are slowly attacked by dilute acids with evolution of sulphureted hydrogen.

The potassium salt is decomposed by water alone with liberation of the same gas. It would appear, indeed, that the more negative metals, such as bismuth, antimony, and arsenic, form sulphophosphates with the greatest facility. The bismuth salt BiPS, remains in the retort after distilling a mixture of bismuth chloride and phosphorus pentasulphide as a dark-colored liquid which solidifies to a gray mass upon cooling, and yields upon pulverization a powder of the color of red phosphorus. Antimony and arsenic form similar crystalline sulphophosphates of a yellow color, which are more volatile, however, and, moreover, may be distilled without decomposition. The arsenic salt solidifies in the receiver in a transparent form resembling amber.

In attempting to prepare a ferric sulphophosphate by the action of phosphorus pentasulphide upon anhydrous ferric chloride, an unexpected artificial synthesis of iron pyrites, FeS₂, in crystals identical with those found in nature, was effected. The reaction occurs as represented by the equation:

The crystals of iron pyrites were formed as a beautiful glistening sublimate just above the heated portion of the retort. They possessed the usual brass-yellow color and brilliant luster, and consisted of pentagonal dodecahedrons and cubes or combinations of these forms, together with faces of the octahedron and of the more complicated forms of the cubic system. Moreover, the same mode of striation was observed as is so characteristic of natural crystals.

NEW VALUATION METHOD FOR RAW SUGAR.

THE usual method of determining the value of raw sugar—subtracting five times the ash from the polarization—has proved to be less satisfactory during the last few years, since it favors the tendency to reduce the amount of ash in any manner as much as possible, without having any regard to the organic impurities present. Since these organic substances also form molasses, without their action being taken into account in the commercial mode of determining the value of the sugar, it follows, says the *Chemiker Zeitung*, that the number obtained as above becomes less and less a true representation of the value of the sugar, as these substances increase in relation to the ash. On the contrary, the greater the yield paid for, or the better the sugar has appeared to be, the less has been the practical yield. After several years' negotiations with a committee chosen by the Society of Beet Sugar Industry, which unfortunately fell through, the Society of German Sugar Refiners has thought it necessary to issue a resolution on its own account aimed against this ever-increasing evil. It has decided after July 1, 1893, to purchase raw sugar only upon a new "yield" which is determined by subtracting from the polarization $2\frac{1}{4}$ times the total non-sugar. The number $2\frac{1}{4}$ has certainly no scientific meaning, but practically has two great advantages: in the first place it is the mean between the amount of non-sugar as actually present when the old method of calculation was introduced (1 ash + 1 organic matter = 2) and that present in the sugar worked in the German refineries in 1891-92 (1 ash + 1.5 organic matter = 2.5), which proportion moreover has since increased. In the second place, normal sugar which contains not more than $1\frac{1}{4}$ organic for one of ash comes out by the new method the same as before, since 1×5 is almost exactly the same as $2\frac{1}{4} \times 2\frac{1}{4} = 5$ (approx.). Sugars which contain more than $1\frac{1}{4}$ organic to 1 of ash come out worse, those which contain less better than before. As a matter of fact, every refinery will willingly pay as much or more for a high yield, when they know that they really get something for their money, while hitherto the statement of yield on which the sugar was bought stood in no practical relation to the amount which could be actually realized in the works. The statement that the new regulation has been adopted with the object of lowering prices is therefore completely erroneous, more especially since the present price is entirely determined by the position of the general market. It is, however, intended that in future only such sugars shall obtain a higher price which actually hold out a prospect of a higher practical yield; i. e., the purchaser wishes to obtain actual value for his money. During the last few years it is just this point which has proved deceptive, and the demand for a change to a more stable state of affairs is thoroughly justifiable.

GILDED PLATINUM.

By W. C. HERAEUS.

THE author, in writing upon this subject, says, in the *Chem. Zeit.*, some thirty-eight of the apparatus constructed by him are already in use, eight of them being in England and America. According to the experience hitherto gained, the loss of weight of the completely gilded apparatus is not only seven times, but from twenty to forty times less than with the old platinum apparatus. It is essential for such a result that the whole of the interior surface of the still be covered with gold, for only in this way is the full advantage of the gilded platinum to be attained. In the upper part of the apparatus, which is not touched by the acid, the layer of gold may be quite thin. It has proved to be unsatisfactory to stop the layer of gold exactly at the surface of the liquid, because the nearest portions of platinum become moistened with the boiling acid and are much attacked, so that differences of thickness soon arise. On the other hand, Faure and Kessler pans, gilded as far as the lute and Delplace apparatus, in which the gilding is carried only a few centimeters into the upper portion, have lasted very well. The Faure and Kessler pans, as described above, have already been introduced into many works. According to the experience gained at the chemical works at Griesheim with a Prentice apparatus completely covered with gold, and which is used almost exclusively for the production of ninety-eight per cent. acid, the apparatus will work for at least fifteen years before requiring a new bottom, while a platinum still would require similar repairs at the end of a year and a half.

