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SCIENTIFIC AMERICAN SUPPLEMENT

No. 961.

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Price 10 cents. For sale by all newsdealers.

PUPIN'S IMPROVEMENTS IN LONG DISTANCE TELEPHONING.

The efficiency of ocean cables for telegraphic communication and of long land lines for rapid telegraphy and telephoning is greatly impaired by their static capacity and self-induction. On lines possessing the last named factors in high degree only slow telegraphy is possible; any attempt to use the Wheatstone system meets with failure, and telephoning is out of the question. There is no doubt that the telegraphic world is waiting for the invention which shall overcome these troubles, and enable a telephonic conversation to be held over a line of ordinary construction, from New York to San Francisco. The present long distance telephone lines are of very expensive construction.

Professor M. I. Pupin, of Columbia College, has been awarded two patents on apparatus for telegraphic or telephonic communication which are designed to secure the possibilities outlined above. If the inventions answer the expectations which they raise, then it should be possible to telephone across the ocean, and the breadth of the continent should oppose no bar to telephonic conversation.

Professor Pupin proposes to divide a telegraph or telephone line into sections, electrically separated one from the other. At each point of separation a condenser is introduced of large capacity compared with that of a section of the line proper. The capacities are so proportioned as to "time" the line to respond to alternations or changes of very high frequency. By this division of the line into sections its periodicity as a whole will be determined by the periodicity of its single parts. Over such a line rapid signaling and telephoning can be executed, and it is believed that it opens up a greatly extended range for this class of electric transmission of voice and signal.

Its application to land lines is simple enough, but in the case of ocean cables some complications, to say the least, would be involved. Whether it would be practicable to sink a line of operative condensers at intervals along the ocean bed is a matter of conjecture. It would seem rather an innovation to cut an ocean cable into sections only electrically related by the medium of condensers. This thing is provided for in the patents, as Prof. Pupin proposes to use a coil of high inductance in parallel with each condenser to supply a metallic circuit for the determination of faults.

The inventions are most ingenious and promise to perform an important part in the field of long distance telephony.

NEW ZEALAND LABOR LAWS.

John D. Connolly, Esq,. United States consul at Auckland, New Zealand, has sent to the State Department a report on the labor laws of New Zealand, a copy of which we have received from the Secretary of State. In a few pages it gives a very striking presentment of paternal legislation in the antipodes, which seems to have proved successful and to be liked by the people. The dreams of Bellamy and of other describers of Utopian states, all of which make the happiness of their fictitious peoples depend upon direct governmental interference, seem to have some degree of realization in New Zealand. It would be hard to find a better place to try these theories. The two islands are not very large, and isolated in the ocean may be taken to represent geographically the New Atlantis. The theories of Sir Thomas More, of Bacon, and of Bellamy may be tried there to great advantage, in the absence of sectional issue and in a country which has every reason for being a unit.

It seems that previous to 1881 New Zealand was afflicted with the borrowing mania, English capital had been largely invested in the country, and for some time there was an abundance of money and "good times." About 1881 the crash came, and for ten years panic reigned. Then the government took up the matter, and by enactments tried to cure or palliate the troubles of the country. A law was passed against unscrupulous promoters and directors of stock companies, making them personally liable for their acts. Another law was for the protection of labor, both in the matter of wages and of personal injuries received while at work. Another act regulated factory labor and established compulsory holidays with full pay. These are but examples of the legislation alluded to, as many more acts were passed.

It is claimed that in the last three or four years the country has wonderfully advanced. The government has charge of almost all large operations. Roads and bridges, occupation for the unemployed, asylums, hospitals, railways, telegraph and telephone systems, life insurance and a savings bank are included among its subjects of work. Profits derived from these enterprises are applied to conducting the affairs of the state.

Most are well managed; some complaints are made against the railroads, however. The public works are conducted on the co-operative system. The government gives the work in small sections to gangs of men, who divide the earnings equally among themselves. There are no contractors. For the unemployed labor bureaus are maintained.

