visible to us in the spectrum makes our white light, it must necessarily vary from the white light seen by these insects, because it wants the supplementary color which they are, but we are not, able to perceive; and as there are few objects in nature in which the blending of several colors does not occur, it is evident that by adding another to the three primitive color elements, red, blue and yellow, we must obtain radically different color effects than any we have ever seen, and that this must make objects look very different to ants from what they do to us.

Many insects, unable to produce sounds which we can distinguish, possess nevertheless sound-producing apparatus, and elaborate organs of hearing analogous to those belonging to other and in general larger species, quite capable of making themselves heard. It is certain that a number of species of animals hear sounds that we cannot hear.

Arthropods in general are indifferent to ordinary sounds. It is possible the compass of hearing possessed by some animals lies in the range of air vibrations above our own, that they can hear no sounds as low as the highest note that is audible to us, as we can hear none as high as the lowest that is audible to them.

But it is without doubt the sense of smell, if indeed we may believe that all the phenomena credited to this sense properly belong to it, which attains its greatest development among insects. Professor N. S. Shaler, of Harvard University, asserts that a female gypsy moth (*Ocneria dispar*) will, by an odor so subtile as to be imperceptible to human olfactories, "attract males from the distance of about a mile away." Albrecht Bethe, the German entomologist, states that a male moth (species not stated) has been known to locate a female several miles distant. Prof. Jordan, president of the Leland Stanford, Jr., University, writes: "In the insectory a few years ago, a few females of the beautiful Promethia moth (*Callosamia promethia*) were inclosed in a box which was kept inside of the insectory building. No males had been seen about the insectory nor in its immediate vicinity, although they had been sought for by collectors. A few hours after the beginning of the captivity of the female moths, there were forty male Promethias fluttering about over the glass roof of the insectory. They could not see the females, yet had discovered their presence in the building.

The sense of smell is most nearly allied to that of taste. Hearing and seeing depend upon nerve responses to vibrations in the air and in the ether. In order to taste a substance, it has to be wholly or partially dissolved; in order to smell a substance, it must encounter the olfactory organs as a vapor, an emanation, a cloud of particles arising from odoriferous matter. An odorous substance can be readily inclosed so that little, if any, odor escapes.

Now in the first instance adduced, a cloud of imperceptible odor arising from an odor-producing organ, situated somewhere about the body of a little insect an inch long, spreads on every side for "about a mile" at least, and is dense enough at that distance to affect the sensory organs of the male moth.

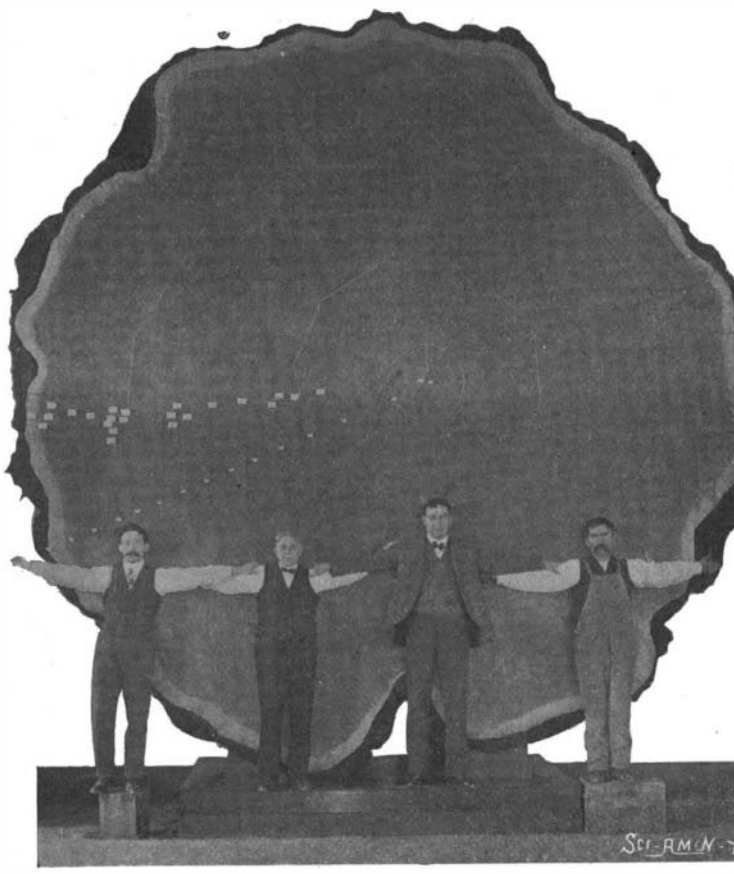
In the second instance adduced, the cloud extends to the distance of several miles without losing its virtue; and in the third, it not only penetrates through the box in which the female insect is kept inclosed, but also the glass roof of the insectory and extending outward to an unknown distance, mingled with, perhaps, as many as a million stronger odors, meets the male moths, which are able to differentiate it from all others, and to know the exact direction from which it comes.

