angle of 45° in an easterly direction. The dip of the mountain varies from 55° to 60°; thus the mines situated farthest from the croppings have to sink the deepest before striking the lode. The lode itself is well defined, lying between strata of hard rock, and consists mostly of porphyry, in which there is a large per cent of lime. This lime, when slaked by the water from numerous springs, generates a great deal of heat, so that in some drifts the miners can work but for a short time. Tons of ice are used daily in each mine; without it the men could not stand the heat. Most of the mines — the Sierra Nevada, Union Con., C. and C., Gould & Curry, Ophir, Chollar, Con. Virginia, etc. — are about equal as regards the depth of the lode, and strike it at about 1,800 feet; while others farther down, as the Yellow Jacket and combination shafts, strike it at about 2,200 and 2,600 feet.

Each mine generally has three shafts, one for pumping and two for hoisting purposes. Some, such as the Ophir, have a fourth, through which the incline is worked. The incline proper starts where the vertical shaft meets the lode, and follows it in its downward dip of 45°. The incline car, or "giraffe," as it is called, is worked by a separate hoisting engine at the surface.

Owing to the secluded situation, each mine has to depend on itself as regards repairs, timbering, etc., and they therefore maintain very extensive works. As an example, I will take the Union Con. hoisting works; the others are similar.

These works consist of, 1st, the hoisting works proper, in which the shafts and hoisting machinery are situated; 2d, the pumping-house, which contains a vertical compound beam pumping engine of 1,500 horse-power, and also a large Burleigh air compressor; 3d, the machine-shop, containing lathes, planers, bolt-cutting machines, drill presses, etc.; 4th, the timbering shop, which resembles a very large sawmill, and in which all the timbers are cut, fitted, and numbered before going into the mine; 5th, the boiler-house, containing ten furnaces, with a double set of 50-inch boilers in each, also two Burleigh air compressors; 6th, the blacksmith-shop, in which all the tools are sharpened; 7th, the ore-house, consisting of large bins from which the ore can be loaded on cars by the use of shoots. There are also several storehouses, offices, etc.

The large hoisting engine is a double, horizontal, direct-acting engine, 28-inch bore, 96-inch stroke, and runs about fifty revolutions per minute. The main shaft, 23 inches in diameter, carries two large iron reels, each capable of winding up 3,000 feet of wire cable three eighths of an inch thick and five inches wide; these reels are loose on the shaft and worked by clutches. The engine never has to lower the cages, this being done by brakes worked by hydraulic pressure. Each engine is provided with a device by which the engineer can tell within half an inch where the floor of the cage is; this is a necessity, as the cars have to be rolled on to the cage from the tunnels at different levels.

The pumping engine is a vertical, compound beam engine, the initial cylinder 60 inches diameter, the expansion cylinder 100 inches, air-pump 62 inches. The beam weighs seventy tons, and is connected to a cylinder at each end. The fly-wheel is connected to one end of the beam and weighs one hundred and ten tons, turning on a shaft of 28 inches diameter. At the other end of the beam is the pump rod, made of 18-inch square timber, and 2,200 feet in length. The sticks of timber used in these rods are from seventy to ninety feet in length, and are put together with large iron straps and hard-wood wedges. By the use of long pieces, wedged together, there is very little lost motion in the rod. To the rod are attached eight 18-inch plunger pumps in pairs, at distances of two hundred feet apart. The lower set take the water at the bottom of the mine, and force it up two hundred feet into tanks from which the next pair are fed, and so on up to the 1,400-feet level, where it is led into the Sutro tunnel and carried off some twenty miles. Before the