IMPROVED WATER MOTOR.

Another contribution to the various devices, which have lately appeared for supplying a cheap and readily available power for general usage, will be found in the novel water motor represented in the annexed illustration. Its object is to drive organ bellows, coffee mills, and sewing machines, and to perform a variety of light work ordinarily done by hand. In brief, its special adaptation is to operations requiring less than a single horse power, although the apparatus may be built to perform much heavier work.

This device consists of a light but firmly constructed iron wheel, provided on its outer rim with buckets, and the whole enclosed in a watertight iron casing. Through the casing an ordinary water pipe is so inserted that a stream of water from the pipe, flowing downward, strikes the buckets at a right angle with the radius of the wheel. The aperture at the end of the pipe is comparatively small, and on this account the water is forced through and against the buckets with a percussion-like effect, thus imparting a rapid and steady motion to the wheel.

In the illustration, the motor is shown attached to an organ bellows, the belt running from a small pulley on the motor to a large wheel on a crank shaft, to which the pitman from each feeder is attached. These feeders are shown at various stages, working alternately. In the supply pipe are two valves, one under the control of the organist, to admit or shut off the water, while the other is a regulator and works automatically. To start the motor, the performer has only to pull up the lever which opens the throttle valve. When the main bellows are full, the upper side, in rising, strikes a lever which is connected with the regulating valve by wire cords and bell cranks as shown, closing said valve and shutting off the water.

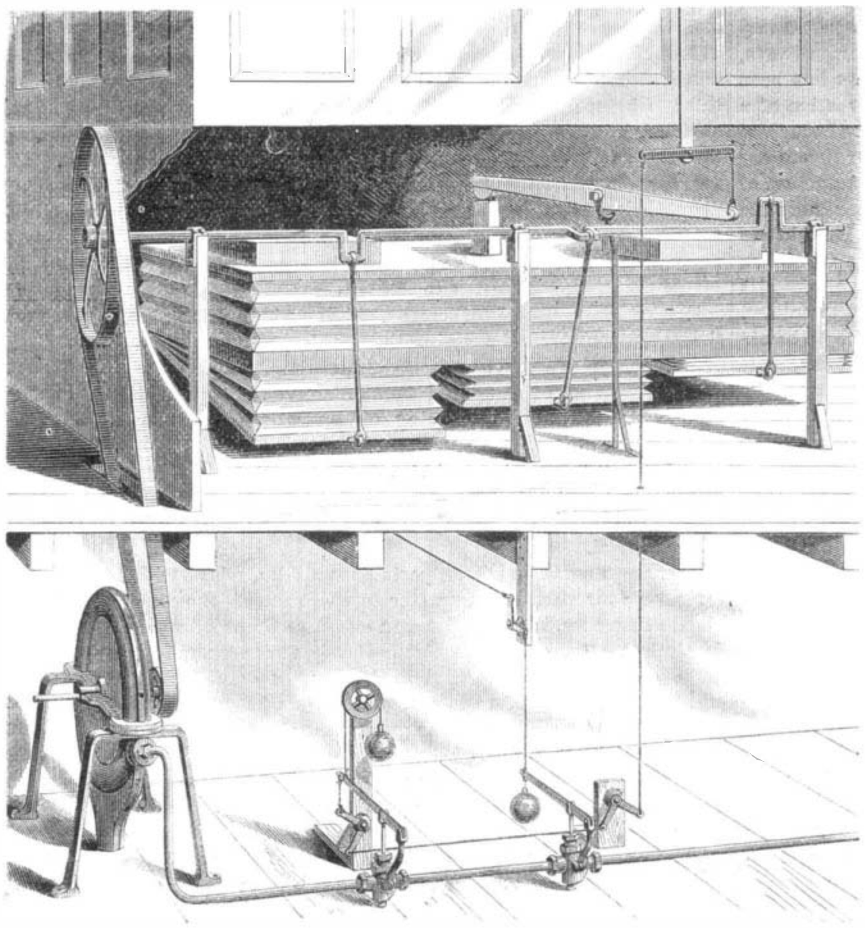
The inventor informs us that this arrangement is extremely sensitive, a mere touch on the keys of the instrument being followed instantly by a few revolutions of the motor, for a period just sufficient to replace the air expended. From testimonials submitted to us, it appears that the employment of the invention upon organs has been successful, and that the amount of water used has been about one third the quantity necessitated by other devices. It is stated that there is no jerking or thumping, but an even, smooth, noiseless, steady motion; while the apparatus is, besides, claimed to be simple, durable, and cheap, and to run for years without repairs. It is now in use on several organs of forty stops, doing the work with a pressure of water of twenty pounds per square inch, costing per annum, as we understand the inventor to assert, from $12 to $15.

The invention is also adapted for driving sewing machines, and, we are informed, can be applied to a single machine for domestic use so as to run at a cost of from $2.50 to $3 per annum. By regulating the water supply through a foot treadle, any speed may be attained from one stitch per second to 1,000 per minute, as desired. The apparatus can be attached to the ordinary water pipes, and it is claimed that a stream no larger than the head of a pin is sufficient to drive a sewing machine. Generally, the device can be used where the pressure is from twelve pounds upwards.

