

Dissolve 1 pound of pure sulphate of copper in 25 gallons of water.

**Simple Solution of Sulphate of Copper.**—For soaking seeds previous to sowing to destroy the spores of smut.

Solution in water, 5 to 8 pounds to 10 gallons.  
**Copper Mixture of Gironde, Bordeaux Mixture.**—For treatment of mildew. For downy mildew and black rot of the grape. For blight and rot of the tomato and potato.

Original formula. —Dissolve 16 pounds of sulphate of copper in 22 gallons of water, in another vessel slake 30 pounds of lime in 6 gallons of water. When the latter mixture has cooled, it is slowly poured into the copper solution, care being taken to mix the fluids thoroughly by constant stirring. It is well to have this compound prepared some days before it is required for use. It should be well stirred before applying. A solution containing the ingredients in the following proportions has been recommended for general use: Sulphate of copper, 4 pounds; lime, 4 pounds; water, 12 gallons. The copper is dissolved in 16 gallons of water, while the lime is slaked in 6 gallons. When cool, the solutions are mixed as described above.

**Eau Celeste, Audoynaud Process.**—For downy mildew. For treatment of downy mildew and black rot of the grape. For treatment of mildew and anthracnose. For blight and rot of the tomato and potato. For apple scab.

Dissolve 1 pound of sulphate of copper in 2 gallons of hot water; when completely dissolved and the water has cooled, add 1½ pints of commercial ammonia (strength 22 deg. Baume); when ready to use dilute to 22 gallons. The concentrated liquid should be kept in a keg or some wooden, earthen or glass vessel.

**Modified Formula.**—Sulphate of copper, 2 pounds; carbonate of soda, 2½ pounds; ammonia (22 deg. Baume), 1½ pints; water, 22 gallons.

Dissolve the sulphate of copper in two gallons of hot water, in another vessel dissolve the carbonate of soda in a similar manner; mix the two solutions, and when all chemical reaction has ceased, add the ammonia; dilute to 22 gallons.

**Solution of Ammoniacal Carbonate of Copper.**—For peronospora of the vine.

Prepared as follows: Into a vessel having a capacity of two quarts or more pour one quart of ammonia (strength 22 deg. Baume), add 3 ounces carbonate of copper, stir rapidly for a moment and the carbonate of copper will dissolve in the ammonia, forming a very clear liquid. The concentrated liquid thus prepared may be kept indefinitely. For use dilute to 22 gallons.

**Sulphate of Iron.**—For anthracnose. Simple solution in water 4 to 8 pounds to the gallon, to be used only as a wash.

**Sulphide of Potassium, Liver of Sulphur.**—For mildew in greenhouses. For mildew on roses. For oidium and erinose of the vine. For orange leaf scab. For celery leaf blight. For pear and apple scab.

Solution in water, ¼ to 1 ounce to the gallon.

**Solution of Hyposulphite of Soda.**—For apple scab. For celery leaf blight. For orange leaf scab.

Simple solution of 1 pound of the soda in 10 gallons of water. Must be used at once.

**Liquid Gison, Eau Gison.**—For mildew on grape vines. For powdery mildew.

Prepared by boiling three pounds each of flowers of sulphur and lime in 6 gallons of water until reduced to 2 gallons, when settled pour off the clear liquid and bottle it. When used, mix 1 part of the clear liquid in 100 parts of water.

**Milk of Lime.**—For peronospora of the vine. For anthracnose.

Simple solution in water, 2 to 6 parts lime to 100 parts water.

**Phenic Acid, Carbohc Acid.**—For powdery mildew of the vine.

Solution in water one half pint to 10 gallons.

**POWDERS.**

**Sulphur.**—For grape mildew. For powdery mildew of the vine.

**Sulphur and Lime.**—For treatment of anthracnose during the growing season.

A mixture of equal weights sulphur and lime.

**Blight Powder and Sulphur.**—For simultaneous treatment of oidium and the downy mildew. For downy mildew of the vine. For tomato and potato blight and rot.

Prepared by thoroughly mixing from 3 to 8 pounds of anhydrous sulphate of copper with 90 to 100 parts of flowers of sulphur.

**Sulphatine, the Esteve Process.**—For the treatment of mildew. For the treatment of downy mildew and black rot of the grape. For the treatment of the tomato and potato for blight and rot.

Mix 2 pounds of anhydrous sulphate of copper with 20 pounds of flowers of sulphur and 2 pounds of air-slaked lime. The proportions may be varied.

**Skavinski's Powder.**—For simultaneous treatment of oidium and downy mildew of the vine. For treatment of mildew.

Mix 22 pounds of finely powdered sulphate of copper with 33 pounds of soot or alluvial earth and 165 pounds of coal dust.

