

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 37 PARK ROW, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included. \$3 20
One copy, six months, postage included. 1 60
Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at \$3.20 each; additional copies at same proportionate rate. Postage prepaid.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly; every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of seven dollars. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter. Address MUNN & CO., 37 Park Row, N. Y.
Subscriptions received and single copies of either paper sold by all the newsagents.

Publishers' Notice to Mail Subscribers.

Mail subscribers will observe on the printed address of each paper the time for which they have prepaid. Before the time indicated expires, to insure a continuity of numbers, subscribers should remit for another year. For the convenience of the mail clerks, they will please also state when their subscriptions expire.
New subscriptions will be entered from the time the order is received but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the order will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVIII, No. 20. [NEW SERIES.] Thirty-third Year.

NEW YORK, SATURDAY, MAY 18, 1878.

Contents.

(Illustrated articles are marked with an asterisk.)

Table listing various articles such as Advertising—a mode of motion, Ants, habits of, Arsenic, Balloon, large of, Bernard, M. Claude*, Bicycle, mechanics of, Bird, gardener, Book notices, Bridge cables, East River*, Business and persons, Cabbage, self-fertilizing, Cats, danger from, Caterpillars, mimicry, Clock, Ithaca calendar*, Communications received, Confectioner as a colorman, Congress a patent mill, Counterbalancing engines [12], Eads, new river improvements, Eclipse, total, Electrical experiments of Plante*, Electro-magnet, Jamn, Elevated railway in New York, Engravings, transferring [5], Etching on glass [6], Eye, cinders in, Flour mill explosion, Galvanic element, new, Glutamine, Gold, dissemination of, Gold lace, Grape culture, Hose, bursting of, Inventions, new, Inventors' rights, raid on, Iron, Syria, Jelly fish, Lead poison, Lemon sirup [19], Lightning, singular effect, Microscope, medical use of, Microscopy, Minerals, Monsters, artificial*, Muscarin, Myxomycetes, silk from, Myxomycetes of the U. S., Names, too many, Natural history notes, Notes and queries, Oaks of the U. S., Opium, Salmon disease, Oysters, purple, Paris exhibition, British India*, Paris exhibition, trophy*, Paris exhibition, opening, Petroleum tanks, Photographic developer, Photographs to color, Photos in colors, Plant crystals, Plants, dreaming of, Plants and oxygen, Plants, preserving colors of, Poisons, disease, Postal card, Swiss double, Protective resemblance in fungi, Rain tree, Rilla for beams, Rudder and screw combined*, Salmon disease, Shoemakers' ink [4], Snake poison, Solar force, possible new, Sophora speciosa, Steam engine, Buckeye*, Steel, rolling white hot, Steel, Shute's adjustable, Stings of insects, Strychnine, Telephone and phonograph, Telephone magnets [10], Waterproofing cloth [2], Wheel, detachable spoke*.

TABLE OF CONTENTS OF THE SCIENTIFIC AMERICAN SUPPLEMENT No. 124, For the Week ending May 18, 1878.