Among other practical applications of the motor may be mentioned its use for printing presses, turning lathes, jewelers' lathes, opticians' and lapidaries' wheels, grinding coffee and spices, cutting sausage, hoisting for stores and private residences, and, in fact, all light machinery requiring one horse power or less.

We understand that this motor is being used in Brooklyn and vicinity with much success, and at very cheap cost. Water sufficient for the purposes of a large organ can ordinarily be obtained for from $12 to $15 per year, or for a sewing machine for about $3.50 for the same period.

The invention was by Mr. Oscar J. Backus, of Oakland, Cal. For further particulars address the manufacturers, Backus Bros., & Co., Wright street and Avenue A, Newark, N. J.



BACKUS' IMPROVED WATER MOTOR.

Progress in Spain.

A very practical sign of real progress and improvement in Spain is seen in the increased demand which is springing up there for scientific information. *La Gaceta Industrial* of Madrid, formerly an insignificant publication, now comes to us enlarged to sixteen quarto pages, and is published twice a month, illustrated with engravings. It has reached its eleventh year. It is a handsome periodical and is ably edited. In the number before us the editor, Mr. Alcover, has a very excellent article upon the Centennial Exposition to be held next year at Philadelphia. He urges the authorities to provide liberally for a Spanish representation on that occasion, which, he says, is to commemorate the glorious anniversary of American liberty. It is to be a demonstration, he thinks, of the achievements of true liberty and independence, that can only be realized by labor, which is the secret of the prosperity of nations, and which has given to the North Americans such an astonishing preponderance.

Fourteen Thousand Miles of Ice.

The Hudson river ice crop for 1875 has now been harvested, and is one of the largest and finest ever gathered. The blocks average 14 inches in thickness, and the total quantity secured is about 2,000,000 of tuns, or seventy millions of cubic feet. If this mass of ice were arranged in a single line or beam, 12 inches square, it would have a total length of about fourteen thousand miles, and would reach more than half way around the world. To transport the entire quantity above named simultaneously, in ice carts, each carrying two tuns, drawn by two horses, driven by one man, would require an army of a million men, two millions of horses, and a million vehicles.

This enormous supply of ice will be chiefly consumed in the city of New York. It is brought down the Hudson river from the great ice houses, which are located at the water's edge, in large barges, towed by steam. It is delivered directly from the barges into the ice carts, and in them conveyed to the doors of private dwellings. For a quarter to half a tun a month is a common supply for a small family. The price charged is from $15 to $30 a tun for families, according to the scarcity or abundance of the supply. Large consumers, such as market men and hotel and restauraunt keepers, get the article at a much less price.

MEASURING MOUNTAINS.

Mr. Verplanck Colvin, in his report on the topographical survey of the Adirondack wilderness, elucidates some new theories on the subject of mountain measurement, and describes one method as follows:

"For short distances, I carefully measure on the mountain side a base line with steel tape, and from its extremities take the angular position of the object, afterward computing the distance. For very distant mountains, an adaptation of trilinear surveying has been employed. From the station of the barometer, the angles between any three of the surrounding peaks, whose positions I have before found trigonometrically, are measured, and afterward, by three point problem (usually graphically upon the survey map) the distance is obtained and the proper allowance made for curvature and refraction. Now that we have so many trigonometrically determined points throughout the region, the tri-linear method is found not only the easiest, but the most accu rate.

The practical application of this method to the work of the survey is well shown by the illustration, which represents a survey party engaged in leveling observations with mountain barometers, at the levels of the different peaks seen in the distance. At A is seen the transit, by whicht the horizontal angular distances between three of the distant peaks are measured in order to obtain the data for correction for curvature and refraction. Below, on the same same mountain side, at e, e, and e, are stations of barometers at the apparent levels of the peaks by the lines of sight level.

At the foot of the mountain is the bark camp, and the assistant observing on barometer at lower station: a guide near by is cutting night wood for camp.

The sight lines, or lines of apparent level (e —— to —— e), are taken from points on the mountain side, which are really lower than the distant peaks; for, following to the left the curve of the earth from the barometer station (h . . . . to . . . . h), it will be seen to descend below the level of the peaks in proportion to their dis ance—the true level of the distant peaks being the curved dotted line of equal hight—above sea level, evidently considerably higher than the stations of their apparent level. The effect of refraction is not shown in the illustration. In practice, the observer on barometer at the lower station takes observations upon his instrument and the attached and detached thermometers every five minutes; and (whenever possible) similar observations are taken on the summit of the peak above the intermediate leveling stations, affording both a lower and an upper station when well determined. The observations, therefore, taken at any five minutes, will be synchronous with those taken on the mountain sides, at leveling stations, or on the peak above; they can then be computed as usual, by the upper or lower station records, and, by the tri-linear measurements, the proper corrections for curvature, etc., made, and the true hight of the distant peak is found."

