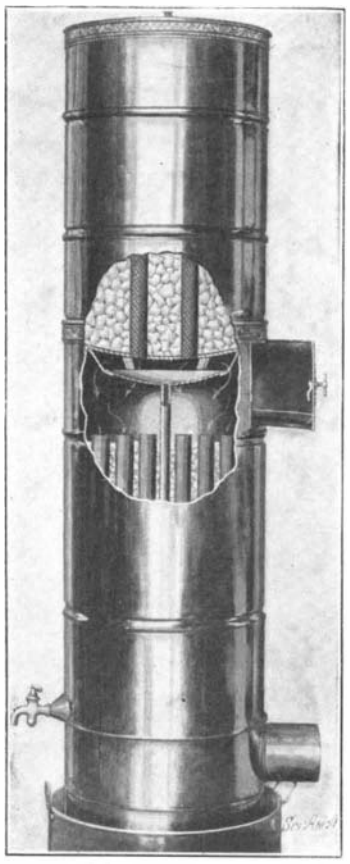
AIR-COOLING APPARATUS.

Prof. Willis L. Moore, Chief of the United States Weather Bureau, Washington, D. C., has invented an apparatus which is designed to moderate the extremes of summer heat just as a stove moderates the extremes of winter cold. This novel cooling stove, however, operates on principles which are the reverse of those of the heating stove. The fuel used is broken ice which is so disposed and mixed with salt as to create a draft through the apparatus in a downward instead of an upward direction. Referring to our engraving, it will be observed that the parts are inclosed in a cylinder of heat-conducting material. The interior is divided into two chambers by a diaphragm having openings at intervals along its edge. Cracked ice is placed in this upper chamber and woven-wire tubes conduct air through this ice and the diaphragm into the lower chamber. This is quite an important feature of the invention, for broken or granulated ice when melting has a tendency to cake into a solid mass, which eliminates interstitial spaces and precludes the proper diffusion of air through the mass and also retards and eventually wholly obstructs its flow. The woven-wire tubes always insure a passageway, and becoming imbedded in the ice serve to hold it up against gravitating into a cake at the bottom and allow lateral diffusion of air through the tubes into the interstices of the ice. The lower chamber of the apparatus is also filled with ice which, however, is more finely broken and is mixed with salt, which lowers its melting point greatly. The air circulation is completed to the bottom of the apparatus by a number of thin metal pipes projecting above the ice level. In order to prevent ice-water in the upper chamber from running along the bottom of the diaphragm and dripping into these pipes, a drip-pan is placed above them which catches this water and directs it to the waste pipe. Cold air is heavier than hot air, so that the natural tendency of the air at the top of the apparatus would be to fall down through the tubes, thus establishing a current which is further strengthened by making the lower chamber colder than the upper one. At the bottom of the device the cold air passes out into the room through the large tube shown at the right in our engraving. The cooling apparatus is provided with a trough at the bottom which is adapted to catch any water condensed from the atmosphere on coming in contact with the cold walls of the cylinder, from which it will be observed that the apparatus dries the air in the room. Furthermore, it purifies the air by absorbing in the ice and brine any particles of dirt or dust carried thereby.

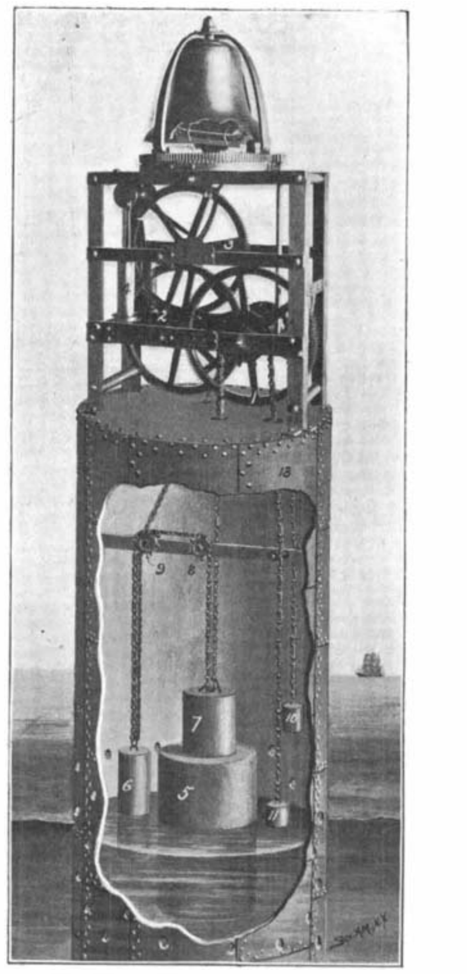


AIR-COOLING APPARATUS.

