, with certain organic substances, what are called nitro-compounds, which are of great value in the arts. So, for example, nitro cellulose (gun cotton), nitro-glycerine, nitro-benzole, nitro-mannite, and a number of analogous products are found. Owing to its powerful oxidizing action, it acts powerfully upon coloring matters, and on this account has some important applications in dyeing. By prolonged treatment with nitric acid, starch, cellulose (wood fiber), and sugar, are converted into oxalic acid; very dilute acid converts starch into dextrine. The fact that it will not attack gold, while energetically dissolving nearly all the other metals, has long been taken advantage of in the arts, in assaying and metallurgy, to separate gold from silver and base metals.

Nitric acid is employed in the chemical industries in great quantities in the manufacture of an immense number of chemical products, in addition to those we have already named. Of these, some of the more important are: the preparation of picric acid from carbolic acid, naphthaline yellow from naphthaline; the manufacture of nitro-benzole, nitro-toluol, and phthalic acid; the preparation of nitrate of silver (lunar caustic), arsenic acid, fulminate of mercury, and, generally speaking, of the salts known as nitrates.

This acid is now manufactured chiefly from the nitrate of soda brought in great quantities from Chili and Peru, and is effected by decomposing this salt by sulphuric acid.—*Mining Journal.*

Spontaneous Combustion by Nitric Acid.

In consequence of the burning of a freight car during the fall of 1879, on one of the railways in Baden, which was suspected to have been caused by nitric acid, Professor R. Haas of Carlsruhe, was called upon by the government to report whether that acid could produce combustion or not. In the experiments made to solve this question the conditions which might be supposed to exist in freight cars containing nitric acid were imitated as far as possible. Small boxes of a capacity of 10 to 16 quarts were charged with variable proportions of hay, straw, tow, and blotting paper—all of which substances are used in packing—and placed within larger boxes, while the space between them was filled with hay or tow, to prevent too rapid a radiation of heat, because the experiments were to be conducted in the open air, and the outer box at the same time represented the walls of a railway car. The material contained in the inner box was now saturated with acid, and rather tightly compressed, so that when the cover was put on it was pretty well filled. At first reddish and afterwards whitish vapors were given off, finally a distinct smoke. On lifting the cover strongly glowing patches could be seen, which rapidly increased all through the contents, and which broke out in bright flames on access of free air or gentle fanning.

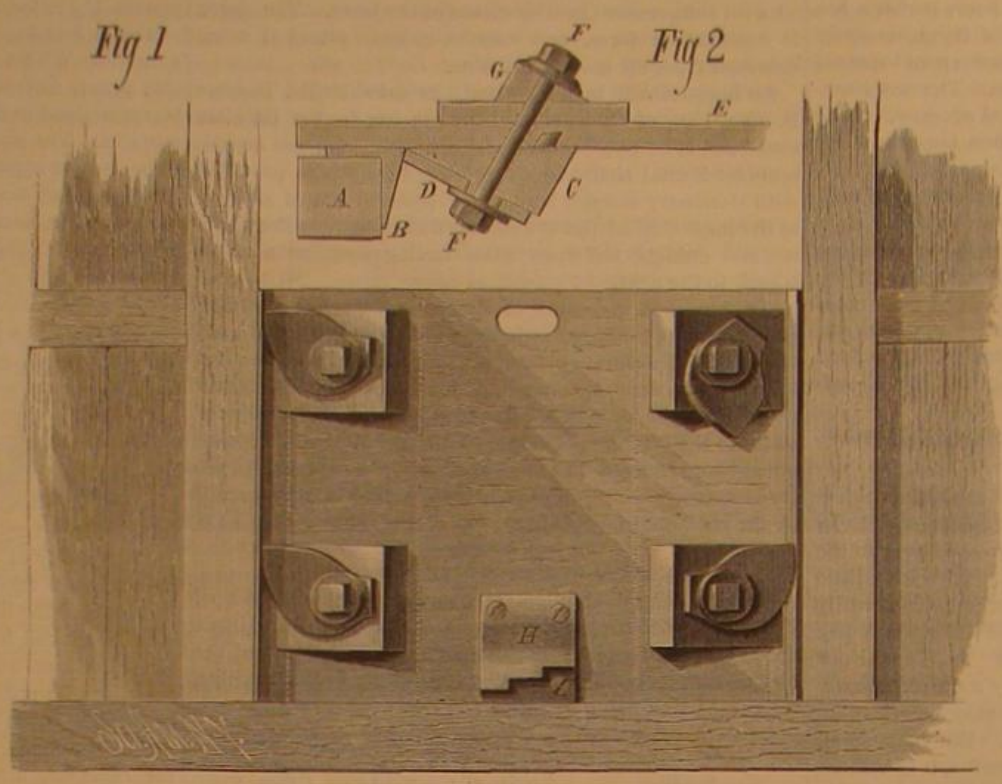
With red fuming acid, or with acid of specific gravity 1·48, these results were obtained very rapidly and within a few minutes. With ordinary acid, of specific gravity 1·395, it required somewhat more time, and the action was less energetic in the beginning; but, in three different trials, after about twenty minutes the same result was finally obtained, provided the material was packed tightly in the box and was thoroughly saturated in its successive layers.

It seems quite probable that even a weaker acid can produce the same result in larger bulk and during warm weather in a confined space which prevents rapid cooling. Hitherto it has often been doubted that spontaneous combustion could be caused under such circumstances, but the above experiments and results are certainly incontrovertible.