SCIENTIFIC AND PRACTICAL INFORMATION.

NOT A "NEW JERUSALEM."

It may perhaps be unnecessary to assure our devouter readers that Virginia City, Nev., is not the much longed for "New Jerusalem, the city of the Saints," notwithstanding its streets are paved with precious metals. It is true, nevertheless, that the denizens of that unsaintly city boast that the very mud of their streets is rich in silver and gold. It happens that the principal streets of the city were macadamized with refuse ore taken from the mines in early days; and since then, they have been steadily dusted with rich ore sifted down upon them from passing ore wagons, making a surface so precious that an ounce or two of mud (taken from the wheel of a wagon to decide a wager) proved on assay to contain, to the tun, silver, $7.54; gold, $2.32; total $9.86. "After this," exults the *Enterprise* of that richly paved city, "we may put on airs, even though our streets are villanously muddy occasionally, for the very mud on our boots contains both silver and gold."

A NEW USE FOR MINERAL OILS.

In a late number of the *Australian Medical Journal*, Dr. John Day maintains that certain of the mineral oils, gasoline especially, are of great use as disinfectants, their value depending, he believes, on the fact that they are rich in peroxide of hydrogen. He employs the gasoline in various ways as a disinfectant, applying it to walls, to articles of furniture, and to clothing; also as a wash for the hands after treating infectious diseases, allowing the moistened hands to dry in the open air. A peculiar and valuable property of these oils as disinfectants is their continuous action, while they improve and gather force by exposure to the air.

THE MARTIAL SEAS.

M. Meunier has recently advanced the theory that the planet Mars is much older than the earth, because of the rarification of its atmosphere and the small extent of its seas. The form of the latter, he says, is exactly that which the terrestrial oceans would assume after partial absorption by the earth's crust. If, for example, the Atlantic were absorbed so that only that portion included in the contour made by the uniform depth of 12,000 feet were left, the shape would be exactly similar to that of some of the seas recognized in Mars.

LEMON JUICE IN DIPHTHERIA.

Dr. Revillout states that lemon juice, used as a gargle, is an efficacious specific against diphtheria and similar throat troubles. He has successfully thus employed it for over eighteen years.

By Whom are Inventions Made?

In the course of a paper at the Society of Arts recently, on the "Expediency of Protection for Inventions," Mr. Bramwell, F. R. S., said: "The bulk, one might almost say the whole, of real substantive inventions have been made by persons not engaged in the particular pursuit to which those inventions relate. Take a few instances. Watt was not a maker of steam engines, the fire engines of his day, but he was a mathematical instrument maker; Arkwright, the inventor of the 'water twist,' was a barber; Cartwright, the inventor of the power loom, was a parson; Neilson, the inventor of the hot blast, was wholly unconnected with smelting operations, he was the manager of gasworks; Wheatstone, who has done so much for electric telegraphs, was engaged in the manufacture of musical instruments; and Ronalds, the very originator of the electric telegraph, had nothing to do with the visual telegraphs in use in his time; Bessemer, who has so enormously increased the manufacture of steel within the last quarter of a century, was in no way connected with that industry. The fish joint for railways, the greatest improvement in permanent way that has been made since railways were introduced, was the invention of a carriage builder. I trust I have given instances enough to establish my position, that the great substantive inventions are made by persons unconnected with the manufacture or art to which those inventions relate; and we can readily see why this should be. The person who has been brought up to pursue any particular manufacture has, even before he had sufficient knowledge to be able to appreciate the merits and the principle of the processes he was taught to follow, been trained in the belief that 'certain ends are to be obtained by particular means.' Under such circumstances, it is difficult for even a powerful mind to break through the trammels which have been imposed upon it, and to approach the consideration of the subject of the particular art with the same broadness of view and power of detecting and grasping the true principles upon which that art is based, as would be possessed by a mind devoting itself to the subject for the first time; and thus the man untaught and unprejudiced in the art is more likely to make a substantive invention than is one who has been trained in it from his youth. Improvements of detail such a person may make; but there, in all probability, will be the limit of his inventions.

One can understand that a man who had been taught from his boyhood to make steel by the process of cementation—that is, by packing bars of wrought iron into brick boxes containing charcoal, and exposing the whole for several days to considerable heat, and thus carbonizing the iron and producing blistered steel—might, not unnaturally, devise some improvement by which this process could be expedited, though one can hardly imagine such a man breaking with the traditions of the industry, and casting away the whole process of cementation. But one bringing a totally fresh mind to the consideration of steel manufacture would, in all probability, study the question from the very beginning, and would say: 'What is steel? What is wrought iron? What is cast iron?' and when he discovered that steel was something between cast iron and wrought, that is to say, it contained less carbon than the one and more than the other, and when he found that cast iron was a cheaper article than wrought iron (wrought iron being commonly produced from cast by practically abstracting the whole of its carbon), he would seek a means by which he might abstract from cast iron, not the whole of the carbon, to leave wrought iron, but so much of the carbon as would leave steel. To one brought up in the steel trade, the very word 'steel' would be associated with the addition of carbon, and it would be most unlikely that he should attempt the manufacture by a process which had for its object the taking away of carbon. Once concede that the great inventions are made by 'outsiders,' then it appears to me that, to continue this, the highest class of invention, protection is an absolute necessity. An inventor must nearly in every case make trials and experiments, and these, as a rule, can only be conveniently done in places where the manufacture is being exercised; but now we are assuming that the inventor is not engaged in the manufacture: he has therefore either to incur great expense to make his experiments—an expense in many cases prohibitory—or to forego the experiments altogether, or else he must seek the aid, and trust to the honor, of some manufacturer.

