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Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural devices, improved.....	124	Ibex kids*.....	123
Antiseptic paper.....	123	India rubber, good vulcanized.....	118
Beer, borie acid in.....	120	Inventions, recently patented.....	124
Bicycle, the.....	120	Labels on glass, iron, etc.....	122
Books and publications, new.....	124	Lunatics, commitment of.....	116
Canada, Fair and Niagara.....	119	Maple sugar, artificial.....	114
Climates of Colorado.....	116	Mechanical inventions, recent.....	124
Cobalt plating.....	120	Mesmerism, the new.....	117
Cremation, modern.....	121	Microphone patent, the Berliner.....	114
Cycle, the Lovell diamond*.....	117	Notes and queries.....	124
Electrical devices come new.....	124	Oyster grounds, natural, South.....	121
Electric lighting of Rome.....	115	Patent, decisions, recent.....	122
Electric railways, progress of.....	114	Patents granted, weekly record.....	125
Elevator shifting device, Flem- ming's*.....	117	Radiation through vacua.....	118
Elixir of cascara sagrada.....	119	Screwdriver, the Howard-Allard.....	118
Engine traction, Stout's*.....	117	Shafts, wire, for steamers.....	122
Esparto grass.....	115	Steamer Elrie, singular accident.....	116
Fair, World's, Chicago.....	115	Steam power, world's use of.....	118
Fire, a peculiar.....	118	Tunneling the Simpson.....	118
Foundry experience, unusual.....	118	Tunnel under East River, N. Y.*.....	113
Fox dogs, Siberian*.....	123	Vipers, Ceylon.....	122
Gas supply, New York, new method of*.....	113	Volcano Mauna Loa, Hawaii*.....	121
Green, Dr......	111	Water, hot, distribution, Paris*.....	120
Hybrids, strange*.....	123	Wrench, Kraft's*.....	117

TABLE OF CONTENTS OF SCIENTIFIC AMERICAN SUPPLEMENT No. 895.

For the Week Ending February 25, 1893.

Price 10 cents. For sale by all newsdealers.

I. CHEMISTRY.—Cicuta Maculata, Linne.—By AUGUSTUS S. BLACKMAN.—Notes on this poisonous plant, which has already produced numerous cases of poisoning, with analysis of the finely powdered dried roots.....	14307
II. CIVIL ENGINEERING.—The London Hydraulic Power Company.—A company supplying power in London by means of running elevators in private dwellings and doing other similar work.—Full details of the plant and of its operations.—6 illustrations.....	14296
III. ELECTRICITY.—Electro-Magnetism.—Notes on the measurement of the intensity of the electro-magnetic field of force.....	14302
The Engineering Details of the New York-Chicago Long Distance Telephone Line.—By JOS. WETZLER.—A valuable paper, giving the particulars of the construction of this great line, size of wire used, and other details.—2 illustrations.....	14303
Improved Electric Drill.—A self-contained drill operated by an electric motor, of great convenience and adaptability.—1 illustration.....	14302
The Electric Railway in New Zealand.—The trolley line in Dunedin, New Zealand.—1 illustration.....	14302
IV. PHOTOGRAPHY.—Breadth in Photography.—An excellent paper on general effect in photography, the photographic and artistic methods of attack.....	14303
V. MEDICINE AND HYGIENE.—Electricity in Medicine.—Graphic presentation of what electricity is doing in medicine and surgery.....	14302
VI. MINING ENGINEERING.—How Ore is Purchased.—The purchase of gold and silver ore.—The system of charging undesirable ingredients against the ore, and so reaching the net result of its value.....	14310
VII. NATURAL HISTORY.—The Common Pheasant.—The history of the introduction and increase of the pheasant in England.—An extraordinary instance of acclimatization of a foreign bird.—1 illustration.....	14306
VIII. RAILROAD ENGINEERING.—Railways of Great Altitude in the Andes.—Notes on the extraordinary railroad enterprises which have been carried on in South America.—Peculiarities of the conditions and methods of overcoming the difficulties.—3 illustrations.....	14300
The Jaffa and Jerusalem Railway.—Opening of the railroad to the city of Jerusalem.—View of the new station at Jerusalem and of the Baldwin American locomotive employed on the line.—A projected railroad to Damascus from the port of Haifa and Mohammedan sacrifices on inaugurating the line.—3 illustrations.....	14299
IX. SURGERY.—The Achievements of American Surgery.—By FREDERIC S. DENNIS.—Conclusion of this notable article, with numerous citations of the triumphs of American surgery and the causes for its wonderful progress.....	14306
X. TECHNOLOGY.—Cheap Carriages.—The possibility of making cheap carriages, with estimate of the possible cost of production. Church Incense.—By J. C. McWALTER.—Notes on the manufacture of incense with formulae for its production of different prices. Gas vs. Electricity for Illuminating Purposes.—An attempt to present the relative merits of gas and electricity so as to give an unbiased view of the advantages of each.....	14304
Silvering Glass Mirrors.—Practical notes on the silvering of astronomical specula.—Exact details of manipulation, with silvering formula.....	14304
The Manufacture of Liquors and Preserves.—By J. DE BREYNE.—The scientific basis of this treatise, giving the manufacture of different kinds of medicinal wines, and opening the subject of the clarification and preservation of liquors.—5 illustrations.....	14305
What Constitutes Good Vulcanized India Rubber.—Practical tests of the quality of vulcanized rubbers as established for the use of the Russian government.....	14305
XI. VITICULTURE.—Black Rot of the Grape and How to Treat it.—The Bordeaux mixture of copper sulphate and lime.—Formulae for its preparation, and the results achieved by it in overcoming the disease.—1 illustration.....	14307