NEW FASTENER FOR GRAIN-CAR DOORS.

The great failing in grain car doors as ordinarily made is their liability to become loosened so as to allow grain to escape. When doors are nailed to compensate for defects in their fasteners, the doors soon become destroyed and the jambs or casings are permanently injured.

We give an engraving of a grain-car door fastening which remedies these defects and permits of fastening the door quickly and securely, and in such a manner as to avail of the jarring of the car to tighten the fastenings rather than loosen them. The inventor of this fastener has been for many years a shipper of grain, and being familiar with the defects of other doors, and knowing the requirements of the case, has devised the door shown in the illustration, which is believed to overcome all of the difficulties hitherto experienced, and to be capable of closing a car so that the grain cannot leak from the door; in fact, the greater the amount of jarring the more firmly does the door become fastened. The fastenings are upon the outside and in plain view, and the door can be loosened and lifted as easily as an ordinary gate is opened. It will be seen that its construction is inexpensive, and that it may be readily applied to old cars, not only furnishing a complete door, but also supplying a protector for the door jambs.



BURNTRAGER'S GRAIN-CAR DOOR FASTENER.

In the engraving, A is the door jamb, and B is a false jamb, made of angle iron and having its inner face beveled or inclined from within outward. C is a wedge-shaped block having on one face a projection on which a cam, D, is pivoted, and on the opposite face two projecting lugs, which enter corresponding inclined sockets in the door, E, to steady the blocks, C, in position.

On the inside of the door, E, are secured vertical panels or braces for strengthening it. The cams, D, are held in place by bolts, F, that pass diagonally through the block, C, door, E, and a wedge-shaped washer, G, which is on the inner face of the panel.

The cams, D, have their semicircular or rounded edges beveled to correspond with the bevel of the false jambs, B, so that when turned and forced down against the bevel of the false jambs, B, as shown in Fig. 1, the cams will draw the door outward and hold it firmly against the outer faces of the jambs. By striking up the cams the door is loosened, and can then be pried up for the removal of the grain from the car by inserting the end of a bar under one of the steps of the block, fixed centrally at the lower edge of the door, a suitable fulcrum being placed in position for the prying bar

It will be seen that the false jambs, B, and beveled edges of the cams, D, form opposite inclined planes, that will continue to bear the same relation to each other and together operate to hold the door tightly closed, however great may be the wear on them.

This invention was lately patented by Mr. Aaron Burntrager, of Mulberry, Ind., who may be addressed for further information.

STORING OF ELECTRICITY.

One of the latest and most interesting of electrical novelties is the improvement in the secondary battery of Gaston Planté, by M. Faure, which has been brought to the notice of the scientific world by the accounts of the transportation of a box of "electric energy" from Paris to Glasgow, for the purpose of having it submitted to Sir William Thomson, the eminent electrician, for tests and measurements. The results of this experiment have been pronounced wonderful, but no facts have yet been made public which afford a basis for an estimate as to the commercial value of the invention.

An extemporized Faure secondary battery of small dimensions has been in operation for several days in the office of the SCIENTIFIC AMERICAN, and although no extended tests have been made as yet, the results of the experiment are very promising. We give below an account of the experiment for the benefit of such of our readers as may desire to investigate the subject.

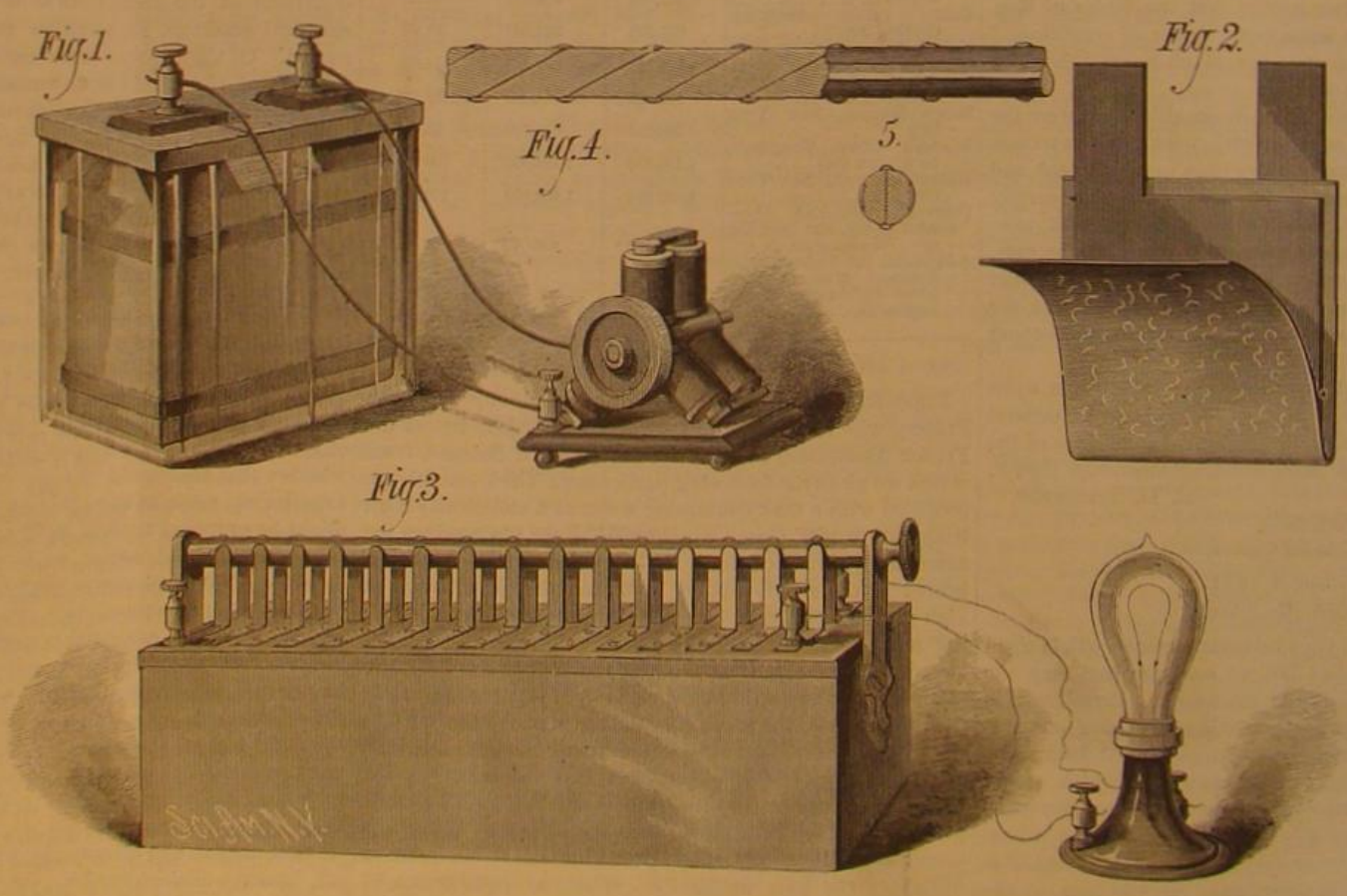
In attempting to follow M. Faure's plan of construction some difficulty was experienced in making the red lead remain in place during the rolling up of the two electrodes. Therefore the battery was constructed of square plates of lead, each having an ear projecting upward from one side, for attachment to a binding post. This plan succeeded very well, the flat plates having the advantage of retaining a great quantity of red lead and of being easily formed into a compact pile.