**Sulfosteatite or Cuprique Steatite.**—For the treatment of mildew (Peronospora).

An exceedingly fine bluish powder composed of steatite, or talc, and sulphate of copper, the proportion of the latter substance amounting to about 10 per cent. Very easily applied; this is considered the most adherent of all the powders used for these purposes.

**David's Powder.**—For downy mildew and black rot of the grape. For mildew and anthracnose.

Dissolve 4 pounds of sulphate of copper in the least possible amount of hot water, and slake 16 pounds of lime with the smallest quantity of water required. When the copper solution and slaked lime are completely cooled, mix them together thoroughly; let the compound dry in the sun, crush and sift. Apply with a sulphuring bellows of some description furnished with an outside receptacle for containing the powder. The copper coming in contact with the disease will very soon destroy it.

**Potechard's Powder.**—For the downy mildew of the vine. For the treatment of mildew and anthracnose.

Air, slaked lime, 225 pounds; sulphate of copper, 45 pounds; flowers of sulphur, 20 pounds; ashes, 30 pounds.

Dissolve the sulphate of copper in the water; when

thoroughly dissolved, pour the solution upon the lime, which is surrounded by the ashes to keep the liquid from spreading; after twenty-four hours add the sulphur, thoroughly mix the compound, ashes and all, and when dry sift through a sieve with meshes of one-eighth of one inch. This preparation may be made several months before it is required for use.

**REFRIGERATING MIXTURES OBTAINED WITH SOLID CARBONIC ACID.**

By L. CAILLETET and E. COLARDEAU.

The authors show that in a mixture of flocculent carbonic acid and ether the latter does not, as commonly supposed, act merely by establishing a more complete contact with the body to be refrigerated, but that cold is produced by the solution of the carbonic acid in the ether. Solid carbonic acid alone produced a temperature of -60° under the ordinary atmospheric pressure, and of -76° in a vacuum. A mixture of solid carbonic acid and ether gave, under ordinary atmospheric pressure, a temperature of -77°, and in a vacuum of -103°. The experiment was repeated with other solvents. Methyl chloride and liquefied sulphurous acid gave each -82°, acetamyllic ether -78°, phosphorous trichloride -76°, and absolute alcohol -72°. In a mixture of methyl chloride and solidified carbonic acid in a vacuum a temperature of -106° was observed.

FROM experiments made in the Danish navy, it appears that there is but little difference in the efficiency of the two bladed and four bladed propellers, the same blades being used in each case, so that the loss of one-half of the propeller surface was balanced by the lessened friction. At speeds greater than 12 knots, however, the vibration with the two bladed propeller was excessive.

**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.

**THE SCIENTIFIC AMERICAN Architects and Builders Edition.**

\$2.50 a Year. Single Copies, 25 cts.

This is a Special Edition of the SCIENTIFIC AMERICAN, issued monthly—on the first day of the month. Each number contains about forty large quarto pages, equal to about two hundred ordinary book pages, forming, practically, a large and splendid Magazine of Architecture, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with full Plans, Specifications, Costs, Bills of Estimate, and Sheets of Details.

No other building paper contains so many plans, details, and specifications regularly presented as the SCIENTIFIC AMERICAN. Hundreds of dwellings have already been erected on the various plans we have issued during the past year, and many others are in process of construction.

Architects, Builders, and Owners will find this work valuable in furnishing fresh and useful suggestions. All who contemplate building or improving homes, or erecting structures of any kind, have before them in this work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

Many other subjects, including Sewerage, Piping, Lighting, Warming, Ventilating, Decorating, Laying out of Grounds, etc., are illustrated. An extensive Compendium of Manufacturers' Announcements is also given, in which the most reliable and approved Building Materials, Goods, Machines, Tools, and Appliances are described and illustrated, with addresses of the makers, etc.

The fullness, richness, cheapness, and convenience of this work have won for it the Largest Circulation of any Architectural publication in the world.

MUNN & CO., Publishers, 361 Broadway, New York.

A Catalogue of valuable books on Architecture, Building, Carpentry, Masonry, Heating, Warming, Lighting, Ventilation, and all branches of industry pertaining to the art of Building, is supplied free of charge, sent to any address.

**Building Plans and Specifications.**

In connection with the publication of the BUILDING EDITION of the SCIENTIFIC AMERICAN, Messrs. Munn & Co. furnish plans and specifications for buildings of every kind, including Churches, Schools, Stores, Dwellings, Carriage Houses, Barns, etc.

In this work they are assisted by able and experienced architects. Full plans, details, and specifications for the various buildings illustrated in this paper can be supplied.