Big Ben, the celebrated clock of London, which regulates the time of a large portion of the British Empire, is having the dials on each of its four sides illuminated with 60-candle power Nernst lamps. The clock was formerly lighted by 24 gas jets on each dial, and on each night a man had to climb up and light these 96 jets. Two men spend three afternoons of each week winding it.

A BELL-BUOY OPERATED BY TIDE MOTOR.

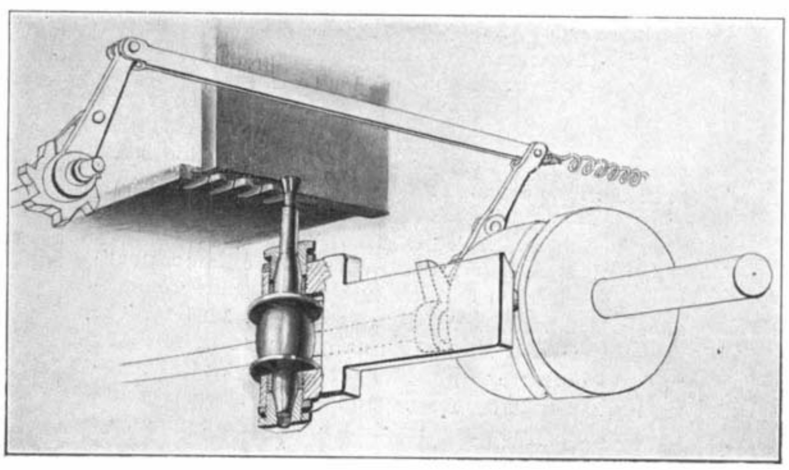
Ordinarily, bell-buoys are rung by the motion of the waves, which causes a steel ball to roll about on a plate under the mouth of the bell, and strike against its inner surface. With a view to making the action of the rolling ball positive, regular, and of a constant power, the Tidal Motor Power Company, of Seattle, provides a motor mechanism actuated by the rise and fall of the tide. The mechanism will be readily understood by reference to our illustration, in which the cylinder 13 is broken away to show the arrangement of the float and the weights. Connected to the gear wheel 1, by ratchet devices are two sprocket wheels. The chain connecting the weight 7 and weight 11 passes over one of these sprocket wheels, and over the other runs a chain connecting weight 6 and weight 10. The float 5 is connected to the weight 6 by a chain passing up through weight 7 and over the idlers 8 and 9. In our illustration, it is assumed that the tide is rising, and so the float is lifting weight 7, while weight 11 takes up the slack. The slack in the chain connecting the float with weight 6 permits the latter to drop slowly, rotating the gear wheel 1. The weight is so balanced as to move downward more slowly than the float moves upward, so that it will continue to operate the gear wheel at a constant rate while the tide is turning, and until the float begins to fall. Thereupon weight 7 continues the operation, while the float 5 falls and lifts weight 6, the slack being taken up by weight 10. The train of gearing 1, 2, 3, serves to greatly increase the speed of rotation imparted by the weights, and communicates the motion to a pair of plungers, working in the cylinder 4, and also to the cradle which carries the steel ball. The plungers govern the rocking of the cradle, so that the ball strikes the bell with a uniform stroke. The vertical rod shown at the right, in our illustration, is driven by bevel gearing on the driving shaft, and serves to slowly rotate the bell so as to prevent it from breaking under the constant hammering of the steel ball.