Fig. 1 in the engraving shows a single pile operating a small electric motor. Fig. 2 shows the method of combining the plates. Fig. 3 shows how a battery may be arranged with a commutator for combining the elements for tension or quantity, and Figs. 4 and 5 are respectively longitudinal and transverse sections of the commutator.

The plates employed in the experimental battery were of pure lead foil, having the thickness of a postal card, a width of 7 inches, a height of 7⅛ inches, with an ear projecting from the top 1⅛ inches wide and 3 inches high. The total effective surface on both sides and edges of each plate is 100 square inches. Ten such plates are sufficient for a single element for ordinary uses, and such an element may be fairly charged by means of four gravity cells, but a stronger current is much quicker and more satisfactory. The method followed in building up these secondary elements was as follows:

After cutting out a sufficient number of lead plates, pieces of canton flannel, 15 inches long and 7½ inches wide, were cut, and finally as many sheets of blotting paper, 7½ inches square, as there were lead plates were provided.

The next step was to prepare a thick paint of red lead by mixing the dry pigment with water containing one-tenth of sulphuric acid. This paint had a consistency of paste, and was applied thickly to one side of the sheet of lead with a common flat paint brush. The canton flannel having been painted to within one-quarter inch of all its edges on the nap side, the lead was laid, painted side down upon the painted canton flannel, when the other side of the lead was painted and the cloth was neatly folded over the lead, completely enveloping it with the exception of the ear at the top, and projecting about one-quarter inch beyond all of the edges of the lead. The lead with its envelope was then laid upon a level board, and another plate was prepared in the same manner and placed over the first, with an intervening layer of blotting paper, and with the ear placed opposite the ear of the first. Other lead plates were added in the same way, with the interposed sheet of blotting paper and with the ears alternating in position, as indicated in Fig. 2. When ten plates had been placed together in this manner they were clamped together with two or three elastic bands, and the ears were brought together and passed through a slit in the wooden cover of the containing cell and bent down upon the top of the cover, as shown in Fig. 1. They were then pierced and traversed by the screw of a binding post which enters the wood. In this way each pole of the element was furnished with a binding post, and at the same time firmly secured to the cover. The cell was then partly or wholly filled with acidulated water—water 10 parts, sulphuric acid 1 part—and after the cloth and blotting paper had become saturated the element was connected with four gravity cells. In one hour the element had stored electricity sufficient to heat 1½ inches of fine platinum wire to redness, to work a magnet strongly, and to run at a high rate of speed for fifteen minutes a small electric motor, that requires at least ten gravity cells to operate it. After this preliminary experiment a number of the new secondary elements were prepared in the same way and charged separately with a dynamo-electric machine. One element of ten plates, after receiving the current from the dynamo, for ten minutes operated the small motor above referred to for something over three hours.



STORING ELECTRICITY.—THE NEW SECONDARY BATTERY.

Another ten minutes' application of the current from the dynamo charged it, so that after eighteen hours of rest it yielded a current which seemed as strong as when it was first charged on the previous day; but a time test proved that it was incapable of running the motor for quite so long a time as when the current is used soon after storing. However, it proved that a large quantity of electricity could be stored and retained for a considerable time.

Six elements of ten plates each can be readily charged with the smallest current that can be obtained from a two light dynamo machine; that is, a current that will not support a single arc light will easily charge the number of elements, and they will readily support a single Reynier or Werdermann lamp.

