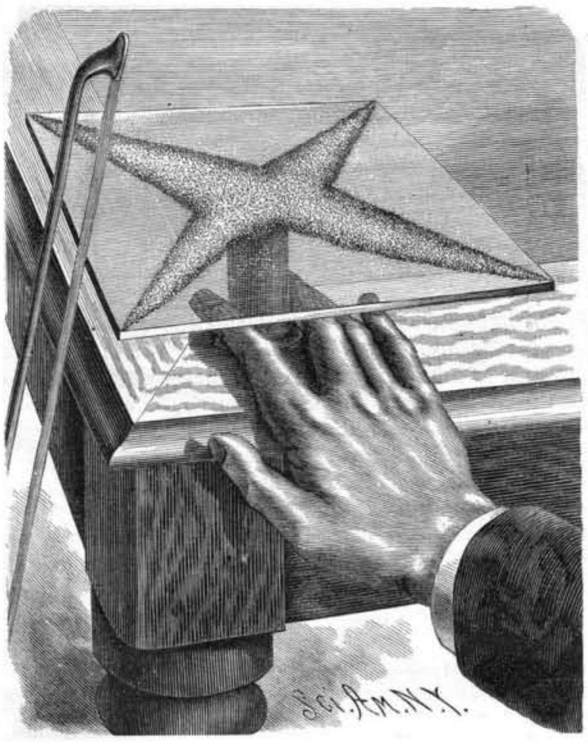
the bottom. A steam launch can easily effect their anchorage by holding them suspended at each side from small cranes, and afterward dropping them at the desired spot.—*L'Illustration.*

EXPERIMENTS IN SOUND.—CHLADNI'S PLATES.

T. O'CONOR SLOANE, PH.D.

The fact that all sounding bodies are in vibration may receive additional illustrations from the tuning fork. If the tines of one are started into strong vibration, and the extreme ends are dipped into water, a characteristic disturbance and splashing of the water is produced, and quite a shower of minute droplets is produced. Held against the cheek, a slight tickling is experienced, and the sensation when the vibrating prongs are touched to the teeth or lips is



CHLADNI PLATE WITH SAND.

almost unendurable. In a good tuning fork, the vibrations last a long time. One of large size, such as used for experiments, will vibrate for five minutes or more. Edison, in one of his dynamos, tried to avail himself of this principle, mounting coils of wire on the prongs of a gigantic fork, and using its oscillations, maintained by external power, as the generating motion.

The monochord, already described, can be made to illustrate longitudinal vibrations. If the finger and thumb, well resined, are drawn along the wire, it will emit a comparatively acute sound. With a violin bow the same can be produced. This illustrates the importance, in playing the violin, of keeping the bow at right angles to the strings, as otherwise more or less of the longitudinal note will creep in and alter the melody.

From what has been said, it will be understood that a cord may vibrate in several loops, or as a whole, producing different notes, one or more octaves apart. If a flat plate could be sustained properly or without interference, it could probably be made to vibrate as a whole. But as its mechanical support always involves one point of rest, loops and nodes are invariably established. The study of these is, from an experimental point of view, one of the most interesting parts of the subject of sound.

A piece of glass, of a regular shape, is good to commence with. A square, six or eight inches on a side, is cut from any piece of window glass. The sides are smoothed off with a file, a coarse whetstone, or on a grindstone. A little dry sand, a spool, and a violoncello bow, with resin, is all that is required for work. The glass plate is placed upon the end of the upright spool, and a little sand is dusted over it. The thumb of the left hand is pressed down upon the plate, and the bow, held vertically, is drawn down against the edge of the plate in the middle of one side. After one or two trials, the note will be found, and the sand will begin to dance about. After a few seconds, it will collect upon the nodes. In doing this, it carries out the phenomena of the riders of the cord. The sand is thrown off the vibrating parts, and rests upon the quiescent places. As soon as the permanent figure is attained, it will be found to form a cross, whose arms, tapering to points, run to the four corners of the plate. This proves that from each corner to the center a long node is formed.

By means of a little sealing wax or Burgundy pitch, the glass may be cemented to the spool. Even then it will be found that the best way to use the plates is to press down the center with the thumb. Another way of sounding is shown in the cut, by which the upper surface is left quite free.