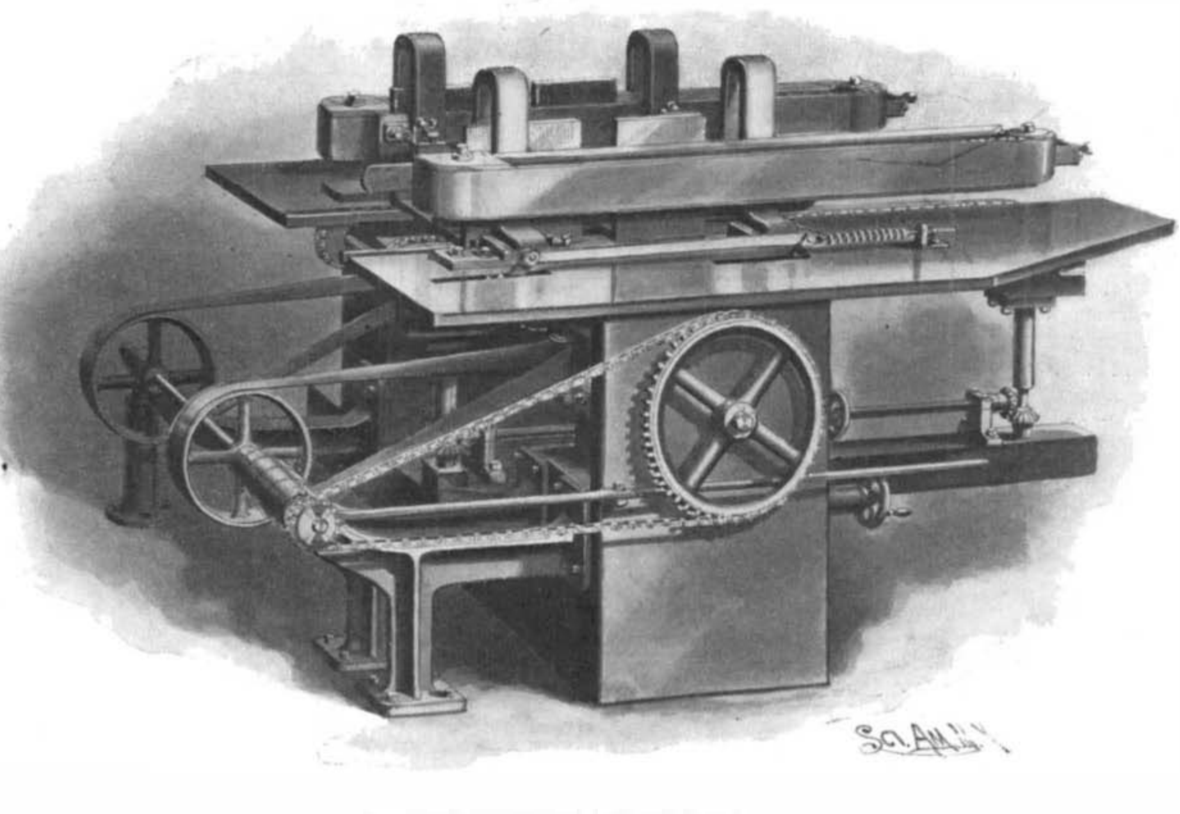
BELL-BUOY OPERATED BY THE TIDE.

DOVETAILING MACHINE.

An improved automatic dovetailing machine has recently been invented by Mr. J. T. T. Grim, of Cumberland, Md. The machine is self-feeding, it only being necessary for the operator to place the stock on the bed, so that the conveying chains may engage the same, and when power is applied the material will be moved properly relative to a rapidly-revolving cutter, and the mortises and tenons cut as desired without further attention on the part of the operator. The machine comprises two sets of mechanisms designed to operate on opposite ends of a bureau drawer or like piece of work. One set is mounted on a carriage which may be moved toward or away from the fixed mechanism to suit different sizes of work. The work is clamped, as shown in the general view, with the pieces in which the grooves are to be cut laid horizontal, while the others, on which the tenons are to be formed, are held in a vertical position. Two conveyor-chains are provided for each piece, and lugs bolted therein at proper locations serve to engage the pieces and feed them forward intermittently. The cutters, of suitable shape, are mounted in spindles which are rapidly rotated by belt connection with pulleys on the countershaft shown at the left of our engraving. The cutter spindles have bearings in brackets mounted to slide in guideways, to give the proper inward and outward movement of the cutters in forming the grooves and tenons. This movement is accomplished by means of a roller on each bracket, which is guided by an eccentrically-arranged cam-groove, as shown in our detail view. The cams are mounted on a shaft driven by sprocket and chain gearing from the counter-shaft. By means of a clutch connection on the counter-shaft, the rotation of the cam-shaft may be started or stopped at will. An intermittent or step-by-step motion is imparted by the cam-shaft to the conveyor-chains through the medium of a ratchet device, which is also shown in our detail view. It will be observed that a ratchet wheel is mounted on the conveyor-shaft, and is engaged by a pawl carried on a link.



