Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada..... **$3 00**
One copy, six months, for the U. S. or Canada..... **1 50**
One copy, one year, to any foreign country belonging to Postal Union, **4 00**
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information. (2) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies, 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, JULY 9, 1887.

Contents.

(Illustrated articles are marked with an asterisk.)

Batteries, primary, economical disposition of 16
Books and publications, new..... 26
Business and personal..... 26
Butter, artificial, identification of 24
Butterflies, to catch and preserve 24
Camera, photographic, simple*... 25
Carpet sweeper, dust controlling* 19
Cotton planting, device to feed the seed in*..... 18
Cruiser Le Terrible, armorclad, French*..... 22
Eggs, raw, do not eat..... 18
Elephant, notable, death of 20
Employer's liability..... 17
Engine, cut-off, automatic*.....23, 24
Engine, steam, in 1809..... 21
Fibers, animal and vegetable, test for 20
Food adulterations..... 20
Furniture, wall protecting attachment for*..... 19
Fuse cutter and cap setter*..... 18
Gold on Alaska islands..... 19
Industrial Union, accession of United States to..... 16
Inventions, engineering 26
Inventions, index of..... 27
Inventions, miscellaneous..... 26
Ironing machine, steam heated*.. 18
Items of interest, many..... 20
Keyhole guide and escutcheon*.. 19
Larvæ of bot fly in horse's stomach*..... 20
Lathe, wood turning, automatic.* 18
Mill to free rice from its hulls*.... 18
Moths, how to catch..... 24
Notes and queries..... 27
Patents, stability of..... 22
Pen for double and single line ruling*..... 19
Petroleum, exhaustion of..... 22
Photographic and photo-micrographic apparatus, simple* .. 25
Photographs, instantaneous, new light for..... 17
Photography in natural colors..... 17
Photography of projectiles..... 24
Photometry, curiosity in..... 25
Pita..... 25
Rag bleaching..... 24
Repeater, a new..... 19
Resin in soaps and fats..... 21
Roburite, the new explosive..... 21
Ships, war, French*..... 22
Siren in marine signaling, use of. 16
Slate, uses of..... 17
Steamship, sunken, raising*... 15, 25
Stool and chair, folding*..... 19
Thermometer, new style of*..... 20
Tin, coppered..... 21
Water gauge float, improved*.... 19

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 601.

For the Week Ending July 9, 1887.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—A Star Finder.—A simple apparatus that can be constructed by any mechanic.—1 illustration..... 9606
Photographic Study of Stellar Spectra, Harvard College Observatory.—First annual report of the Henry Draper memorial observations.—Review of the work by Prof. EDWARD C. PICKERING..... 9603

II. BIOLOGY.—Sponges.—The growth and life history of sponges.—Report of a recent lecture at the London Royal Institution by Dr. R. VON LEDENFELD..... 9605

III. ELECTRICITY.—Phenomena of Alternating Currents.—By Prof. ELIHU THOMSON.—16 illustrations..... 9601

IV. ENGINEERING.—An English Car Coupling.—Description of an English automatic coupling.—2 illustrations..... 9593
A New Process of Casting Iron and other Metals upon Lace, Embroideries, Fern Leaves, and other Combustible Materials.—By A. E. OUTERBRIDGE, JR.—A new and eminently practical process of producing ornamental castings.—4 illustrations..... 9596
Bricks and Brick Work.—By Prof. T. ROGER SMITH, F.R.I.B.A.—The history and technical review of this subject.—A most remarkable contribution to the engineering of architecture..... 9598
Link Belting.—By CHARLES A. SCHIEREN.—An interesting and practical paper on leather belting made of links.—9 illustrations.... 9595
Recent Progress in Gas Engineering.—A lecture by Mr. A. MACPHERSON, of Kirkcaldy, reviewing the last improvements in this branch..... 9596

V. MISCELLANEOUS.—Herbet's Tepid Douche.—Apparatus in use for bathing soldiers in the French barracks.—1 illustration..... 9606
Kent's Torsion Balance.—A new type of balance, involving torsional suspension instead of knife edges.—5 illustrations..... 9594
Preservative Liquid.—Note on preservation of organic substances..... 9594
The Falls of Gairsoppa.—The great Indian falls, higher than Niagara.—2 illustrations..... 9595
The New British Coinage and Jubilee Medal.—Illustrations and descriptions of the new pieces.—8 illustrations..... 9598
The Winner of the Derby.—Portrait and description of Merry Hampton..... 9604