I. ENGINEERING AND MECHANICS.—Manufacture of Bessemer Steel and Steel Rails. By C. B. HOLLAND. Read before the Iron and Steel Institute. The processes at the works of Brown, Bayley & Dixon, Sheffield. The Plant, The cupolas, converters, the ingot pit, the blowing engines, etc. The Hydraulic Pressure and the Blast. Model of Working. The Manufacture of Steel Rails, 5 illustrations. Improved Topped Guard, 2 illustrations.—Improved Beech-Loading Mechanism, 4 illustrations.—The Shell Trials at Shoeburness.—Process of Sinking Oil Wells.—An Iron Warehouse.—The Coal Question.—The Huelva Pier of the Rio Tinto Railway.—The Underground Railway in Paris.—New Subway in London.—"Gaspillage et Insouciance."—An Artesian Well 3,120 feet deep.
II. TECHNOLOGY.—Increase of Mail Service in the South. Speech of Hon. Robt. B. Vance of North Carolina in the House of Representatives. Southern Productions: Cotton, Tobacco, the Precious Metals, Grapes and Apples. The South as a Field of Emigration, and as a Health Resort. Harbors, etc.—How Granite is Polished.—Cleaning Old Engravings.—Processes for the Preparation of Violet Ultramarine.—Copying Ink.—Improvements in Aniline Blacks. By ANTHONY GUYARD.—Improvements in Aniline Colors.—Grisophenylamid.—Gelatine Negatives. By Rev. H. J. PALMER.—Patience in Dry Plate Photography.
III. CHEMISTRY AND METALLURGY.—Bismuth. A comparison of the Methods for its Estimation. By THOMAS B. SILLIMAN.—The Microscope in Chemistry. By H. C. SOHBY, F. R. S. Lecture delivered at the Chemical Society.—Solubility of Magnesia, Baryta, and Sulphate of Lime in solution of Sugar.—Sulphur Mines.—Manufacture of Anthraquinone.—Colors from Iron Turnings and Filings. By R. and C. STEPHENS.—On the Denaturation of Alcohol.—Sprouting of Silver and its Cause. By THEODORE FLUGGER.—Detection of Copper.—Chromic Blue.
IV. ELECTRICITY, LIGHT, HEAT, ETC.—The Phonograph and its Future. By THOMAS A. EDISON. The Phonograph and its Action. The Durability, Duplication, and Postal Transmission of Records and Messages. How it may be used for Letter Writing. Its unequalled utility in Business Correspondence. Dictation. Books printed with 40,000 words on a page. Educational Purposes, Music, Family Records. The Last Words of the Dying Recorded. The Words of Testators, Witnesses in Court, etc., Recorded. The Application to Toys, Musical Boxes, and clocks. Oratorical Utterances Preserved. Telegraphy of the Future. The Phonograph and Telephone combined.—Musical Sound. By Dr. JAMES BLAKE.—The Radiometer and the Spheroidal State.—The Hair Hygrometer.—Power for Electric Illumination.—Certain Consequences of the Constitution of the Solar Spectrum.—Transient Variations of Permanent Magnetism.
V. MEDICINE AND HYGIENE.—The Nature, Origin, and Progress of Disease in the Human Body. By J. B. GRAYES, M. D.—The Ear. Anna Morandi Mazzolini, Professor of Anatomy at the University of Bologna. By Madame VILLARI.—Facts about sleep.—Antipathies.—Cost and Nutritive Value of Foods.
VI. NATURAL HISTORY, GEOLOGY, ETC.—The Canons of the Colorado. Compiled from the report of J. W. Powell. A land of surpassing geological interest. The wonderful caves. The cliffs of Erosion and of Displacement. Kaibab Plateau. Glen Canon. The various geological faults and folds illustrated. Volcanic action. Hurricane L. dge. Grazing lands. The Indians of this region and their habits. The animal life. The Carboniferous, Jurassic, Tertiary, and other beds. 14 engravings.—The Hot Springs, Bath County, Virginia. Analyses. Scenery, Climate, etc. Curative Properties of the Springs.—Recent eruption of Mt. Hecla.—A New Rocky Mountain Gold Mine.
VII. CHESS RECORD.—Biographical Sketch and Portrait of J. A. Graves, with one of his Enigmas.—Problem by J. Dobrusky.—Problem by J. B. Munoz.—Problem by R. Wilmers.—Oxford and Cambridge Chess match.—Petroff's Defense. Game between J. T. Chatto and H. Lee, with Notes.—Solutions to Problems.

A RAID ON INVENTORS' RIGHTS.

As the patent law now stands there are two ways for a patentee to recover for an infringement of his rights. He may proceed at law and recover damages, that is, what he has lost by means of the infringement; or he may proceed in equity to recover the infringer's profits, or the saving effected by the use of the pirated appliance or process.