THE TWO GREAT SHIP CANALS.

We give in another column an account, by an officer of the navy, of a recent visit to the Panama and the Nicaragua canal works. The descriptions given of the present condition of these great enterprises are especially interesting, coming as they do from the pen of a careful, disinterested observer. The U. S. S. Kearsarge, which conveyed our correspondent, lately reached Havana, from Greytown, Nicaragua.

THE BERLINER MICROPHONE PATENT.

The famous Bell telephone patent, to which the courts have awarded an unexampled scope, will on March 7, 1893, reach its last limit of life. The invention of the telephone, as far as covered by that patent, will after that day be public property. The claims of this patent, it will be remembered, were held by the courts to cover the use of the so-called undulatory current for telephoning. Next, in the practical application of this decision in numerous cases the courts held that no operative telephone was ever shown them which did not employ this current. Finally, no alleged anticipating device was ever allowed by the courts to show the transmission of articulate speech by an undulatory current of electricity. Sometimes it seemed as if the law was almost strained in this exclusion of prior devices. The old House telegraph patent showed a perfectly operative telephone, although the inventor had no idea that it could transmit articulate speech. The doctrine that a device when patented is patented for all possible uses was not allowed to apply to the anticipation of the Bell telephone. The courts seemed gradually to adopt the principle that the Bell telephone was entitled to the broadest possible scope. They protected it by their action as no patent has ever yet been protected. The public to a certain extent felt that special tribute was due to so wonderful an invention. Now the original patent lapses. Next year another fundamental patent expires, but the field is not yet to be open.

The Bell telephone, working by the currents induced by the motion of an armature in front of the poles of a magnet, is, when used as transmitter, of but little value. As a receiver it is of high utility. Right on its track came the microphone, which supplied the missing element. The microphone is an excellent transmitter, but is not a practical receiver. The two form a complete system, and all telephoning is now executed by the use in one circuit of both instruments.

The telephone used as transmitter is, properly speaking, a species of dynamo or generator. It produces electric impulses by the currents induced in a coil of wire surrounding a magnet coil. These currents are induced by the motions of a diaphragm of soft iron acting as armature of the magnet. The voice causes this to vibrate and so changes the field of force. Used as a receiver, the action is reversed. Varying currents passing through the coil throw the diaphragm into vibration. If these currents are of proper quality, articulate speech results.

The microphone operates by changing the resistance of the circuit. The apparatus includes in general terms two surfaces in contact. Against one of the contact pieces a diaphragm of iron rests. On speaking against the diaphragm it vibrates, alters the pressure between the contact pieces, and so changes the resistance. A battery being in the circuit, this causes changes in intensity of current, which operating on the telephone reproduce sound.

The fundamental microphone patents, which were applied for in the early days of telephony, and were granted to Blake and Edison, have all lapsed by the expiration of foreign patents. It would seem that this should end the regime of the telephone monopoly. But within the last few years a good deal has been published concerning an application for patent by Emil Berliner which dated back to 1877, which became the property of the Bell Telephone Co. in 1878, and which was very lately granted. By statutory action this application, it was alleged, was kept alive by the Bell Co. These assertions were confirmed on Nov. 17, 1891, when the Berliner patent was issued to Emil Berliner, assignor to the American Bell Telephone Co.

