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 rib and 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.