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Contents.

(Illustrated articles are marked with an asterisk.)

Air, impure (6061).....	349	Inventions recently patented.....	348
Anaglyphs.....	341	Irrigation, windmill.....	346
Armor plate, 18 inch, failure of.....	342	Labor laws of New Zealand.....	338
Ball bearings for wagons.....	342	Lantern slide making.....	339
Books and publications, new.....	348	Locomotive, a triple boiler.....	344
Breech-loading guns, illustrated history of.....	337	Marbles, artificial.....	347
Bridge, 7th Avenue, N. Y. City.....	340	Notes and queries.....	349
Channel, English, tubular railway, proposed.....	347	Orange-ouang, a gigantic.....	345
Columbia, cruiser, official trial of.....	342	Patents granted, weekly record.....	349
Comet.....	342	Photographic developing (6054).....	349
Cyclometer, the Hillier.....	346	Photographing a human head on a table.....	344
Dentistry, novelties in.....	346	Physics, training in college.....	338
Easter, occurrence of (6055).....	349	Railway, proposed, under British Channel.....	347
Electrical sanitation.....	347	Sleeping sickness of West Africa.....	339
Electric lamp, the Pollard.....	339	Steel castings, improved process for.....	342
Electric railway dangers.....	344	Stock feeding and watering devices, Winch's.....	341
Electric stable fixtures, Winch's.....	344	Surgery, operative, use of heat.....	339
Engine, steam, Devoissaud's.....	340	Telephoning, long distance, improvements in.....	338
Eyes, what is injurious to.....	340	Tool, combination, Harris's.....	340
Fires, banked.....	347	Tuberculosis and public health.....	342
Fisheries Association, the American.....	343	Water flow through cast iron pipes.....	338
French prosperity.....	339	Water, velocity of under head (6059).....	349
Fungus, effects of metal on.....	339	Wheel, the London gigantic.....	341
Gas well, a remarkable.....	343	World Fair, the, British report.....	345
Guns, early styles of.....	337		
Heat in operative surgery.....	339		
Incandescent lamps, destruction of.....	342		
Insomnia.....	346		

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT

No. 961.

For the Week Ending June 2, 1894.

Price 10 cents. For sale by all newsdealers.

	PAGE
I. AERONAUTICS.—The Air Ship Division of the German Army.—Use of the balloon in military tactics.—Details of the maneuvers.—5 illustrations.....	15352
II. ASTRONOMY.—The Fixed Stars.—By Prof. EDWARD S. HOLDEN.....	15354
III. CHEMISTRY.—Chemical Notes.—Some recently produced chemical compounds of much interest.....	15357
IV. ELECTRICITY.—Transparent Conducting Screens for Electric and Other Apparatus.—Important paper on a source of error in electric instruments.....	15353
V. FORESTRY.—Fair Forestry Outside of the United States.—By JOS. CRAWFORD, Ph.D.—The exhibits in forestry as shown at the Chicago Fair.—Interesting notes on the more remarkable exhibits.....	15363
VI. HORTICULTURE.—The Ovary.—A magnificent aquatic plant, with a leaf of lace-like texture.—1 illustration.....	15362
VII. METEOROLOGY.—Kernot on Wind Pressures.—Recent experiments with a new apparatus on this important engineering factor.....	15365
VIII. MILITARY TACTICS.—Infantry Footwear.—By Lieut. NAT. P. PAISTER, First United States Infantry.—An essay on this important subject of interest to the pedestrian as well as to the military officer.....	15359
IX. MINERALOGY.—Diatoms.—By Mr. W. A. TERRY.—How to find and identify infusorial silica.....	15366
X. MISCELLANEOUS.—Avian Athletics.—By MATRICE THOMPSON.—Graphic description of the gymnastics of birds.....	15365
Greenland as a Summer Resort.—The possibility of opening Greenland to summer visitors.—Its climate and peculiarities.....	15366
Hints on Coloring Lantern Slides.—By GEO. M. HOPKINS.—A very practical and popular paper on the production of these beautiful objects for projection.—1 illustration.....	15359
XI. ORDONANCE.—Krupp Ordnance.—The Krupp exhibits at the Chicago Fair.—Firing experiments with the great guns.—1 illustration.....	15362
XII. PALEONTOLOGY.—Extinct Monsters.—By STEPHEN BOWERS, A.M., Ph.D.—Continuation of this popular article describing the monsters of the geologic ages.....	15364
XIII. PHARMACY.—Chemistry in Relation to Pharmacotherapeutics and Materia Medica.—By Prof. B. J. STOKVIS, of Amsterdam University.—Role of chemistry in pharmacy.—An advanced and suggestive paper.....	15366
XIV. PHYSICS.—Amorphousness.—A very simple experiment in physics without apparatus.—2 illustrations.....	15357
Temperature of Visibility.—An interesting point in the physics of life discussed.....	15357
Problems of Lighting.—Continuation of this interesting and valuable contribution to physical science.—Advanced photometry.—3 illustrations.....	15358
XV. PHYSIOLOGY.—The Legal Responsibility of the Aged.—By J. CALDWELL, M.D., Baltimore, Md.—Most suggestive paper on the relations of age to moral responsibility.....	15361
XVI. POMOLOGY.—American Apple Exports.—Interesting statistics on this industry of the Atlantic States.....	15362
XVII. TECHNOLOGY.—Brquette Machine.—A fuel making machine utilizing waste coal dust.—1 illustration.....	15353
Improved Stereo Matrix Process.—The manufacture of paper mache matrices.—A machine for expediting the process.—2 illustrations.....	15354
Steam Kindling Wood Manufactory.—Popular article on the manufacture of kindling wood in this city.—6 illustrations.....	15355

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 presentation 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, they must not 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.