It is an interesting experiment and the results will be of the deepest interest. It is still an open question whether the great improvement of the last few years is due in part to the government's action.

PHYSICAL TRAINING IN COLLEGE.

A large number of boys who went to college in the first half of this century earned a part or the whole of their expenses. It was not uncommon for them to walk from their homes, long distances to college, to save stage fare; they cut their own wood; some of them boarded themselves and took care of their own rooms. The vacations were arranged with reference to their working through them with most profit, and not to their resting.

Their concern was how to find the time for study which they craved. These were the men who were the leaders in the nation in the dark days of the rebellion, as their fathers and grandfathers were in the revolution.

But changes in our social fabric have been nowhere, perhaps, more radical than in college life.

In the last quarter of a century we have become a wealthy people. There are still students in our colleges (and they are often those who take highest rank) who are obliged to work with their hands or brains, or both, to pay their bills, but there are sons and daughters of so many rich people that gymnasiums have become as much a necessity as chapels or recitation rooms. No well equipped preparatory school or college is without one, and exercise in them is part of the day's regular duty. In the best ordered institutions this exercise is taken after a physician's examination and according to his prescription. Calisthenics begin in the kindergarten with the sewing and songs and gifts, and they are continued through every grade of the best secondary schools.

Athletics is the new word which tells the story of our having got beyond the time when college life is for any one strictly a working period—one of work with the hands, so as to be able to work with the brain. The "crack pitcher" or oarsman, the captain of the boat crew or the ball nine, is now the man whom his fellow students point out to strangers as the conspicuous man in his class. He not unfrequently has a good standing for scholarship, but that is of less consequence. The regulations which men who are preparing for these trials of skill are obliged to follow ought to be suggestive and helpful to students who have no part in the games and races except as admiring spectators. These are the rules which are imperative for men in training.* "They must be in bed at ten o'clock every night, they must not smoke, chew nor drink beer or coffee; they must avoid pastry and sweets. They are obliged to run from one to three miles per day, in addition to their regular gymnastic movements. They take a complete bath at the close of each day's exercise."

But the gymnasium, the ball and tennis grounds, and the lakes and rivers, are not the only places where the college students of to-day get physical exercise.

The student who has spent two hours in a laboratory working with blowpipe and reagents, with physical apparatus or a dissecting knife, is perfectly sure while he is washing up his utensils and putting his desk in order that he has had some exercise. Much of the scientific work drives students afield, and the worn geological hammer and battered botanical can may be put in evidence to prove that students handle other tools than books. It is largely because the college work is much more practical than it was a generation ago that the age of graduation has advanced. Memorizing theories did not require so long as testing them does.

It is a requirement of one department of the Massachusetts Institute of Technology (it may be of others) that every student shall, from his own investigation, add at least one fact to the sum of human knowledge.

This institute, the Institutes of Technology at Hoboken, Worcester, and Troy, and the scientific departments in many of the leading colleges all offer fine facilities for men whose tastes and talents are not likely to lead them into the learned professions. In all of these, physical and intellectual effort go hand in hand.

The Flow of Water through New Cast Iron Pipe.

This subject was recently investigated by Mr. S. Bent Russell, of the St. Louis (Mo.) Water Works. The pipe was 12 inches in diameter, 1,631 feet long, and laid on a uniform grade from end to end. In a letter to Mr. J. C. Trautwine, Jr., Mr. Russell states that, as there was an opportunity to make some fairly accurate measurements on the discharge of the pipe, he had the necessary observations carried out, and found that under an average total head of 3·36 feet, the flow was 43,200 cubic feet in seven hours; under an average head of 3·37 feet it was the same; under an average total head of 3·41 feet, the flow was 46,700 cubic feet in eight hours thirty-five minutes. Making allowance for loss of head due to entrance and to curves, it was found that the value of c in the formula $v = c\sqrt{r\,s}$ was from 88 to 93.

*Rules furnished by Dr. Anderson of Yale University.