These two courses are adapted to two entirely different classes of patents, though in many cases the patentee may elect which course he will pursue in case of infringement, both being open to him. Where the value of the patent consists wholly in the right to make and sell the thing patented, the rule of damages is applicable. Where the value of the patent consists wholly in the use of the patented appliance or process, cases of infringement go to courts of equity, and the amount of the patentee's money recovery is measured by the infringer's gains through the infringement. In an action at law the plaintiff recovers actual damages. If he has been in the habit of granting licenses to make and sell his invention, thus establishing a market value for the right, such license is made the primary (but not the absolute) basis for measuring damages. In case the evidence on this point is not sufficient to determine a just measure for damages, the court or jury determines the damages from all the evidence in the case. Where the profit of an invention accrues only to the user of it, the doctrine of equity is that a trust exists in behalf of the inventor or owner of the patent, for whose benefit the user of the patent is a trustee; and whatever money an infringer derives from the use of the invention he is bound to pay over to the owner of the patent. This even where the infringer fails to make a profit by the infringement, since his misuse of the patent may be more seriously injurious to the patentee than its proper and profitable employment could possibly be.

To obviate certain practical difficulties in the working of this last rule—obviously also to prevent the enactment of something worse—the Senate committee adopted Section 2 of the amended Senate bill No. 300. As analyzed by Judge Foote (it is too long to be quoted here), this section divides all cases of infringement into two classes. First, where no account of profits or savings shall be allowed; secondly, where it shall be allowed. In the first class there are two divisions—(a) where the patentee has elected to license other persons generally to use his invention, in which case the license fee is to govern the assessment of damages; (b) where it shall appear to the court and jury that it is for the interest of the patentee that other persons generally should use his invention and pay a license fee therefor; then the court and jury are to say what would be the proper license fee. In the second class of cases the bill provides that in taking an account of profits "the defendant shall not be charged with any saving he may have made, if he shall show that it has not enabled him to realize an actual profit in that part of the business connected with the use of the invention."

Strenuous objections were urged against this section. It was pronounced an unnecessary innovation in patent legislation, and unconstitutional, in that it turned the patentee's absolute and exclusive right, during the life of the patent, into a qualified and limited right. Mr. Walker claimed that its effect would be to abolish the recovery of profits altogether, and limit the recovery to the damages which the patentee has suffered, thus taking away the lion's share of the benefit derivable from a vast portion of the inventions made and conferring that share upon infringers. Among other objections, Mr. Hubbel urged that, in making the license fee the measure of the damage, the infringer would be placed on a better footing than the parties taking a license. "It would be simply a license to the defendant to go on and pirate a patent, and be subject to no greater license fee than was paid by the most favored parties of the patentee, who had risked their capital and everything they had, perhaps, to demonstrate whether or not it was a success. . . . What right has Congress, when a man has an exclusive right granted, to come in and say, 'If you demonstrate, through capital, through any of your friends, through any influences which will enable you to carry it into execution, that it is a successful business matter, therefore any pirate may come in and take away your profits or participate in them by setting up an infringement, and you shall only hold him to the same measure of license fee?'"

To leave it to judge or jury to decide whether or not it was to a man's interest to issue licenses, Judge Foote insisted, was not only a new feature in patent law, but new to the jurisprudence of any civilized country. Even worse in effect were the provisions forbidding the accounting of profits where the infringer did not make a profit on his entire business, and requiring the profit, where it was allowed, to be determined by an investigation into all the business connected with the use of the invention to determine its share of the gains. After going through the whole section to show that it had been draughted in the interest of infringers, Judge Foote said: "Suppose, Mr. Chairman, we had a band of robbers amongst us of great wealth and power; that they were accustomed to enter people's houses and drive them from their homes, that they took their cattle and their horses—that the wheat, the corn, the cotton, that others by their labor and expense had produced, they should appropriate, and to meet such an emergency you should pass an act like this second section, to wit, that there should be no recovery against these robbers beyond the price in the market of the articles taken, or what a court or jury should say ought to be a market price; that in case of an accounting nothing should be recovered unless the robbery had been

profitable, and that the court should determine what proportion of profits was due to the robbery and what to other elements; and, finally, you should make all legal proceedings against them so onerous and expensive that none but very rich men could contend with them—would it not be justly said that you had promoted fraud and wrong, and discouraged industry, and injured all the best interests of society? I cannot view this section in any better light, in reference to the rights and interests of patented property."