As regards the economy of the apparatus, it is of importance to note that a considerable amount of the gold which goes into solution is deposited in the metallic form as a red powder in the platinum exit tube. If it were possible to collect the whole of the gold in this form, no loss of material would have to be feared. The preparation of ninety-eight per cent. acid, which has been undertaken in so few works on account of the great wear of apparatus, can now, however, be carried out without trouble.—*Chem. Tr. Jour.*

JUST PUBLISHED.

THE MANUFACTURE OF LIQUORS AND PRESERVES.

By J. DE BREVANS.

PRICE \$3.00, POSTPAID.

The author is an eminent French chemist who has devoted much time and study to the preparation of Liquors and Preserves. The great value of the work consists in the formulas, which number over 300, and are so arranged that, if the manufacturer has no distilling plant of his own, he can yet make many of the liquors from the essences. The manufacturer of French *liqueurs*, etc., from essences is very profitable and does not require large capital. The raw materials, the plant of the distiller, etc., are described according to the best modern practice. The book has 65 illustrations, 18 tables, and a full index.

Send for Table of Contents.

MUNN & Co., Publishers,

SCIENTIFIC AMERICAN OFFICE,

361 Broadway, New York.

NOW READY.

Fourteenth Edition of EXPERIMENTAL SCIENCE.

REVISED AND ENLARGED.

120 Pages and 110 Superb Cuts added.

The unprecedented sale of this work shows conclusively that it is the book of the age for teachers, students, experimenters, and all others who desire a general knowledge of Physics or Natural Philosophy.

In the new matter contained in the last edition will be found the Scientific Use of the Phonograph, the curious optical illusion known as the Anorthoscope, together with other new and interesting Optical Illusions, the Optical Projection of Opaque Objects, new experiments in Projections, Iridescent Glass, some points in Photography, including Hand Cameras, Cane Cameras, etc.; Systems of Electrical Distribution, Electrical Ore Finder, Electrical Rocker, Electric Chimes, How to Color Lantern Slides, Study of the Stars, and a great deal of other new matter which will prove of interest to scientific readers.

840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, \$4. Half morocco, \$5. Send for illustrated circular.

MUNN & Co., Publishers,

OFFICE OF THE SCIENTIFIC AMERICAN,

361 Broadway, New York.

STAR ★ MAPS.

By RICHARD A. PROCTOR, F.R.A.S.

A series of twelve elegantly printed Maps of the Heavens, one for every month in the year. Specially prepared for use in North America. With descriptions accompanying each map, giving the names of the principal stars and constellations, showing their relative positions at given hours and days of the month.

A most beautiful and convenient work, especially adapted for the use of those who desire to acquire a general knowledge of the starry realms.

To which is added a description of the method of preparing and using artificial luminous stars as an aid in fixing in the mind the names and places of the various stars and constellations, by Alfred E. Beach.

Altogether this is one of the most popular, useful, and valuable works of the kind ever published.

One quarto volume, elegantly bound in cloth. Price, \$2.50, postpaid. MUNN & Co., Publishers, 361 Broadway, New York.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF RECEIPTS, NOTES AND QUERIES.

708 PAGES. PRICE \$5.00.

Bound in Sheep, \$6.00. Half Morocco, \$6.50.

This splendid work contains a careful compilation of the most useful Receipts and Replies given in the Notes and Queries of correspondents as published in the SCIENTIFIC AMERICAN during nearly half a century past; together with many valuable and important additions.

Over Twelve Thousand selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public.

The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use.

Almost every inquiry that can be thought of, relating to formulae used in the various manufacturing industries, will here be found answered.

Instructions for working many different processes in the arts are given. How to make and prepare many different articles and goods are set forth.

Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings.

Those who are in search of independent business or employment, relating to the manufacture and sale of useful articles, will find in it hundreds of most excellent suggestions. MUNN & Co., Publishers, 361 Broadway, New York.

THE

Scientific American Supplement.

PUBLISHED WEEKLY.

Terms of Subscription, \$5 a Year.

Sent by mail, postage prepaid, to subscribers in any part of the United States or Canada. Six dollars a year, sent, prepaid, to any foreign country.

All the back numbers of THE SUPPLEMENT, from the commencement, January 1, 1876, can be had. Price, 10 cents each.

All the back volumes of THE SUPPLEMENT can likewise be supplied. Two volumes are issued yearly. Price of each volume, \$2.50 stitched in paper, or \$3.50 bound in stiff covers.

COMBINED RATES.—One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, \$7.00.