For general experimental purposes the battery may be conveniently arranged as shown in Fig. 3. Each pole of each element is connected through the cover to a spring which is bent upward at right angles. The springs of the

two opposite poles of the battery touch upon opposite sides of a commutator cylinder supported a short distance above the top of the box.

Two opposite sides of the commutator are provided with straight bars connecting all the springs on each side, so that the current from all of the positive electrodes may be taken from the binding post attached to the spring at the end of the series on one side, and the current from all of the negative electrodes may be taken from the binding post at the end of the series of springs on the opposite side. When the commutator is in this position the battery may be charged and a quantity current may be obtained from it. When a current of high intensity is required, the elements are connected in series by means of the diagonal wires running through the commutator cylinder and terminating in buttons arranged on a median line between the metal strips. With this device all that is necessary to connect the elements for intensity is to turn the commutator through a quarter of a revolution.

It is too early to speak with any degree of confidence in regard to the capabilities of this new battery, but it seems susceptible of a great number of very useful applications.

For general experimental work its advantages are obvious. For electric lighting on a small scale it appears practicable, since a larger secondary battery may be charged by a small battery during the night and day for use during the evening. For use in connection with small electric motors for domestic purposes it would seem to have another application. For galvano-cautery it may serve a good purpose, and there are a thousand uses requiring only a brief expenditure of considerable power which would allow a large margin of time for the accumulations of electricity, where this battery may be advantageously applied.

The action of the battery is thus described in one of the English journals: "When a current is passed into this cell the minium on one plate is reduced to metallic lead, that on the other is oxidized to a state of peroxide. These actions are reversed while the charged cell is discharging itself."

A Water Carrying Tortoise.

At a meeting of the California Academy of Sciences the other evening, a very fine specimen of the desert land tortoise, from Cajon Pass, San Bernardino County, in this State, was received. The specimen had been carefully prepared, and was as large as an ordinary bucket. The tortoise is a native of the arid regions of California and Arizona, and Prof. E. T. Cox, who was present, related a curious circumstance connected with it.

He found on dissecting one of them that it carried on each side a membrane, attached to the inner portion of the shell, in which was about a pint of clear water, the whole amount being about a quart. He was of opinion that this water was derived from the secretions of the giant barrel cactus, on which the tortoise feeds. This cactus contains a great deal of water.

The tortoise is found in sections of country where there is no water, and where there is no vegetation but the cactus. A traveler suffering from thirst could, in an emergency, supply himself with water by killing a tortoise. They are highly prized by Mexicans, who make from them a delicious soup. The foxes of the desert attack the tortoise and finally overcome it by dragging them at times for miles.

B. B. Redding said he would try to obtain a live one for the Academy, in order that its habits and peculiarities may be carefully observed and noted. He instanced being on the Gallapagos Islands in 1849, and assisting in the capture of 92 land tortoises, varying from 450 to 600 pounds in weight, which the vessel brought to San Francisco and sold for more money than the whole cargo of lumber netted at that time. They were two months on board the vessel, yet ate nothing, and those killed had in them considerable quantities of pure water. They live on the high lava rocks, which rise as mountains on the island, where there are no springs or streams, and the only dependence of animal life for water is necessarily upon the irregular and uncertain rain showers.

It may be mentioned that the tortoise are of different species, though they may have the same habit in respect of carrying water. The famous edible species of the coast of the Pacific and Indies, of which the headquarters is at Gallapagos Islands, is the *Testudo Indica*. They grow to five, six, and even seven hundred pounds or more. Those found in this State are smaller, and are the *Agassii* species, first described some years ago by Dr. J. G. Cooper, if we recollect aright. Those Mr. Redding describes from the Gallapagos were offered water while on the ship, but refused it. Yet when killed they all contained water. The place they inhabit is a dry one, lacking water. It may be that they go to the high places and obtain it from the vegetation, the same as our species does.—*Mining and Scientific Press.*

THE SLENDER DRAGON FLY.

There are many species of dragon flies, all similar in their habits. They are properly named, being among the most voracious and cruel of insects, and even in their preliminary stages they exhibit their predatory disposition. In their larval and pupal state they inhabit the water, and are found in most streams, propelling themselves along by a very simple apparatus. They breathe by means of the oxygen which is extracted from the water, the liquid passing into and out of their body through a gill at the end of the tail. After giving up its oxygen the water is violently expelled, thereby forcing the insect forward.

The lower lip is jointed and can be extended about an inch. When at rest it may be folded, and can be protruded and withdrawn. It is furnished with a pair of forceps at the end, so that it may be able to grasp objects. This creature remains for some ten or eleven months in the preliminary stages of existence before developing into the perfect insect.

SLENDER DRAGON FLY.

Our engraving represents the slender dragon fly (*Lestes*). The male has a light gray encircling band around the middle part of the emerald-green body, the brown or black wing markings have almost a white edge, and it has two large pointed teeth at the inner edge of the clasping pincers.

The manner in which this species lay their eggs has been observed by Siebold, on the borders of a pond overgrown with rushes, and is shown in the engraving.