CAM-ACTION OF THE DOVETAILING MACHINE.



IMPROVED DOVETAILING MACHINE.

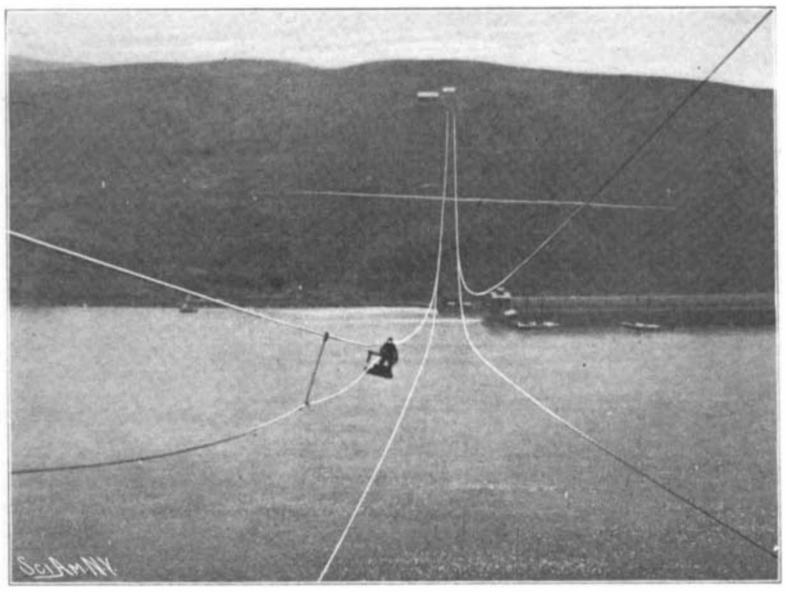
which is connected by a rod to a lever mounted above the cam-shaft. The lower end of this lever is provided with a roller, which engages a face-cam on the shaft. This cam is so shaped as to swing back the lower end of the lever when the drum-cams have drawn their respective cutters to the outer positions. This serves to push forward the link and pawl, turning the ratchet wheel on the conveyor-shaft; the conveyor-chains are all suitably connected with this shaft, so that the work on the beds will move forward in position for the next cut, while the cutters round the inner faces of the tenon that are being formed. After the projection on the cam has been cleared, the lever, together with its connections, is drawn back by the tension of a spring, and the pawl snaps behind the next tooth of the ratchet wheel, ready to move it forward another notch, when the cam projection again engages the lever. In the meantime the cutters are moved inward, each forming another tenon in its respective vertical piece and cutting grooves in the horizontal piece. Thus the work continues without requiring any attention on the part of the operator. When it is desired to dovetail an irregular piece of work, such as the swelled or curved front of a bureau drawer, it is necessary to support this front while the ends are being acted upon by the cutters. A central support and a supplemental conveyor-chain are therefore provided for the purpose. These are of course adjustable to different heights according to the shape of the work, and provision is made for moving them sidewise, also, in order that they may be properly positioned for work of different lengths. The machine embodies many improved details of construction which we cannot here describe, owing to the limits of space. One important construction will be observed in the mounting of the cutter spindles. It will be seen that they have tapered portions which fit in tapered bearings. The bearings may be screwed down to take up any play due to wear of the spindle. It is obvious that any size or shape of cutter may be secured in the spindle to meet the requirements of the work.

LONG-DISTANCE HIGH-TENSION TRANSMISSION OF POWER IN CALIFORNIA.

BY HAMILTON WRIGHT.

In the vast developments of electric power and its transmission California is fast solving the problem of cheaper fuel and power. The remarkable development that has occurred in the long-distance high-tension transmission of power as well as the approximate magnitude of the transmission industry is directly traceable to the absence of coal in material quantities in this State and the corresponding high price of mechanical power. The great cost of steam power at the time of earliest efforts toward electric transmission was responsible for the turn of the California tide of engineering effort from the coal pile to the waterfall as the most promising source of energy whence to operate the rapidly-growing electrical industries of the Golden State.