In spite of such objections as these, the Senate committee saw fit to adopt the obnoxious section; most probably, as we have already intimated, as a compromise; for the enemies of the patent system were striving to introduce features even more vicious and disastrous in their tendency. Greater success has attended their efforts before the committee of the House. After a strangely brief consideration (less than five minutes, it is said) that committee adopted, April 26, a substitute for this second section (S. 300; H. R. 1,612), which seeks to reduce still more the limited right in his invention which the original allows the patentee. It provides that in all suits for infringement the measure of the plaintiff's recovery shall be the same both in law and in equity. That measure is the license fee, as established either by a reasonable number of transactions applicable to the case at bar or by a jury; and no evidence on account of the economy of the pirated invention is to be admitted to help the jury to determine its value. The only exception to the rule is "in cases where the defendant has made an actual profit from selling the thing patented or the product thereof; and in such cases the proportion of the actual profit of such sale due to such infringement shall be determined, and that proportion of such actual profit shall be the measure of the plaintiff's recovery."

It will be readily seen that this device puts all inventors practically under the thumb of infringers; and in the large number of cases in which the value of a patent consists in the use of the invention, as in railroading, and not in the sale of the thing patented or some product of it, the inventor's rights are laid open to the freest invasion. Whether or not the section was draughted by the attorney of the Western Railway Association, it certainly covers just what he has been laboring for before the committee.

Said a prominent railway superintendent and member of that association: "Whenever our attention is called to a patent of value, we use it, and in a few cases we are made to pay by plucky inventors; but in the aggregate we pay much less than if we took licenses at first." This provision, if made a law, will save them, and the like minded everywhere, no end of annoyance, and possibly a good part if not all of what they are now made to pay by "plucky inventors." But it seems impossible that Congress can adopt a measure so grossly unjust and mischievous. The would-be plunderers of our inventors are already too numerous and too willing to act upon "the good old plan, that they shall take who have the power, and they shall keep who can," to need any such legal authorization and encouragement. There never was a bolder raid upon the property rights of any class of the community; and it is to be hoped that the friends of justice will not suffer Congress to act on this matter unwittingly.

THE MECHANICS OF THE BICYCLE.

A correspondent wishes to know why it is that power is gained by the use of a velocipede in traveling long distances; or how it is that one can travel so much faster without getting fatigued by using a velocipede than when relying upon the ordinary means of locomotion; or where the extra force comes from that enables a velocipedist to accomplish high speeds, totally impossible to the pedestrian.

In answering our much esteemed correspondent's questions, we do not propose to open out the subject of the nomenclature of dynamics, and to pronounce upon the distinctions between force, power, energy, work, and all the rest. The questions, as asked in familiar terms, are susceptible of accurate and exhaustive replies in equally familiar language.

To condense the whole into a verbal nutshell, the walker or runner is wasting his strength in moving himself up and down, while the velocipedist has to contend solely against the friction of his machine.

The action of walking, as so happily described by Dr. Holmes in his article on "The Human Wheel; its Spokes and Fellies," is essentially a rolling one, the body rolling or rocking on the ball of one foot as a fulcrum, and rapidly moving the other foot ahead to prevent falling when the center of gravity of the whole overhangs the base. It is a forcible, perilous, and complex operation. That it is forcible is demonstrated whenever we "run against" a post at night. Its complexity is illustrated by the extreme difficulty in acquiring it; while the peril of the operation lies in the combination of its force and difficulty. Now that we are used to it, it seems a very easy and simple operation, of course—and the comparison with the rolling of a wheel with portions of the periphery removed is not a bad one—save in one thing, which is where the genial Autocrat of the Breakfast Table neglected dynamics to help along his simile. At each of those swinging motions which we call steps, the center of the wheel, and all the weight hung from that center, are lifted bodily as they swing over an upper arc of a circle.

That this is the case may be proved by attempting to walk along under a board placed at such a height as to exactly touch the top of the head. The rising of the whole body to