After the pairing the male clasps the female firmly by the neck and controls her movements. Both fly in this condition with outstretched bodies, lighting upon the water plants and appearing to be animated by one will. Frequently the male settles down on the top of one of the rushes; in this case the female curves her body, and placing the point of it behind the feet, pushes the sabre-formed egg-depositing instrument from out its horny sheath and presses it into the outer skin of the rush. As soon as this is done she creeps down the rush a single step, piercing another place with this apparatus, and continues to work in this manner, drawing the male after her, until the bottom of the rush is reached. Then both fly away to another rush and repeat the operation. Upon the stalks worked upon in this manner there may be perceived rows of whitish yellow spots. A strip of the skin of the rush is ripped up from the top to the bottom by this operation, but is pressed back again by the convex part of the apparatus after it is withdrawn. In almost every one of these pierced places an egg is found deposited in the back part of the roomy air cells of the rush, with its pointed dark-brown end crowded into the inner part of the principal crevice; the somewhat thicker rounded end is of a pale-yellow color and projects into the cell.

Sometimes no egg is found behind the pierced place in the rush; in this case it is probable that no time was given to the female to deposit one, for the male often flies up before the whole length of the stalk is traversed. Pairs of these insects have been observed upon the rushes which grow up out of the water. This does not prevent them from pursuing their accustomed way to the base of the plants. They both disappear under the surface of the water, having previously laid their four wings close together.

If the female betakes herself to the water the male quickly follows after, and she does not begin her work until he is quite surrounded by water. He bends the back part of his body into a position like that of the female, so that all the pairs that have been observed under water form a double curve with their bodies. A thin stratum of air clings to their bodies, their legs, and wings, which they use without doubt for breathing, for they will remain under water half an hour, for here as on the land they descend in the pond to the base of the rush. When they have reached the bottom they creep up the stalk again and fly away. It often happens that when one pair are already upon a rush

Minute Disease Organisms.

The organisms described by Pasteur as the origin of epidemics and contagious diseases are so minute and few compared with the multiplying swarms of bacteria, etc., pervading all generating solutions, that it becomes necessary to provide a means of eliminating the masses of infusoria from solutions to be studied under the microscope. These microzoa haunt even the clearest water at times. M. Certes suggests the use of osmic acid as a sure means of killing them without destroying their tissues. He dips a glass rod into the solution to be examined, and then into 1½ per cent solution of the acid; washing this in a narrow test tube of distilled water, it is easy to collect what is necessary.

Good bricks are unquestionably the best building material used. They come nearer to being fireproof than any other substance. Iron is treacherous and almost worthless in many places where it is used. A good oak pillar is far better as a support in case of fire than iron.

under the water another pair betake themselves to the water upon the same side of the rush. In this case the upper pair turn to the opposite side of the stalk, and thus they carry on their work unhindered. At the approach of an observer they fly away, apparently disturbed in their work, but when they are under water they can only be disquieted to a certain degree. If they are touched they clasp the stalk more firmly, and if still further disturbed they creep up the stalk more quickly than usual in order to fly away.

The pierced places in the stalk spread out into a brown spot under the water. The larva emerge from the pointed end of the egg.

Nearly all dragon flies are brilliantly colored, but the colors fade with their life, and in a few hours after death the most brilliant dragon fly will have faded to a blackish brown.—*Brehm's Animal Life.*

NATURAL HISTORY NOTES.

The Seventeen-Year Locust.—Professor C. V. Riley states in the *American Naturalist* that the present year will be marked by a quite extended appearance of this interesting insect, both a seventeen and a thirteen year brood simultaneously appearing. These two locusts agree in every respect except in the time required for their full development. The last simultaneous appearance of the two broods was in 1860, and their appearance the present year will doubtless give entomologists a chance to perfect their knowledge as to the geographical range of the insects. Pupæ have already been reported either near or upon the surface of the ground in several localities. The thirteen-year brood is by far the more extended, and occurs very generally throughout the Southern States, both east and west of the Mississippi.

Electrical Insects.—Entomologists inform us that a few insects are known which have the power, like the electrical eel (*Gymnotus*), of giving slight electrical shocks to those who handle them. Kirby and Spence, in their Entomology, describe one of these insects, the *Reduvius serratus*, known in the West Indies as the "wheel bug," and state it can communicate a shock to the person whose flesh it touches. Two instances of effects upon the human system resembling electric shocks, produced by insects, have been communicated to the Entomological Society by Mr. Yarrell: one mentioned in a letter from Lady de Grey, of Grobz, in which the shock was caused by a beetle, one of the *Elateridæ*, and extended from the hand to the elbow on suddenly touching the insect; the other caused by a large hairy lepidopterous caterpillar, picked up in South America by Captain Blakeney, R.N., who felt on touching it a sensation extending up his arm similar to an electric shock of such force that he lost the use of his arm for a time, and his life was even considered in danger by his medical attendant.

Growth of Plants in Oil.—M. Van Tieghem has quite recently discovered, and communicated to the *Bulletin* of the Botanical Society of France, the curious fact that many of the lower plants (Ascomycetes, Mucorini, etc.) can live and sometimes fruit very well when they develop in oil alone and far removed from all contact with the atmosphere. Unpurified oils are sown with a quantity of spores, and then, if a slightly moist substance be immersed in the oil, it becomes covered with vegetation. The common mould, *Penicillium glaucum*, among others, develops in oil and fructifies very well in the midst of the liquid, but to make the spores germinate requires the introduction of a small quantity of water at first. These plants germinate owing to the oxygen dissolved in the oil, and they possess the property of forming water at the expense of the elements of the oil. A species of yeast cultivated under such conditions has the property of extensively saponifying the oil in which it develops, without the disengagement of gases.