Many animals can follow a scent trail left by another upon the surface of the ground; but to follow unerringly to some distant point in space, from which it arises, an odor extending indefinably in every direction in the air, is a very different proposition.

ONE OF THE LARGEST TREES IN THE WORLD.

BY WALTER L. BEASLEY.

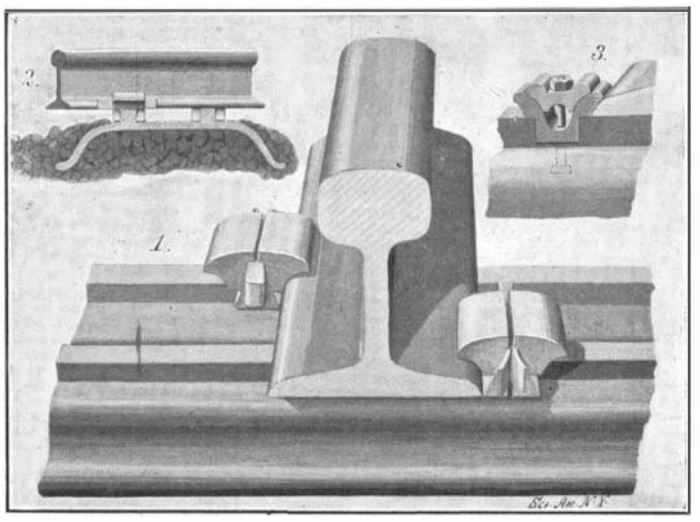
The American Museum of Natural History has now on exhibition one of the largest sections of a tree ever brought from a forest. The fast passing away of the big trees, the majestic relics of the forest primeval and prehistoric times, due to the ax of the commercial lumberman, is rapidly going on, and it will only be a question of time when all save those in government and State reservation groves will be cut down. Recently the government sent an expert forester and secured a magnificent cut from one of the giant Sequoias of the King's River area, Southern California. The tree stood over 300 feet in height, and measured 90 feet at the base. A section 20 feet above ground was obtained 4 feet thick and weighing 50 tons. The diameter of the block is a little over 18 feet, and its circumference measures 56 feet. The specimen is highly polished and will be the main feature of the new wing of the Forestry Hall. Prof. H. C. Bumpus, Curator of the department, has illustrated the life-history of the tree in a striking and unique manner, by placing tags marking every hundred years of growth, which is estimated from the cross-section concentric rings. In addition the great events and happenings in geology and other sciences are likewise recorded in these rings. The tree began to grow 550 A. D., and was 13 feet in diameter when Columbus reached our shores. Some of the trees in the same vicinity are said to be from five to eight thousand years old. Forest experts have estimated that a tree of this size contains 750,000 feet of lumber, which being cut into telegraph poles 8 and 9 at the base and 4 and 5 at the top, and 24 feet high, would make one pole forty miles long, or enough to supply a telegraph line from Kansas City to Chicago.



SECTION OF ONE OF THE LARGEST TREES ON RECORD.

RAILWAY TIE AND FASTENING.