Imagine a country clergyman who has some knowledge of chemistry making an invention of an improvement in smelting iron ore. If he were a man of real ability, as I have supposed, he would appreciate the great complexity, and the many practical difficulties, of that process, and he would know that nothing short of a trial of his invention in the actual furnace could assure him that his method would not be frustrated by some such difficulty. What, without a patent law, is that inventor to do? Forego the trial? Devote $25,000 of the large property which usually belongs to a country clergyman to the erection of an experimental blast furnace; trust to the honor of a manufacturer; or give up the invention? I think the probability is that he would pursue the last course, and that thus the invention would be lost to the community. But even supposing the preliminary difficulty of a practical trial not to exist. Assume, for example, that the invention be one such as that of the Giffard injector, one of the most substantive of the present day. This might have been tried in private by its inventor without insuperable difficulty, even although he were wholly unconnected with any of the mechanical arts, and he might have perfected his invention in every detail. But when he had done this, what would have been his chance of reward? How would he have set about reaping the pecuniary benefit which he would desire, and which would be his reasonable due? Would he make up his mind to forego all his usual habits of life, and to become a manufacturer? Say that he did so, and that, in spite of the difficulties to which I shall have to revert, he succeeded in making a certain number of the injectors for sale, and that then he knew enough of business to obtain purchasers for them, what would be the inevitable result? The very first mechanical engineer (a steam pump maker) into whose hands one of these injectors fell, would say: 'Here is an implement that seems likely to compete seriously with the use of steam pumps. Why should not I make it? At present I know it is being manufactured by the inventor only, a person who was not brought up to the trade, and who is living in a purely agricultural district; it is a hard case if I cannot hold my own against him.' Thereupon the steam-pump maker goes to work, with all the advantages of an established factory, with its befitting plant, its staff of superintendents, its foremen, and its body of workmen, to produce injectors, and with a whole system of travellers and agents, and the advantage of a large connection, to dispose of the injectors when made. What chance would the inventor have, in his capacity of manufacturer and seller, against such an organization as this? Obviously, none; therefore, as it seems to me (equally obviously), he (foreseeing this) would not have bestowed the thought necessary to invent, and even if he had, he would not have incurred the labor and expense of experimenting upon his invention."

Useful Recipes for the Shop, the Household, and the Farm.

Frosted glass, useful for screens, etc., is made by laying the sheets horizontally and covering them with a strong solution of sulphate of zinc. The salt crystallizes on drying.

A teaspoonful of powdered borax dissolved in a quart of tepid water is good for cleaning old black dresses of silk, cashmere, or alpaca.

Butter will remove tar spots. Soap and water will afterwards take out the grease stain.

Black shoes may be bronzed by a strong solution of anilin red in alcohol.

Four parts borax and three parts Epsom salts, mixed with three or four parts warm water to one part of the combined substances, is said to form an excellent fireproof wash for clothes. It should be used immediately after preparation.

Flaxseed and tallow are used in Germany as a stuffing for cushions. One part of tallow to ten parts of flaxseed are employed, the mobility of the greased seed rendering the cushion very soft and pliable.

Gold bronze for furniture is a mixture of copal varnish mixed with gold-colored bronze powder. The last is bisulphate of tin.

The total number of strings in a piano, when properly stretched to produce the right tones, exert a pull of over ten tuns; this explains why good pianos must be durably and heavily built.

To prevent moths in carpets, wash the floor before laying them with spirits of turpentine or benzine.

Straw matting should be washed with a cloth dampened in salt water. Indian meal sprinkled over it and thoroughly swept out will also cleanse it finely.

In washing windows, a narrow-bladed wooden knife, sharply pointed, will take out the dust that hardens in the corners of the sash. Dry whiting will polish the glass, which should first be washed with weak black tea mixed with a little alcohol. Save the tea leaves for the purpose.

Gray marble hearths can be rubbed with linseed oil, and no spots will show.

Sprigs of wintergreen or ground ivy will drive away red ants; branches of wormwood will serve the same purpose for black ants.

Papering and painting are best done in cold weather, especially the latter, for the wood absorbs the oil of paint much more than in warm weather; while in cold weather the oil hardens on the outside, making a coat which will protect the wood instead of soaking into it.