The patent shows and describes a microphone, such as might be used on a telephone circuit to-day. Aided by the apprenticeship of many years litigation, and by the many undulatory current decisions of the courts, six claims have been written for the patent, and have been allowed by the Patent Office. The first claim is for the method of producing in a circuit electrical undulations similar in form to sound waves by causing the sound waves to vary the pressure between electrodes in constant contact, so as to strengthen and weaken the contact, and thereby increase and diminish the resistance of the circuit.

This is the main claim of the patent. It covers the present form of transmitters. The only escape from it for any particular transmitter would seem to be in denying variation of pressure, and in holding that simple motion of the electrodes upon each other effects the result.

The other claims are for structures. They claim transmitters with vibrating plate and electrodes in

constant contact. The force in law of this "constant contact" will be seen when it is noted that the telephone decisions have virtually been based on the assumed inability to telephone by the make and break current; the assertion that constant contact is essential to the transmission of speech by electricity has now the force of law.

Private corporations are very chary of attacking the Bell Telephone Co. The limitless pecuniary resources of the great company enable it to sustain litigation with great vigor. But in the matter of the Berliner patent the Federal authorities have taken the matter in hand. A brief has been filed in the United States Circuit Court by United States Attorney-General Miller, which marks the beginning of a proceeding to annul the patent. It is perfectly obvious that for the Patent Office to receive applications for two fundamental patents, to grant one of the patents outright and to permit the other application to be kept alive for fourteen years by dilatory motions is clearly inequitable. If the present law provides no way of preventing such proceedings, a new law should be enacted. On its face the Berliner patent continues the telephone monopoly up to 1908.

In his brief the Attorney-General holds that the Berliner patent, on various grounds, should be annulled. The delay of fourteen years in taking out the patent is alleged as contrary to equity and to the plain spirit and intent of the patent law. It is on such a ground as this that success in annulling the patent would be most acceptable. A decision to this effect would be a most valuable precedent. In this aspect the case seems to be a conflict between law and equity. Patent cases are tried in equity proceedings. It is to be hoped that the full powers of an equity tribunal will be exercised by the court.

Various other allegations are contained in the complaint. It is charged that the specifications and drawings were all struck out and new ones were substituted. The Patent Office objected to the turn the proceedings were taking, and eventually an affidavit by Berliner was filed, stating that the matter in the substituted application was invented by him prior to filing the original and formed part of that invention. The filing of the affidavit is claimed to be fraudulent and to give sufficient ground for annulling the patent.

Another very curious basis of attack is furnished by the Berliner patent of 1880. In this a microphone identical with the one of the 1891 patent is described, but although a microphone, it is claimed both as transmitter and receiver. This is cited as a prior patent, and seems to be for the same invention, and hence destroys the validity of the disputed patent. The law holds that two patents for the same invention cannot both be valid. One or the other patent must lapse.

The proceedings will be watched with much interest, as the points of law involved are very interesting. The case may lead to the enactment of new laws to prevent the recurrence of such proceedings as those complained of in this action.

Progress of Electric Railways.

We are now, says Mr. Bonnett, using much larger and heavier cars and more powerful motors, and the improvements due to the great advance of the electric power industry tend to increase the efficiency of the motors and gearing employed. The development of the low speed motor will lead to one in which, for ordinary speed of street traffic, the armature can be placed directly on the driving wheel, thus dispensing with all outside losses. When this result is arrived at, which time is not far off, and either a light storage battery or a practical system of power transmission to do away with overhead wires and their attendant damages is developed, the electric street car will stand at the head of methods of surface rapid transit. As an instance of modern practice, I would quote one of the St. Louis suburban electric roads where, with modern cars and equipment, a run of 8 miles out from the city is made in 30 minutes schedule time.

Probably the largest electric locomotives yet constructed are those now being built by the Thomson-Houston Company for the Baltimore and Ohio Railroad Company to transfer passenger and freight trains through the city of Baltimore. These motors have the armatures directly on the driving axles and at a speed of 30 miles per hour make about 170 revolutions per minute.

Their principal dimensions are as follows:

Diameter of driving wheels.....	5 feet.
Service speed.....	30 miles per hour.
Size of conductors.....	8 sq. in. cross section.
Transmission of power.....	overhead trolley.
Pressure of current.....	About 700 volts.
Current.....	1,500 to 2,000 volts per motor.
Weight of locomotive.....	90 tons.
Electric H. P. developed.....	1,500 H. P.
Drawbar pull.....	40,000 lb.

THE Victoria railroad bridge over the St. Lawrence at Montreal is two miles long, cost over \$5,000,000, and contains 10,500 tons of iron and 3,000,000 cubic feet of masonry.