Perhaps the most consequential and interesting phase of electric transmission engineering in California lies in the unification of remotely separated electric systems into a single unit of vast proportions. In other words, all the electric lighting, power and railway interests of all the cities of the central and northern portion of the State have been concentrated and centralized into a single system which receives power from sources enabling the cheapest generation. The development and perfection of extremely long-distance transmission lines has made such unification of interests possible, and the honors should perhaps be divided equally between the Standard Electric Company of California, with its 145-mile electric San Francisco transmission, and the Bay Counties Power Company, with its main-line transmission of 142 miles from the Colgate power house to Oakland. The Standard Electric Company was the first in the world to come out with a definite and matured project for the transmission of power of great quantity over a distance materially in excess of 100 miles. It built its electric power plant and sub-stations and finished its pole lines practically ready for operation, but unforeseen difficulties prevented the completion of its water system, so that the Bay Counties Power Company, although beginning operations at a considerably later time, finished its plant before the Standard plant and in so doing secured the honor of being the first enterprise to successfully undertake such a long transmission. More than this, the Bay Counties Company secured a temporary contract with the Standard Company by which the Bay Counties Company delivered current to the Standard lines at Oakland for transmission to Stockton, a distance of 211 miles from the power house at Colgate, and as far north on the peninsula of San Francisco as Burlingame, a distance of 218½ miles from Colgate. These are the longest systems of electric transmission in the world. Now both the Standard and the Bay Counties plants are in operation, and each over its own line.



Greasing the Cables of the Colgate Power House.

The plan of centralization was the direct outgrowth of the success of extremely long-distance transmission. The Bay Counties Power Company's pole lines traverse that entire portion of California from Nevada County on the east to Butte County on the north, to Sonoma and Modoc counties on the west, and to Alameda County on the south, taking in each and every city, mining or other community consuming power *en route*. The electric lighting, electric power, electric railway and gas interests of this entire section are, almost without exception, under one transmission service for the operation of their electrical business, for all take power from the power houses under the control of the Bay Counties Power Company. In fact, this company operates in all more than 3,000 miles of transmission lines.

By means of its transmission lines the Standard Electric Company is tying together the electrical interests of the cities and towns extending around the Bay of San Francisco from Oakland to San Francisco. The Standard plant at Electra, in Amador County, has a capacity of 15,000 horse power, while that of the four generating stations of the Bay Counties Power Company, located in Yuba, Nevada, and Butte counties, is close to 23,000 horse power. In addition to these outputs the Standard Company is now building a new 21,000 horse power station in Stanislaus County and the Bay Counties Company is building an 8,000 horse power station in Butte.

However, these two great systems, which fairly cobweb the central portion of the State from east to west, by no means comprise a major portion of the electric long-distance transmission plants in California.