To suggest a conception of how the plate vibrates, the familiar action of the bottom of an oiler, or hand oil can, may be cited. Every one knows how it springs in and out, as pressed or released from pressure. In a sounding plate, each loop, or venter, as it is more correctly termed, acts in this way, but on a far smaller scale as regards amplitude of vibrations. Recurring to the loops of a cord, one of the loops rises as its neighbor descends, and *vice versa*. It is the same in the plate. As one venter rises, the next descends. One phase of a plate in this form of vibration is shown in the cut on a greatly exaggerated scale. Assuming the plate to vibrate two hundred and fifty times a second, then it exists in this phase that number of times per second, the phase being succeeded by exactly the reverse condition the same number of times.

This much is the beginning of the subject only. If the plate is touched at the center of one of its sides with the finger, and the bowing is executed on any side at a point as near the corner as possible, another cross will be produced, whose arms will run to the center of the sides, instead of the corners. With good plates of glass, more complicated figures can be produced. To execute the experiments, different nodes must be established, by touching different points with one or more fingers and bowing in different places. Heavy plate glass, ten inches on a side, may be thrown into vibration with ease, showing how wonderfully efficient a contrivance a violin bow is. Almost anything that has a sound in it can be made to produce it by this instrument.

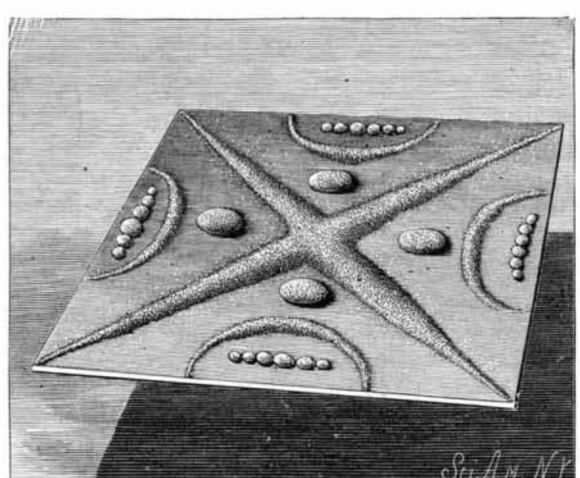
The plate, in vibrating, establishes air currents that are directed toward the venters of the plate. If lycopodium is sprinkled over the plate, owing to its lightness, it will be acted on by these currents, and will be drawn toward the venters, acting exactly the reverse of sand. It accumulates in curious circular piles wherever there is the most motion. If the plate is strewn with a mixture of sand and lycopodium, and is sounded, a separation, more or less perfect, of the two takes place, the sand going to the nodes and the lycopodium to the venters. This experiment, properly carried out, surpasses anything that can be done with the plates.

For it, and for the production of complicated forms, a metal plate should be used in preference to glass. A piece of sheet brass, of the size given for glass, answers all requirements. By careful manipulation, with a certain amount of chance, it can be divided into little squares, or other equally curious figures. In the cut a representation of a figure produced on such a plate, with sand and lycopodium mixed, is shown. The plate should be from one-sixteenth to one-eighth of an inch thick, and secured to its standard by a screw through the center. The vibrations in such a plate last for a few seconds after the bow is removed, keeping the sand dancing most curiously, while the lycopodium will form little clouds of dust when the vibration is powerful.

So far the reference has been to square plates, but any shape can be used. A circle, equilateral triangle, and regular hexagon, with the square, make a good set. The different figures produced run into the hundreds, so there is a large field open for experimenters.

Skinning of Small Quadrupeds for Mounting.

The following is taken from a pamphlet by Wm. T. Hornaday, chief taxidermist at the National Museum, and published by the Smithsonian Institution.



EXPERIMENT WITH SAND AND LYCOPODIUM ON METALLIC CHLADNI PLATE.