VI. NAVAL ENGINEERING.—The Falke Type Torpedo Boat.—The fastest type of British torpedo boat, constructed by Messrs. Yarrow & Co.—1 illustration..... 9591
The German Navy.—The New Gunboat Eber.—A description of a late accession to the German navy.—1 illustration..... 9591

VII. ORDNANCE AND GUNNERY.—Magazine Rifles.—Continuation of this important article, including the Chaffee-Reece, Kropatschek, and other magazine guns.—3 illustrations..... 9598
New British Torpedo Experiments.—Experiments with torpedoes against a ship.—The efficiency or torpedo nets.—The effects of Whitehead torpedoes..... 9592

ACCESSION OF THE UNITED STATES TO THE INDUSTRIAL UNION.

The following announcement is made in *La Propriete Industrielle*, the official organ of the International Bureau of the Union: "From a communication addressed to the Federal Council of Switzerland by the United States minister at Berne, the date of the accession of the United States to the Union for the protection of industrial property has been fixed for May 30, 1887." According to the above, the United States is now a member of the Union, and our citizens are entitled to the enjoyment of all its benefits. The fact, we presume, will be soon proclaimed by the President.

It is difficult at the present time to foresee all the results, advantageous or the contrary, that may accrue to us from this membership. It has been very extensively published in the daily press that, under the laws of the Union, all American patentees would enjoy a priority of time for seven months after the date of their American patents, during which they could take patents in all the several countries covered by the Union. But this is an error, as the laws of the Union provide for a priority of seven months, not from the date of the patent, but from the date of the *application for the patent*.

As the business of our patent office is considerably in arrears, in some classes more than seven months in arrears, in such cases the Union affords no benefit. In other classes the arrearage is not more than two or three months. In these cases the Union will be of some benefit.

The other laws of the Union relate chiefly to trade marks, concerning which the protection accorded to the members of the Union is full and satisfactory.

The following are the present members of the Industrial Union: Belgium, Brazil, Spain, France, Guatemala, Italy, the Netherlands, Portugal, Salvador, Servia, Switzerland, Great Britain, Mexico, Sweden, Norway, Paraguay, Uruguay, Roumania, Tunis, the United States.

In the official statement of the articles of the convention, published in the *Patent Office Gazette* of May 24, 1887, it was stated that Germany was a member of the Union; but this we believe to be an error. Germany, we are informed, has not yet become a member.

USE OF THE SIREN IN MARINE SIGNALING.

In certain cases, as in fogs and tempests, optic telegraphy is impossible. Cannons have long been employed in these cases. A slightly violent wind makes them nearly useless, and even in good weather they are of little use, because of the difficulty of sufficiently multiplying their detonations, as to whose number there are no certain and invariable agreements.

As for the ordinary whistle, these can only serve as toys, and could they be employed in signaling, the steam whistle, already much used, would be preferable. Here, too, the lack of agreement as to meaning of signals operates to restrict their use.

For some little time, ocean vessels owned by the large shipping companies have been provided with an instrument giving sounds of wonderful height and intensity. We speak of the siren. The siren, invented by Cagnard de la Tour, has been greatly modified, and steam has replaced the original currents of air. Applied to the same uses, the siren leaves far behind it the cannon, ordinary whistle, and steam whistle. Nothing remains but to fix a certain and invariable standard of comparison.

We give below the ideas emanating from M. Edme Genglaire, student of the naval school of medicine at Toulon.

The siren being in communication with the boiler, the current of steam can be governed by an ordinary valve. The sounds produced vary in height and intensity in proportion to the quantity of steam emitted, so that sounds of any given pitch can be obtained. A set of resonators completes the apparatus.

It is well known that two identical resonators vibrate together for the same sound and for that only. Starting with this principle, in two similar frames containing several resonators, the corresponding resonators will vibrate or sound only when the note corresponding to them is produced. The siren will produce these sounds causing vibrations in the resonators, and two distant ships, or a shore station and a ship, or two land stations, supplied with sirens of similar model and identical frames of resonators, could most conveniently communicate. For this end each resonator should have attached to it an invariable signification, the same for all the frames.