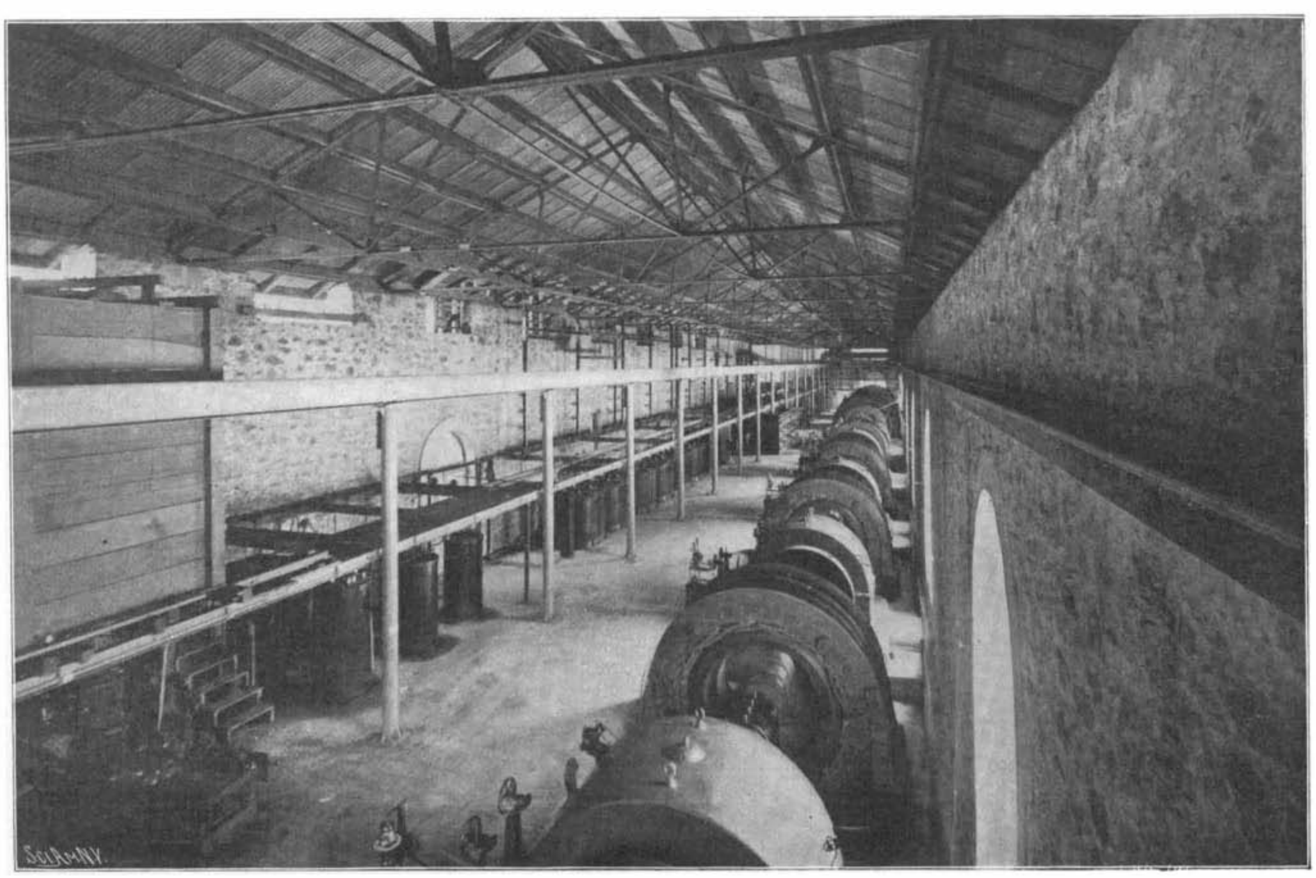
In the northern California system are the Butte County Electric Power Company, supplying Chico and the gold dredgers of that region and traveling with 23,000 volts thirty miles, and the Keswick Electric Power Company, which supplies power from Shasta to Redding and the Mountain Copper Company.

Electricity in mining is proving of immense value, especially for gold and silver mining in the desert regions where water is precious and fuel is costlier than almost anywhere else in the United States. With electricity, shafts, tunnels, leads, and slopes may be illuminated, drills may be run, elevator hoists lifted, fans will keep out impure air and pumps will keep the mine dry, while dynamite blasting may be conducted with less than half the present dangers.

The famous Yellow Aster Mining Company, at Randsburg, has gone to great expenditure in demonstrating the uses of electricity in working mines and has recently contracted to buy 3,500 horse power from a power company which is developing 8,000 horse power for mining purposes. Very recently a company with $1,500,000 paid-up capital has been organized for utilizing the power in five great streams along the Sierras. A corps of engineers who have been making plans for the development of electric power from the Kaweah River in Tulare County put the total expense of the work at $9,000,000. About 9,000 horse power will be obtained and this may be utilized in Tulare, Porterville, and other San Joaquin Valley towns. The San Joaquin Valley Company has recently finished harnessing a stream in the Sierras and is now transmitting several thousand horse power to Fresno and Hanford, over foothills and across rivers, ranches, orchards, and vineyards, for a distance of thirty-two miles. This is the cheapest power in the world and is furnished at as low a rate as two cents per horse power per hour.

Probably the most remarkable use to which electric power has been put is to move the implements of agriculture. At this writing a number of big grain raisers in San Joaquin Valley, California, are closing a successful series of experiments by which a combined harvester is impelled by electric power. Thus the stream which has furnished the wheat fields with water for irrigation purposes, also gives the power by which the crop may be later harvested.

The world's first successful experiment in electrical transmission was made in Germany in 1891. From Lauffen a line of 108 miles was run into Frankfort to light an exposition held there in that year. It worked successfully. Within a year the first electrical power plant in which the specific gravity of water was used in the United States was begun at Pomona,



The Latest View of the Interior of the Colgate Power House.

LONG-DISTANCE HIGH-TENSION TRANSMISSION OF POWER IN CALIFORNIA.