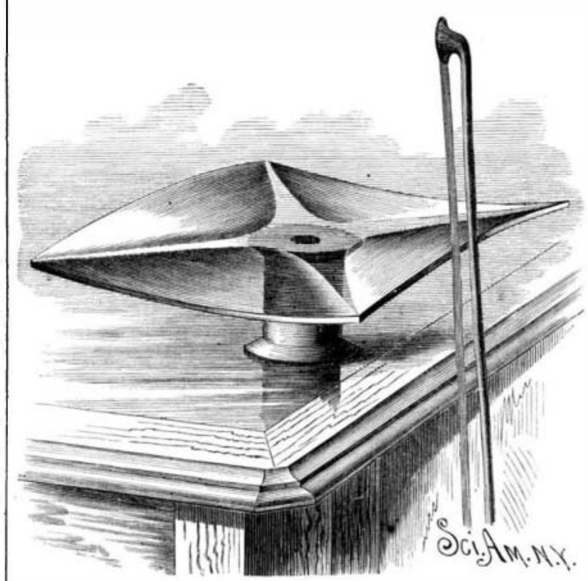
Lay the animal flat upon its back, and beginning at the throat, make a straight, clean cut in the skin along the middle of the neck, breast, and abdomen, quite to the base of the tail. Except in very small animals, the tail also must be slit open along the under side, from about one inch above the root quite to the tip.

The bottom of the foot must be slit open lengthwise from the base of the middle toe to the heel. All the opening cuts in the skin are now made

Begin at the middle of the abdomen, and cut the skin neatly from the body, leaving no flesh, or at least but very little, adhering to it. We come very soon to where the foreleg joins the body at the shoulder, and the hindleg at the hip. Cut through the muscles at those points, disjoint the legs, and detach them entirely from the body.

Skin each leg by turning the skin wrong side out over the foot, quite down to the toes. When this has been done, cut the flesh away from the bones of the leg and foot, but be careful to leave the bones attached to each other by their natural ligaments, and to the skin itself at the toes. *Never throw away the bones of an animal if the skin is to be mounted*, but leave them attached to the skin.

Detach the skin from the back, shoulders, and neck,



NODES AND VENTERS IN A VIBRATING PLATE.

and when you come to the ears cut them off close to the head. Turn the skin wrong side out over the head and proceed until you come to the eyes. Now work slowly with the knife, keeping close to the edge of the bony orbit until you can see, through a thin membrane under your knife edge, the dark portion of the eye. You may now cut fearlessly through this membrane and expose the eyeball. It is a good plan with large mammals to hold one finger of the left hand in the eye and cut against it to avoid cutting the lid.

Skin down to the end of the nose, cut through the cartilage close to the bone, and cut on down to where the upper lip joins the gum. Cut both lips away from the skull close to the bone all the way around the mouth, except directly in front of the incisors.

The lips are thick and fleshy, and must be split open from the inside and flattened out, so that the flesh in them may be pared off. Do not cut off the roots of the whiskers, or they will fall out. Pare away the membrane which adheres to the inside of the eyelids and turn the ear wrong side out at the base, in order to cut away the flesh around it.

If the ears have hair upon them they must be skinned up from the inside and turned wrong side out quite to the tip, in order to separate the outside skin, which holds the hair, from the cartilage which supports the ear.

To clean the skull, cut the flesh all off the cranium, cut out the eyes and tongue, and with a bent wire, or a spoon handle bent up at the end, draw out the brain through the occipital opening at the back of the skull.

By this time the skin will most surely have become bloody in several places, and before applying any preservative it must be washed *perfectly clean*. Blood left upon the hair imparts to it a lasting stain, and usually causes the hair to come off in mounting.

A Lubricant for Brass Work.

Writing to *Nature* regarding various fats which are used to smooth and bind the surfaces of various kinds of apparatus, such as air pumps, stop cocks, etc., Mr. H. G. Madan says:

"Melted India rubber answers fairly, but it has too little 'body' and too much glutinosity; moreover, it does, undoubtedly, in course of time, harden into a brittle, resinous substance. Vaseline is quite without action on brass, and never hardens; but it has not sufficient tenacity and adhesiveness. A mixture of two parts by weight of vaseline (the common thick brown kind) and one part of melted India rubber seems to combine the good qualities of both without the drawbacks of either. The India rubber should, of course, be pure (not vulcanized), and should be cut up into shreds and melted at the lowest possible temperature in an iron cup, being constantly pressed down against the hot surface and stirred until a uniform glutinous mass is obtained. Then the proper weight of vaseline should be added, and the whole thoroughly stirred together. This may be left on an air pump plate for, at any rate, a couple of years without perceptible alteration, either in itself or the brass."