The Flora of Pompeii.—In 1851, the botanist Schouw published in his book, "Die Erde, die Pflanzen und der Mensch," some facts relating to the plants represented on the frescoes of Pompeii. In a recently published work by Professor Horace Comes, "Illustrazione delle Piante rappresentate nei dipinti Pompeiani," the author has passed in review no less than fifty species which are represented on the frescoes, and which he was enabled to identify, and twenty concerning which he is in doubt. Among the identified species are several that have never been mentioned by other writers on the subject; for example: *Althæa rosea* (holly hock), *Chrysanthemum coronarium*, *Lagenaria vulgaris* (calabash), and *Narcissus pseudo-narcissus* (daffodil). The *Althæa*, well enough known by the ancients to have a place on their frescoes, may well have been the "arborescent mallow" of which Theophrastus speaks, and which has been referred to *Lavatera arborea*, although its full growth is attained in a few months, according to the Greek author. *Narcissus pseudo-narcissus* corresponds in its emetic properties with the "Narcissus genus alterum herbaceum" of Pliny. The edible fungus, *Lactarius deliciosus*, is easily recognizable on the frescoes, and it is to this species, and not to a *Boletus* nor to *Russula integra*, that Pliny refers in the passage: "Fungorum lætissimi qui rubent," etc. (Hist. Nat., xxii., 23).

It appears from the frescoes that in the time of Pliny the naturalist, the Romans possessed through acclimatization, or at all events knew with certainty, plants foreign to Italy. Among these are the *Lagenaria*, cited above, the peach tree, *Acacia nilotica*, *Platanus orientalis* (plane tree), *Tamarix indica*, etc. One of the pictures represents the *Papyrus* and *Nelumbium speciosum*, along with the hippopotamus. *Morus nigra* (black mulberry) is among the plants recognized by Professor Comes, and this confirms the opinion of Fraas. The author has classed the plants in alphabetical order, and devoted to each one an article in which he recalls the principal passages of the authors and commentators who have referred to it. He believes the huakindos of Homer to have been *Gladiolus segetum*, and the hyacinthus of Pliny, *Iris germanica*.

A New American Fern.—The many lovers and collectors of ferns will be interested to know that another new species has recently been added to the list of the Pacific Coast forms. This time it is a *Cheilanthes*—a very beautiful species—and it has been named by Mr. G. E. Davenport (who describes and gives a very beautiful figure of it in the June number of the *Torrey Botanical Bulletin*), *C. Parishii*, in honor of its discoverer, Mr. W. F. Parish, of San Bernardino, Cal. It was detected in the crevices of rocks on a hill in San Diego county. Nothing definite is as yet known of its abundance, but Mr. Parish thinks that it is probably scarce, as he could find but two or three plants.

AGRICULTURAL INVENTIONS.

An improved sack or flexible receptacle for cotton, wool, and other substances, has been patented by Mr. Milledge B. Wever, of Johnston's Depot, S. C. The sack is attached to and envelops a jointed extensible frame that may be so adjusted as to distend it and support it in upright position, thus enabling it to be filled quickly and easily.

An improved stalk and weed roller and cutter has been patented by Mr. Henry H. Spencer, of Mound City, Ill. This machine is so constructed that the knives are at rest or have no reciprocating movement until, in the revolution of the cylinder, they arrive underneath the axle, when they are made, by cam-and-gear mechanism, to make a quick stroke, thus instantly severing the stalks or weeds upon which the whole weight of the machine is at that moment imposed. The knives are instantly retracted after such stroke by means of springs suitably arranged for the purpose.

Mr. Lewis Shepard, of Mace, Ind., has patented an improved harrow that can be conveniently adjusted to adapt it for various kinds of work. The harrow is made in two parts, each of which is made in the shape of what is known as the "A" harrow.

An improved hopple or device for confining the legs of horses or other grazing quadrupeds, so as to hamper their motion and thus restrain their wandering, has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter.

How Hides are Taken Off and Salted.

In the abattoirs of this city the flayers of cattle use in taking off the hides a knife with a straight back and a keen edge, broad at the haft, but tapering up almost into a point at the end. The hoofs are first taken off at the first joint, a piece of the loose flesh at the throat cut out, an incision made in the neck, and the knife run down through the middle of the belly and the center of the lower side of the hair tail. The animal, which, up to this time, has been lying on its back, is inclined a little to one side, being supported in that position by a prop under the downwardly-inclining forequarter. Beginning at the neck, the flayer runs his knife carefully along until the hide is taken nearly off the side which is uppermost, then the animal is rolled over on that side and propped up as at the beginning, and the same flaying operation is repeated on the part which was downward at first. Next a wooden support, about four feet long, six inches deep, and two inches wide, having a large iron hook in the middle adapted to be fastened to a rope for hoisting purposes, is run through incisions made in the hind legs just above the first joint; the rope is adjusted to the hook, and the carcass lifted up by a windlass, when the projecting ends of the joist are supported by cross beams about nine feet from the floor, and the body hangs suspended therefrom. One of the workmen now grasps those portions of the hide which have been taken off the sides of the animal near the neck, and another takes a large butcher's cleaver, and using the back, not the edge of the instrument, by repeated blows frees the skin from the rest of the carcass, while it is pulled off by the first workman. Great care is exercised in the process of flaying, as the workmen are subject to a fine for each cut and score on the hide.