Never paper a wall over old paper and paste. Always scrape down thoroughly. Old paper can be got off by damping with saleratus and water. Then go over all the cracks of the wall with plaster of Paris, and finally put on a wash of a weak solution of carbolic acid. The best paste is made out of rye flour, with two ounces of glue dissolved in each quart of paste; half an ounce of powdered borax improves the mixture.

An oaken color can be given to new pine floors and tables by washing them in a solution of copperas dissolved in strong lye, a pound of the former to a gallon of the latter. When dry, this should be oiled, and it will look well for a year or two; then renew the oiling.

Kerosene and powdered lime, whiting, or wood ashes will scour tins with the least labor.

Spots can be taken out of marble with finely powdered pumicestone mixed with verjuice. Cover the spots and allow the stuff to remain for twelve hours; then rub clean, dry, and rinse.

Soapstone hearths are first washed in pure water and then rubbed with powdered marble or soapstone, put on with a piece of the same stone.

A strong solution of hyposulphite of soda is said to be excellent for cleaning silver.

Two ounces of common tobacco boiled in a gallon of water is used by the Chatham street dealers for renovating old clothes. The stuff is rubbed on with a stiff brush. The goods are nicely cleaned, and, strange to add, no tobacco smell remains.

Never use wrought iron instead of steel simply because it it is more easily worked and cheaper than the latter; nor brass instead of gun metal in heavy machinery.

Shellac is the best cement for jet articles. Smoking the joint renders it black to match.

Barrels intended for alcohol may be rendered perfectly tight by applying inside a solution of 1 lb. leather scraps and 1 oz. oxalic acid in 2 lbs. water, afterwards diluted with 3 lbs. warm water.

A solution of chloride of iron will remove nitrate of silver stains from the hands.

Unslaked lime is excellent for cleaning small steel articles, such as jewelry, buckles, and the like.

Glass may be powdered to render it suitable for glass paper, for filtering varnishes, etc., by heating it red hot and then suddenly plunging it in water.

To remove old paint, cover with a wash of 3 parts quick stone lime, slaked in water to which 1 part pearlash is added. Allow the coating to remain for 16 hours, when the paint may be easily scraped off.

Aluminum Utensils.

Seventeen years have passed since Deville first produced aluminum on a commercial scale; but the expectations regarding this very interesting and meritorious invention of the distinguished French chemist have not as yet been fulfilled. Although many of those expectations were somewhat exaggerated, they were not so unreasonable as many poeple believed them to be; for a metal with so many valuable properties would be useful in many of the technical arts. Among these properties are a beautiful color that does not change in the air, nor yet in sulphurous exhalations, and further remarkable lightness, an agreeable reasonance, and a capability of being worked into any shape. Moreover, in the use or manipulation of aluminum, there have not hitherto been observed any deleterious effects.

It is generally conceded that the cost, and not the absence of properties which make other metals valuable, has prevented the more extensive application of aluminum; and the price, although it was considerably less than it was at first, has remained high for many years. The cost of production of this metal, which can only be extracted by the use of sodium, cannot possibly be the only cause of its high price; for the commercial manufacture of sodium may be considered as a solved problem; and as soda ash is very cheap, sodium might be produced at a moderate cost if the demand were greater than it is. Large production is caused by large consumption, and the use of aluminum has been hitherto limited, mainly because custom and use have in a measure opposed the introduction of such a novelty, except for fancy articles.

Stories have been told and written about poisoning by cooking vessels made of copper, by glazings containing lead, and the formation of verdigris on spoons of (alloyed) silver; but if people were only determined to produce these utensils from aluminum, all danger from poisoning would be removed, and they would have vessels, the appearance and durability of which would leave scarcely anything to desire. They would be more convenient to handle than our light crockery ware, for they can be made as light, and, what is important, cannot be broken. Splendid pitchers, plates, goblets, lamps, etc., might be manufactured from deadened and embossed aluminum; and the lightness of spoons of this metal would make them more convenient than those of silver now in use. In this case it is not the price, but only prejudice, which presents itself as a drawback, for the price is only half of that of good silver; beside, the difference in the specific weights of both metals and the consequent cheapness in the use of aluminum are so great that, for the value of one silver spoon, at least seven equally large aluminum spoons might be bought. True, aluminum is neither a rare nor a noble metal; but it possesses, nevertheless, advantages over alloyed silver which give it a much finer appearance; it does not get black, nor does it form verdigris, and what it lacks in brilliancy and appearance is well compensated for in its agreeable lightness. But, unfortunately, it has been found impossible to plate with aluminum, either by the electro-galvanic or the foil method.

Poisonous Magenta Colors.