All the navy and commercial vessels possessing sirens and a frame carrying the same number of resonators, each marked with a number having its signification, will be prepared to communicate with each other or with the shore. It must be remembered that these acoustic effects can be conveyed intelligibly to an immense distance by the aid of the siren and the additional apparatus. The apparatus, moreover, does not cost much for establishment.

The preceding theory being admitted, the following is the practical way of carrying it out as proposed by M. Genglaire:

In front of each resonator will be placed two metallic reeds; one rigid, the other thin and producing extended oscillations with the least effort. Each of these pieces of steel communicates with one pole of a battery by means of the circuit wire. When the resonator vibrates, the thin reed oscillates, touches the other bar, and the two poles of the battery being connected, an electric bell rings, thus giving a signal, so that the call, whether from ship or shore, can be recognized, while the bell of the signaling station by its sounds shows that the desired vibration or note has been produced. —*Electricite.*

THE ECONOMICAL DISPOSITION OF PRIMARY BATTERIES.

The true action of a primary galvanic battery in some of its features is not generally comprehended, even by those familiar with the ordinary phenomena of electricity. The size of a battery, and the direct effects of varying it, and the deleterious effects of internal resistance, are among the factors least grasped. At the present day the error is sometimes made of supposing that the size of a cell affects its electromotive force, and internal resistance is often spoken of as a beneficial element.

Yet if the subject be brought down to facts, the case is a very clear one. The electromotive force is quite independent of dimensions, and a cell the size of a percussion cap will produce as high electromotive force as the largest made. This, to many, sounds a truism, yet it is by no means universally realized. But on the subject of resistance a more firmly fixed misconception prevails to a considerable extent. It is often asserted that low resistance batteries are not wanted. The truth is that they are wanted, and that the invention of a non-polarizing or constant and low resistance battery would be a valuable contribution to the resources of the electric engineer. The source of the error on the subject of resistance is doubtless due to the universal application of Ohm's law for fixing the number of cells in a battery for given external resistance.

By simple mathematical demonstrations it is proved that the most economical distribution of battery, as far as the number of cells is concerned, is attained when the internal, or battery, resistance and the resistance of the external circuit are equal. Thus with ten ohms resistance on the outer circuit, enough cells should be provided to have the same resistance internally. This, however, refers only to the number of cells, and not to their economic working. This limitation is very generally overlooked. The arrangement of battery so as to make internal and external resistance the same is considered the ultimatum, and the low resistance of cells is held not to be a specific advantage.

The ordinary calculation of the number of cells required to supply a circuit may be used as an example. Suppose a difference of potential of 35 volts is to be maintained between the extremities of an external circuit of 40 ohms resistance, giving a current of 0·875 ampere, and assume each cell of the given battery to yield 1·75 volts with an internal resistance of 1 ohm. In making the calculation, it is at first taken for granted that the internal resistance of the battery must be 40 ohms. Therefore the total resistance to be overcome is 80 ohms, so that the effective voltage of the battery is reduced one half. Dividing, therefore, 35 volts by 0·875 volt, the dividend 40 is the number of cells that must be arranged in series. Then, as these will have a resistance of 40 ohms, the problem is solved, and this is treated as the most advantageous possible arrangement. This it is far from being; it is the best arrangement of forty elements in the given circuit. It contains the minimum number of elements that will maintain the given current through the circuit, but it is not an economical arrangement as regards consumption of material.

The battery in the case cited having exactly the same resistance as the external circuit, absorbs one half of the current. One half of the electrical energy disappears in forcing the current through the battery. This represents fifty per cent of the chemicals and zinc which is actually wasted or spent on useless work. A battery run on this principle by no fair principle can be compared with a steam boiler, to settle the point of efficiency. It is doing only a shade over half the useful work that it is capable of. To compare the cost of a battery with any other prime generator, it must work under widely different circumstances from that instanced. Its difference of potential, and at the same time its resistance, must be lowered. This can be done by increasing the number of elements and arranging them in several parallel series.

The battery and circuit above cited having a resistance of 80 ohms with 70 volts difference of potential in the battery, maintains a current of 0·875 ampere. By arranging four such series of cells in parallel, the internal resistance would be reduced to 10 ohms, the total resistance to 50 ohms, and a current of 1·4 amperes would be produced. To reduce this to 0·875 ampere, four parallel series of twenty-three cells each would be required. This is an increase in cells. The total number is 92 instead of 40. But as the battery would only have one seventh the resistance of the whole circuit, it would absorb one seventh instead of