When freshly taken off the hide is worth about 8 cents per pound. In this state it is sold to the salters with the pates and tails on. The salters place them in beds of about 600 each. The floor of the salt room is generally cemented, and the bottom layer of the hides is laid with the hair side down; the salt is then sprinkled on the flesh side, and another layer is put down in like manner until the bed is complete. The hides are usually left in the salt from ten days to two weeks. The salt used must be of good quality and ground rather fine, as in case a lump of even the size of an egg is left upon the flesh side it will eat into the hair of the hide placed above it and very seriously detract from its value. It takes about 180 bushels of salt, worth from 32 cents to 35 cents per bushel, to each pack of 600 hides. When the hides are taken out of salt they are well shaken and folded, first doubled lengthwise, and then wrapped up in four or five folds. In some cases salters contract their hides to tanners by the month or year, and settlements are made at the end of each month on the basis of the average ruling price during that period. It is now, however, becoming customary for them to sell each lot to the tanner or dealer who will pay the highest figure at the time of delivery.

In some of the abattoirs where the butchers do not do their own salting, the salters hire the pens and make no charge to the slaughterers, but receive the hoofs of all the animals killed in lieu of other compensation. In the Jersey City abattoir the salters pay $1,000 per annum for each pen, affording accommodation for fifteen animals at a time.—*Shoe and Leather Reporter.*

Sugar from Rags.

The newspapers have lately taken up the subject of making sugar from rags, and some of them seem to regard it as a new invention. This, however, is by no means the case. It has been long known to chemists that if vegetable fiber, such as that of cotton, flax, etc., be submitted to the action of sulphuric acid, it is converted into soluble starch or dextrine, and this is readily convertible into sugar. The ordinary process of malting is simply a conversion of the starch of the barley into sugar by the agency of a ferment called "diastase," which is formed in the barley, and is so effective that only one five-hundredth part is sufficient to set up the action by which the insoluble starch is converted into dextrine, and then into sugar. This occurs when the grain of barley is sown in the ground, and is the natural operation by which the germ is fed: the germ having neither mouth nor stomach, cannot take solid food like the original starch granules which surround it in the seed; but when that starch is converted into sugar, the baby plant can absorb it, and continues to absorb it until its rootlets and first leaf are formed. By this time the sugar is all used up, but the plant is now able to obtain its nourishment from the ground by its root, and from the carbonic acid of the air by its green leaf or leaves.

Such is the ordinary life history, not only of the barley plant, but of all others. The starch is to the plant germ what the yolk and white of the egg are to the chick germ. If the sugar were ready formed in the seed it would be dissolved away at once by the water in the soil, and the germ would perish prematurely, but by the exquisite chemistry of nature the conversion of the insoluble starch into the soluble food of the germ goes on just so fast as the germ can use it, and thus the supply is kept up till the young plant can shift for itself. The maltster forces the natural process, and then kills the germ by roasting the seed when he has obtained the maximum amount of sugar.

Fruits also are sugar factories, in which is conducted the whole process of making sugar from rags, the fiber of the rags being represented by the fiber of the unripe fruit. Every boy who has struggled to eat an unripe apple or pear knows that the unwholesome luxury is what he calls "woody," as well as sour. The chemist describes it similarly. His technical name for the tough material is "woody fiber," under which name he includes nearly all the fibrous materials of the vegetable world, for they all have fundamentally a similar chemical composition. This woody fiber is made up of carbon and the elements of water. Starch and sugar are composed of the same elements, their differences of properties being due to differences of arrangement and proportions of the constituent elements. Thus the change of insoluble starch into dextrine, and dextrine into sugar, or the change of woody fiber into dextrine and sugar, are effected by very small modifications of chemical composition.

We all know that the unripe apple or pear is sour, or that it contains an acid as well as the woody matter. Now, this appears to act after the manner of the sulphuric acid that the chemist applies to the rags, but it acts more slowly and more effectively. The sweetest of pears are gathered when hard and quite unfit for eating, but by simply setting them aside and giving this acid time enough to do its work, the hard fibrous substance becomes converted into a delicious, sweet, juicy pulp.

The natural chemistry here has a great advantage over the artificial operation, seeing that the natural acid either becomes itself converted into sugar or combines with the basic substances in the fruit, forming wholesome salts. Not so the sulphuric acid of the chemist. He must get rid of this from his rag sugar; and herein lies the difficulty of the process. The writer tried the experiment more than twenty years ago, using lime for the purpose of removing the sulphuric acid, but found that in removing the sulphate of lime he lost much of the sugar which this solid absorbed, and from which it could only be removed by great dilution, and then not completely. To do this practically would cost so much that the rag sugar would be far dearer than that which nature beneficently manufactures by similarly, but more effectively, acting upon the fibers of the sugar cane or beet root.

There is little risk of the sugar trade being disturbed, or of the paper makers being deprived of their raw material, by the rivalry of rag sugar, though the chemist may display in a show glass some crystals that he has made from one of his own worn-out shirts.—*London Grocer.*

A Good Word for Cast Iron Stoves.

For some time Prof. Ira Remsen, of Johns Hopkins University, has been investigating for the National Board of Health, the alleged danger to health in apartments heated by hot air furnaces and cast iron stoves. The results of the investigation, Prof. Remsen tells the Baltimore *American*, "cannot well be given in a few words, but in general, it may be said that there is practically not much danger from carbonic oxide involved in the use of hot air furnaces and cast iron stoves."