Dr. Springmühl, the editor of the *Musterzeitung*, states that out of 25 specimens of magenta only one was found free from arsenic. In 14 the amount was sufficient for quantitative determination. In four samples the proportions were respectively 6·5, 5·9, 5·9 and 5·1 per cent. Such qualities, of course, must prove dangerous if used for coloring liquors, confectionary, and toys. In dyeing, however, the amount of the poisonous matter which attaches itself to the wool is relatively trifling. This the author ascertained by an interesting experiment. In a beaker he dissolved 1·55 grains of the most poisonous sample in hot water. The solution, of course, contained 0·093 grains of arsenic. In it a square foot of pure wool (woolen tissue) was dyed. It was then well rinsed in a second beaker of pure water, and again in a third. The dyed wool, the residual dye, and the two wash waters therefore contained 0·093 grains of arsenic, and it remained to ascertain its distribution. In the dye bath were found 0·072 grains, in the first washing water 0·016. In the second washing water, the amount was too small to be determined. It, however, and the dyed wool must together contain the residue, 0·005. According to Marsh's test, the wool appeared to contain less than the second washing water. Hence a square inch of the woolen could contain scarcely 0·0003 of a grain of arsenic. If the proportion of arsenic is low, as in well purified magentas, the wool, when dyed, gives no indications by Marsh's process.

The two most frequent adulterants are oxalic acid and sugar. The author has found 21 per cent of the former, and twenty-four per cent of the latter. Joly has detected sugar to the extent of 50 per cent.

Aniline violets are more liable to sophistication than magentas, from the fact that they are sold, not in well defined crystals, but in powder or in cakes. The author has detected gum in a Hofmann's violet to the amount of 12 per cent, and 8 per cent of finely ground charcoal in a common phenyl violet.

Of 32 samples of iodine green examined, 5 were unquestionably sophisticated. One contained 18 per cent of sugar. An English sample was cleverly sophisticated with a salt of lead, probably the picrate, and deflagrated when a portion was heated upon platinum foil. Metallic lead was found to the extent of 10 per cent, corresponding to 21 per cent of the picrate. Two other samples contained respectively 14 per cent of common salt and 26 per cent of magnesia. Oxide of chrome is also a possible adulteration.

The finest sample of iodine green examined was from the manufactory of H. Siegle, in Stuttgart. The author considers that in the production of this beautiful and costly color the Germans are superior to the English and the French.

Correspondence.

The High Lakes in the West.

To the Editor of the Scientific American:

In your issue of December 22, under the caption of "The Highest Lake in the United States," you claim for Lake Harkness, Plumas county, Cal., that distinction, accrediting it an altitude of but 7,330 feet.

We have in Clear Creek county, Col., two beautiful little lakes, each of about a mile in circumference, very deep; and the water, of dark bluish green, is extremely cold. There is no apparent source of supply, as the lakes are surrounded by high mountain walls of granite blocks, piled in magnificent confusion, and quite heavily timbered. They are at an altitude of at least 9,000 feet, and are the source of the famous Clear Creek Cañon stream.

Again, about six miles south of these lakes and at an altitude of fully 10,000 feet, as it is just above our timber line, is situated Chicago Lake, now widely known as the scene of Bierdstadt's "Storm in the Rocky Mountains." It is a most picturesque sheet of clear, limpid water, but appears at a little distance to be almost black, owing to its great depth. The water is intensely cold, but contains an abundance of trout. The lake is about a half mile in diameter; and at the upper or northwest side, a perpetual bank of ice and snow creeps down to the water's edge. On the south, an imposing wall of smooth granite towers almost vertically to the hight of 2,000 feet; while on the west, there are a series of majestic terraces, like huge steps 300 to 400 feet high. The north wall slopes away at an angle of about 45°; and to the south and east, there is an easy, gradual slope down into Chicago Cañon. This lake would appear to have been the crater of some volcano. Yet there are no traces, that we could find, of any volcanic action. C. R.

St. Louis, Mo.

To the Editor of the Scientific American:

Your journal for December 22, 1874, states that a certain lake in California, having an elevation of 7,330 feet, is probably the highest in the United States.

There are hundreds of lakes in the Rocky Mountains having a greater altitude than 7,330 feet. Prominent among these are the Twin Lakes, 8,700 feet, San Cristobel and Lake Mary in the San Juan county (somewhat higher), and Grand Lake in Middle Park. There are many smaller lakes in the region of the timber line, varying in elevation from 10,000 to 12,000 feet. These lakes are all along the snowy region: in the National, Elk, Saguache, San Miguel, Uncompahgre, Sangre de Christo, and other ranges. In the National range, which, according to Professor Hayden, "is by far the largest and grandest in the United States," there are several considerable lakes above 9,100 feet, and many smaller ones, from 10,000 to more than 12,000 feet, above the sea level.

West Hallock, Ill. HERBERT R. SAUNDERS.

Hollow Bolts and Axles.

To the Editor of the Scientific American;

For several years it has cost me five dollars a week to keep the bolts on my trip or cushioned hammer heads in repair, and, finding it to wear on my patience, I tried all kinds of iron, but to no use; break they would. I made the threads of a round or U shape, which worked much better than the V; but still they broke. I finally bored a hole, one third the diameter of the bolts (1¼ inches), and put a ⅜ of an inch hole down, some way below the thread, which formed a tube. I have now run them for three months, and they show no signs of giving out. The wrench used would break the other bolts easily; but it cannot do so with these. My work on spindles requires the dies to snap together about nine times in ten, which tells very severely on the bolts; and I believe that the bolts broke because the severe strain on the nuts stretches the outside grain of the iron by the concussion, so that there is a contention between the outside and inside strain.