A new steel tie that may be readily formed by rolling and then drop-forged into shape, is illustrated in the accompanying engraving. The tie is adapted to be used in connection with a very simple device, by means of which the rails may be quickly and securely fastened. A patent for this invention has just been granted to Mr. G. W. Schellenbach, of Joplin, Mo. The tie has the shape of an inverted trough, so that dirt or ballast may be packed underneath the same. On the top of the tie along opposite sides are ribs provided each with an opening to receive the fastening device. The opposite walls of these openings are undercut, and the fastening devices consist of two jaw portions having the outer sides of their bases inclined to engage with the inclined walls of the opening. These jaws have shoulder portions for engaging on the upper face of the rib. The outer sides of the jaws are made hook-shaped to engage the base flanges of the rails. Of course, only one jaw of a pair will be engaged with the rail, but it is preferred to make the two jaws of similar shape, so that should one become worn, the device may be turned and the other jaw engaged with the rail. After placing the fastening devices in the openings, wedges are forced in between the jaws. The wedges are split at the thin ends so that they may be bent outward to prevent accidental disarrangement. It will be noticed that the act of driving in the wedge results not only in an expansion of the fastening device in its socket, but also in a downward pull of the jaws which serves to clamp the rail down on the tie. These fastening devices are illustrated as short pieces not much longer than the width of the rib on the tie. However, if desired, they may be made sufficiently long to engage in opposite openings or opposite ribs. Obviously by this invention, a rail may be quickly fastened in place and very little packing will be required at the outer sides of the tie. To reduce noise a block of wood may be placed between the rail and the tie. The fastening thus arranged combines great strength and elasticity and is practically indestructible. No spreading of the rails can occur. In Fig. 3 we show a modification of the fastening device consisting of two jaws connected at the bottom by a cross-piece. The jaws are held and slightly spread by means of a wedge arranged between them and forced down by a bolt passing through the tie.



RAILWAY TIE AND FASTENING.

Odd Uses for Rawhide.

It was the great packing and killing houses of Chicago which helped to bring about the present uses of rawhide, says the New York Sun.

Rawhide is a form of leather in which the curing process stops far short of destroying the life of the material. The result of this treatment is a product remarkable for toughness, durability, tensile strength and pliancy. It is used for belting, rope, hydraulic packing, laces of various kinds, pinion wheels, washers, harness, mauls and mallets, flynets, trunks, saddles and artificial limbs.

Rawhide rope is handsome and astonishingly strong, besides having great power of resistance when exposed to the action of the weather. At a little distance it looks like very white and clean new hempen rope. It is delightfully supple, and once tied it holds for a lifetime. The cost of such rope puts it beyond the reach of most consumers, yet for some purposes it is the cheapest material that can be used.

It costs from 10 or 12 cents to more than $2.75 a foot, according to diameter and quality. The cheapest is about a quarter of an inch in diameter; the most expensive, save that made to order in special sizes, is two and a quarter inches diameter. It is largely used for the transmission of power, especially where the line of transmission is long and indirect. Only a close examination brings to light the points where strands are joined, and splicings are so made that they show no change in the diameter of the rope.

One of the most curious applications of rawhide is to the manufacture of pinion wheels for the transmission of power. Such wheels are usually made of iron or steel, but the rawhide can be made sufficiently rigid, hard and tough to serve all the purposes of metal in such articles. The rawhide pinions are almost noiseless, and they require little lubrication. A somewhat similar use is in the gear of friction wheels.

Mallets and mauls of rawhide are used for a variety of purposes in manufacturing. The former are entirely of hide save the handle; the latter have a wooden or metallic base with a rawhide face. Hammers with rawhide faces are also made.

The old-fashioned rawhide whips, the "cowhide" of many a social and political row, are made in several forms, as are blacksnake whips of the same material, rawhide lashes, and miners' whips. Rawhide lariats are also manufactured, though there was a time when every plainsman made his own. They cost from 15 to 20 cents a foot, according to diameter and form of pleat. They are rarely seen east of the Mississippi save in the factories.

In order to determine the density of the earth, President F. W. McNair, of the Michigan College of Mines, and Major John F. Hayford, of the U. S. Coast and Geodetic Survey, will conduct experiments at the Tamarack mine, which is particularly well fitted for this purpose, since its shaft is one of the deepest in the world, penetrating to a depth of 4,550 feet in strata of uniform density. The density of the earth is largely a matter of scientific conjecture. It has been computed by formulæ based on Newton's laws of gravitation. It is true that Sir George Biddel Airy, the British Astronomer Royal, computed the earth's density from experiments which he carried on at a Welsh colliery, but the figures which he obtained varied so much from those based on the formulæ that they have not been generally accepted.

The Rome-Paris telephone line was opened to the public in the beginning of December. The trials were most successful. The line is the longest in Europe, covering as it does 1,000 miles.