A liberal discount to booksellers, news agents, and canvassers.

MUNN & CO., Publishers,

361 Broadway, New York, N. Y.

TABLE OF CONTENTS.

	PAGE
I. AERONAUTICS.—The Aerial Castle at the Antwerp Exposition.—A suggested substitute for the Eiffel tower for the Antwerp Exposition of 1894.—1 illustration.	14699
II. ASTRONOMY.—A New Apparatus for Measuring Photographic Plates.—An apparatus for measuring star distances on astronomical plates.—1 illustration.	14701
Sights with a Five Inch Telescope.—By GARRETT P. SERVISS.—Astronomy under simple auspices.—Notes of interesting objects.	14708
III. BOTANY.—The Victoria Regia.—The great water lily of the Amazon.—1 illustration.	14707
IV. CHEMISTRY.—New Cellulose Derivatives and their Industrial Applications.—By C. F. CROSS, E. J. BEVAN, and C. BEADLE.—A most interesting and remarkable chemical product of great practical value.	14708
New Valuation Method of Raw Sugar.—Recent action by the Society of German Sugar Refiners.—Properties of this series of Salts of Sulphophosphoric Acid.—Abstract of the president's address on the modern work of chemistry.	14710
V. CIVIL ENGINEERING.—The Port of Bizerte.—Important works conducted in Africa for the establishment of a new port.—5 illustrations.	14698
VI. COLUMBIAN EXPOSITION.—The Columbian Exposition.—The Builders Iron Foundry Exhibit of 12-inch Breech-loading Rifled Mortars.—Exhibition of United States mortars at the World's Fair and details of the manufacture.—1 illustration.—The World's Columbian Exposition.—The International Quarter.—Notes on the government buildings at the Fair.—3 illustrations.	14695
VII. EDUCATION.—The Ideal Engineering Education.—By WILLIAM H. BURR, of Columbia College, New York.—An admirable paper read before the Engineering Congress in Chicago.—What the young engineer should study.	14699
VIII. ENTOMOLOGY.—Insects Injurious to Drugs.—By PROF. L. E. SAYRE.—Valuable contribution to applied entomology.—2 illustrations.	14704
IX. GEOGRAPHY AND EXPLORATIONS.—The Departure of Dr. Nansen's Arctic Expedition.—Graphic description of the departure of Nansen's expedition from Norway.—1 illustration.	14703
X. GEOLOGY.—The Geological Work of High Pressure Gas.—Most curious and interesting experiments on the action of enormously high pressure gases on rocks.	14703
XI. MECHANICAL ENGINEERING.—Steam Carriages of Sixty Years Ago.—Early steam carriages.—The predecessors of the modern railroad.—1 illustration.	14699
XII. METEOROLOGY.—A Rain of Ice.—An unprecedented storm in England, in which some pieces of ice as large as an ostrich egg fell.—1 illustration.	14706
XIII. MINING ENGINEERING.—New Fire Damp Indicators.—Alcohol and hydrogen flame lamps for detecting traces of fire damp in air.—2 illustrations.	14702
XIV. MISCELLANEOUS.—A Cook's Appeal Case.—Adulteration of food and an English judgment concerning it.	14707
XV. NATURAL HISTORY.—The Medusa of Lake Tanganyika.—A medusa from an African lake.—2 illustrations.	14705
XVI. NAVAL ENGINEERING.—The Japanese Cruiser Yoshino.—A recent addition to the Japanese navy.—The fastest cruiser afloat.—Data of speed trial.	14697
XVII. PHOTOGRAPHY.—The Photographic Lens.—By W. K. BURTON, Imperial University, Tokyo, Japan.—Description of the new Dallmeyer lens, giving wonderful results in photography of distant objects.	14701
XVIII. TECHNOLOGY.—Gilded Platinum.—The use of gilded platinum in sulphuric acid stills.	14710

A New Catalogue of Valuable Papers

Contained in SCIENTIFIC AMERICAN SUPPLEMENT during the past ten years, sent free of charge to any address. MUNN & CO., 361 Broadway, New York.

Useful Engineering Books

Manufacturers, Agriculturists, Chemists, Engineers, Mechanics, Builders, men of leisure, and professional men, of all classes, need good books in the line of their respective callings. Our post office department permits the transmission of books through the mails at very small cost. A comprehensive catalogue of useful books by different authors, on more than fifty different subjects, has recently been published, for free circulation, at the office of this paper. Subjects classified with names of authors. Persons desiring a copy have only to ask for it, and it will be mailed to them. Address

MUNN & CO., 361 Broadway, New York.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had forty-five years' experience, and now have unequalled facilities for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them: directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc. We also send, free of charge, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,

361 Broadway, New York.

BRANCH OFFICES.—No. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.