I was apprenticed to William Fairbairn, in Manchester, England, and I have known his 8 inch axles on locomotive engines to break, owing probably to the rails resting on stone sleepers. They had some 6 inch tubular axles made, with 2 inch holes; and they never broke one of them, to my knowledge. JOHN BIRKENHEAD.

Mansfield, Mass.

Bolting Reels.

To the Editor of the Scientific American:

There is at present considerable interest manifested by millers as to the best method of constructing bolting reels and clothing the same, the best arrangement of the various numbers of cloths, etc. It is now almost universally conceded by the most intelligent millers that the less violently the meal is acted upon in the reel in the process of bolting, or, in other words, the nearer the motion of the meal is to a slide, the cleaner and whiter will be the flour. In endeavoring to attain this sliding principle, various plans of constructing and clothing bolting reels have been resorted to. Among some of the methods employed are putting the cloth on the inside of one riband on the outside of the adjacent one putting the cloth on the inside of all the ribs, using large reels and running them at a slow motion, also using the round form of reel. The writer has tried all the plans above mentioned, and more too, but finds the round reel much the most satisfactory, both on account of the improved color of the flour and the greater capacity of the reel.

It is the practice in many of the best mills in the Northwest to bolt the meal in the usual manner, and then rebolt the flour through a bolt of the round form, covered with a somewhat finer cloth, one round bolt of twenty feet long being of capacity sufficient to rebolt two hundred barrels of flour in twenty-four hours.

I would like to hear from brother millers as to what they consider the best style of dress for millstones for grinding spring wheat. D. T. CHOAT.

Cedar Falls, Iowa

[For the Scientific American.]

THE VOICES OF ANIMALS.

BY PROFESSOR JAMES ORTON.

Aquatic animals are mute. A world of radiates, molluscs, and fishes, therefore, would be silent. Insects are about the only invertebrates capable of producing sounds. Their organs are usually external, while those of higher animals are internal. Insects of rapid flight generally make the most noise. In some the noise is produced by friction (stridulation); in others, by the passage of air through the spiracles (humming). The buzzing of flies and bees is caused in part by the vibrations of the wings; but it comes mainly from the spiracles of the thorax.

Snakes and lizards have no vocal cords, and can only hiss. Frogs croak, and crocodiles roar by the vibration of the glottis. The huge tortoise of the Galapagos Islands utters a hoarse, bellowing noise.

The vocal apparatus in birds is situated at the lower end of the trachea, where it divides into the two bronchi. It consists mainly of a long drum with a cross bone, having a vertical membrane attached to its upper edge. Five pairs of muscles (in the songsters) adjust the length of the windpipe to the pitch of the glottis. The various notes are produced by differences in the blast of air, as well as by changes in the tension of the membrane. The range of notes is commonly within an octave. Birds of the same family have a similar voice. All the parrots have a harsh utterance; geese and ducks quack; crows, magpies, and jays caw; while the warblers differ in the quality rather than the kind of note. Some species possess great compass of voice. The bell bird can be heard nearly three miles; and Livingston said he could distinguish the voices of the ostrich and lion only by knowing that the former roars by day and the latter by night.

The vocal organ of mammals, unlike that of birds, is in the upper part of the larynx. It consists of four cartilages, of which the largest (the thyroid) produces the prominence in the human throat known as Adam's apple, and two elastic bands, called vocal cords, just below the glottis or upper opening of the windpipe. The various tones are determined by the tension of these cords, which is effected by the raising or lowering of the thyroid prominence. The will cannot influence the contraction of the vocalizing muscles, except in the very act of vocalization.

The vocal sounds produced by mammals may be distinguished into the ordinary voice, the cry, and the song. The second is the sound made by brutes. The whale, porpoise, armadillo, ant eater, porcupine, and giraffe are generally silent. The bat's voice is probably the shrillest sound audible to human ears. There is little modulation in brute utterance. The opossum purrs, the sloth and kangaroo moan, the hog grunts or squeals, the tapir whistles, the stag bellows, and the elephant gives a hoarse, trumpet sound from its trunk and a deep groan from its throat. All sheep have a guttural voice; all the cows low, from the bison to the musk ox; all the horses and donkeys neigh; all the cats *miau*, from the domestic animal to the lion; all the bears growl; and all the canine family(fox, wolf, and dog) bark, howl, and whine. The howling monkeys and gorillas have a larger cavity or sac in the throat for resonance, enabling them to utter a powerful voice; and one of the gibbons has the remarkable power of emitting a complete octave of musical notes. The human voice, taking the male and female together, has a range of nearly four octaves. Man's power of speech, or the utterance of articulate sounds, is due to his intellectual development rather than to any structural difference between him and the apes. Song is produced by the glottis, speech by the mouth.