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) F. M. E. asks for the composition of the inks used for stamp ribbons, such as are used on type writing machines. I have such a writer, but have not used it for two years, for the reason that I cannot re-ink the ribbons. A. Dissolve 1 oz. of best soluble nigrosine in 4 oz. of hot glycerine by triturating together in a hot mortar, and add ¼ oz. of soap previously made into a thick paste by triturating and macerating it with a small quantity of hot water. Rub this well into the ribbon.

(2) S. W. asks: What ingredient can be mixed with lime whitewash to prevent it turning yellow in rainy or damp weather when used on outside work? A. See answer to O. E. C., page 375 (40), current volume.

(3) W. L. S. asks for what purpose lampblack is used. Is it in demand, and what is the market value? A. It is extensively used in the preparation of various black paints, varnishes, japans, printing, marking, stenciling, and transfer inks. Address the dealer in paints and colors. See column of Business and Personal and Hints to Correspondents.

(4) B. W. B. asks how to make an ink that, when first written, cannot be seen, but when applied to heat it turns black. A. Use a dilute solution of chloride of cobalt (pure) in soft water. 2. Also an ink that after a certain time after it is written disappears. A. We cannot give you a receipt for such an ink. See Inks, in SUPPLEMENT, No. 158.

(5) H. G. F. asks for a remedy for mildew in sailcloth exposed to rain and sun. Something more potent than lime water, but not too expensive? A. Saturate the cloth with a strong hot solution of soap, press out excess of the liquid, and digest for six hours or more in a solution of alum 1 lb., in water 1 gallon. Rinse in plenty of clean water before drying. Acetate of lead is sometimes used instead of the alum.

(6) In answer to L. M. and others, C. M. says: The price of soap is regulated by the cost of materials employed, provided the manufacturer is fully competent in the art of soap making. My own experience is that a cotton seed oil soap costs 3½ cents a pound for materials, and a pure tallow soap 4½ cents a pound.

(7) L. B. writes: I wish to stencil some letters and figures around an ordinary white opaque glass globe (for gas). What kind of paint can I use that will not run and will not wash off? A. Try good black japan varnish, thinned with turpentine if necessary.

(8) A. B. asks: 1. How much sulphuric acid, chalk, and water, or sulphuric acid, marble, and water, or sulphuric acid, bicarbonates of soda, and water is necessary to make ten square feet of carbonic acid gas? A. Under ordinary conditions of temperature and pressure ten cubic feet of carbonic acid gas will require, in practice, 3½ pounds of good chalk or marble, 4 pounds of sulphuric acid and 1¼ gallons of water; or 2¾ pounds of bicarbonate of soda, 1½ pounds of sulphuric acid, and about 3 quarts of water. 2. Does strong pressure hinder the development of the carbonic acid gas? A. The reaction by which the gas is produced takes place under pressure the same as when the materials are exposed in an open vessel. 3. What is the best elastic material to resist the action of the mineral acids? A. Vulcanized rubber.

(9) W. J. B. asks: Will the common type used in printing stand to be heated hot enough to print letters in gold on the leather covers of books without injury? A. With care, yes. 2. Will the recipe given to W. S. P., in No. 23, do for lettering cloth book backs? A. Yes.

(10) A. B. B. asks (1) for a receipt for making a cement for cementing stone to wood. A. Melt and mix together equal parts of pitch, gutta percha, and shellac. Use hot. See Cements in SUPPLEMENT, No. 157. 2. Of what is hydraulic cement made? A. It is prepared by strongly calcining an argillo-silicious limestone or by calcining an intimate mixture of finely-ground lime, or limestone, clay, and sand. See Gillmore's "Cements and Mortars." 3. What is used for making artificial marble for tops of stands, etc.? A. The materials used are lime, lime carbonate, barytes, zinc white, and waterglass. Some of the stone is hardened by immersing it in a strong solution of chloride of calcium. For minerals, see under appropriate heading.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

May 24, 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.

Abdominal supporter, S. A. Richardson 241,883
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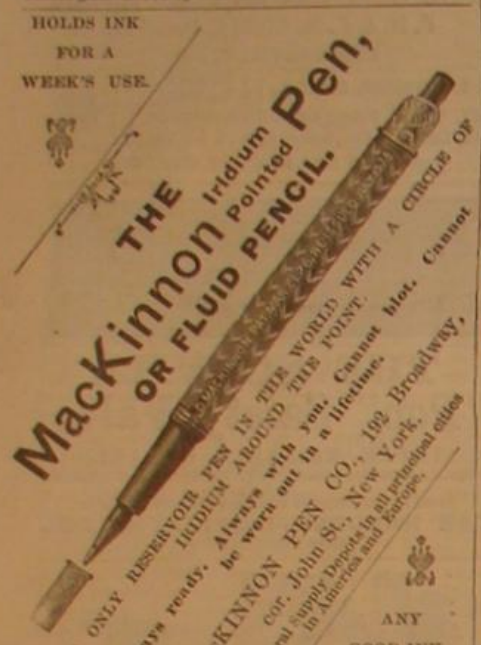

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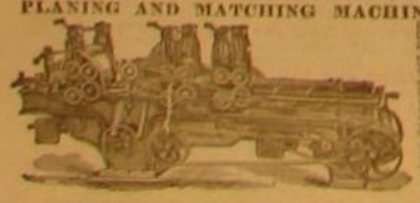

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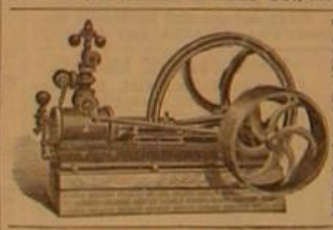

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