To cement metal to glass, mix two parts powdered white litharge and one part dry white lead into a dough with boiled linseed oil and lac copal. The metal is to be coated with the cement and then pressed upon the glass.

RECENT RESEARCHES IN THE SPECTRA OF THE PLANETS.

Professor Vogel has recently published an important work on the above subject, in which are embodied the results of his latest observations. The light of each planet has been analyzed by the aid of the spectroscope, and from the luminous bands and rays the author translates the self-written history of the other worlds.

The principal rays of the spectrum of Mercury coincide absolutely with those of the solar spectrum. Furthermore, certain bands which are not produced in the solar spectrum, except when the sun is very low in the horizon and when the absorption due to the atmosphere is considerable, appear permanently in the Mercurial spectrum. From this the existence of a gaseous envelope about the planet may be concluded, which exercises on the solar rays an absorbing action equal to the maximum similar effect of our atmosphere. Generally the least refrangible portions of the Mercurial spectrum are more brilliant that those of greater refrangibility; but it is impossible to separate here the effect due to our atmosphere from that produced by the atmosphere of the planet.

The light from Venus is also similar to that from the sun, with the addition of like absorption rays. It is concluded that the light is reflected from the cloud envelope which is known to encompass the planet. So far as the atmosphere of Venus is concerned, water must be present, so that one indispensable necessity for life there exists.

The spectrum of Mars gives a great number of the solar spectrum rays, beside, as in the two planets before referred to, others similar to the absorption lines of our atmosphere. It is concluded that Mars possesses an atmosphere not differing essentially from our own in composition, though richer in watery vapor. The red color of the planet seems to result from an absorption which takes place generally on the red and violet rays in their entirety. In the red, between C and B, lines appear which are peculiar to the Martial spectrum, but it has not been possible to fix their position definitely, owing to their feeble luminous intensity.

M. Vogel's observations on the minor planets, Vesta and Flora, have not been very productive of results, owing to the dimness of the spectrum; though sufficient indications relative to the former planet have been obtained to point to the existence of an atmosphere about it.

The greater portion of the lines in the spectrum of Jupiter coincide with others in the solar spectrum; but the Jovial spectrum differs from that of the sun in the existence of dark bands in the least refrangible portion, among which one in the red may be especially noted. The length of the luminous wave to which it is due has been estimated at 0·00185353 of an inch. The other lines present, different from those of the solar spectrum, coincide with the telluric lines.

While bands are produced in the less refrangible portions of the spectrum, the radiations of the more refrangible blues and violets experience a uniform absorption. The gaseous envelope which surrounds Jupiter exercises, then, on the solar rays which traverse it, an action analogous to that of our atmosphere. Hence, the presence of water in the Jovial atmosphere may be inferred. With reference to the band above mentioned, it cannot be precisely determined whether the same is due to the presence of some body not found in our atmosphere, or to the gas composing the Jovial atmosphere being mixed in proportions different from that of air. It is possible that the composition of the two atmospheres may be the same, but that their action on the solar rays varies only through circumstances of temperature and pressure, quite different on Jupiter from those found on the earth. The spectra of the dark belts observed across the disk of Jupiter are especially characterized by a very marked, uniform absorption, which is undergone by the blue and violet rays. The new absorption bands, peculiar to the spectrum of the planet, never appear, but the lines are more marked and are larger than elsewhere. This proves clearly that the dark portions of the Jovial surface are deeper than the neighboring parts. The solar light penetrates more deeply into these portions of the planetary atmospheres, and thus is subjected to more marked alteration. The red color of the planet, and especially the more decided tint of the dark belts, is attributable to the uniform absorption exercised by its atmosphere upon the blue and violet rays.

In the spectrum of Saturn, the most marked rays of the solar spectrum are present. A few bands, especially in the red and orange, have no equivalent in the spectrum of the sun; but they coincide with some groups of spectral lines belonging to the terrestrial atmosphere. The greatest absorption of blue and violet rays takes place at the obscure equatorial zone. In general, it may be stated that the spectra of the body of Saturn and of Jupiter are very similar. The same is not the case with the rings of the former planet. The characteristic band in the red is absent or marked by a feeble trace: whence it may be concluded that the rings have no atmosphere, or are surrounded only by a gaseous envelope of very small density and thickness.

The feeble light of Uranus prevents the distinguishing of the Fraunhofer lines, except to a degree which might admit extensive errors in drawing deductions from their positions. It appears, however, that the absorption of the solar rays may be sufficiently recognized to infer the presence of an atmosphere about the planet; but the direct causes of the absorption it is not possible to determine. The Neptunian spectrum is essentially different from that of the sun, but, for the same reason as in the case of the planet last referred to, little can be definitely ascertained regarding it, except a general supposition that it closely resembles that of Uranus.

IF gilt frames are varnished with copal varnish, they can be washed with cold water without injury.