Those who contemplate building, or who wish to alter, improve, extend, or add to existing buildings, whether wings, porches, bay windows, or attic rooms, are invited to communicate with the undersigned. Our work extends to all parts of the country. Estimates, plans, and drawings promptly prepared. Terms moderate. Address

MUNN & CO., 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. AGRICULTURE.—Fungus Diseases in Plants—Their Treatment.—A valuable paper on the application of fungus-destroying substances to plants.—1 illustration.....	10517
II. CIVIL ENGINEERING.—Improved Water Ballast Steam Roller.—A roller for road making in which water is used as ballast.—3 illustrations.....	10503
The Hawkesbury Bridge, Australia.—A remarkable engineering feat executed by American engineers in Australia.—Details of operations.—4 illustrations.....	10504
III. GEOGRAPHY AND EXPLORATION.—Norfolk Island.—By ISAAC ROBINSON, U. S. Consul.—The story of the settlement of the island and its anomalous position.—A government with few laws and no prisons.....	10511
The Proposed Railway from Winnipeg to Hudson's Bay.—The scene of the proposed route and the natural difficulties in way of the proposed line.....	10506
IV. GEOLOGY.—Coal, Asphalt, and Petroleum Deposits in Venezuela.—A description of the great richness of Venezuela in these deposits.....	10515
Geology.—By ARTHUR D. GEIKIE, LL.D., F.R.S.—The first instance of an extensive treatment of the subject of rock formation.—The formation of sedimentary rocks, with illustrations and experimental suggestions.—11 illustrations.....	10512
V. METEOROLOGY.—A Study on Whirlwinds.—A very interesting and graphic account of some personal observations of dust and snow vortices.—5 illustrations.....	10516
VI. MICROSCOPY.—Microscopical Measurements.—By CHARLES FASOLDT, Sr.—The variations in such determinations due to difference in lights employed.....	10510
VII. NAVAL ENGINEERING.—New Additions to the French Navy.—Notes of dimensions and costs of some new vessels.....	10506
Steam Navigation.—The history of ocean steam transport. A most interesting recital of early details of the inception of the great work.....	10503
The Propelling Machinery of Modern War Vessels.—Notes of a recent lecture on this subject.—By H. J. ORAM, Esq., Engineer, R. N.....	10506
VIII. PHOTOGRAPHY.—A New Method of Measuring the Time of Exposure given by Photographic Shutter.—A simple method for effecting this determination without the use of the electric light.—2 illustrations.....	10507
Photographic Notes.—Improving defective negatives.—A vexatious problem considered, with formulae for varnish, intensifier, etc.....	10507
The Reproduction of Negatives.—By W. H. RAFF.—How to make a negative from a negative; full practical details.....	10506
IX. PHYSICS.—Refrigerating Mixtures Obtained with Solid Carbonic Acid.—By L. CAILLETET and E. COLARDEAU.—A curious and important note on the role played by ether mixed with solid carbon dioxide in refrigeration.....	10518
The Photometry of Negatives.—An interesting investigation in a hitherto comparatively untried field of work.....	10510
X. PHYSIOLOGY.—Effects of Food Preservatives on the Action of Diastase.—Pancreatic extract and pepsin.—By HENRY LEFFMANN, M.D., and WILLIAM BEAN, M.A.—An important question, and of growing importance in the light of the increasing use of food preservatives, experimentally treated; tables of results.....	10510
XI. TECHNOLOGY.—Apparatus for Dyeing, Cleaning, and Bleaching Textile Materials.—An interesting apparatus involving a distinct principle for treatment of thread on bobbins.—7 illustrations.....	10508
Distillation of Peppermint.—By ALBERT M. TOLLE.—How to make peppermint oil, a short and clear paper on the subject, with figures of manufacturing results.....	10509
Yellow Prussiate of Potash.—How this salt, the basis of Prussian blue manufacture, is made on the large scale.....	10509

**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 author. 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.**

In connection with the Scientific American, Messrs. MUNN & Co. are solicitors of American and Foreign Patents, have had 42 years' experience, and now have the largest establishment in the world. Patents are obtained on the best terms.

A special notice is made in the Scientific American of all inventions patented through this Agency, with the name and residence of the Patentee. By the immense circulation thus given, public attention is directed to the merits of the new patent, and sales or introduction often easily effected.

Any person who has made a new discovery or invention can ascertain, free of charge, whether a patent can probably be obtained, by writing to MUNN & Co.

We also send free our Hand Book about the Patent Laws, Patents, Caveats, Trade Marks, their costs, and how procured. Address

MUNN & CO., 361 Broadway, New York.

Branch Office, 622 and 624 F St., Washington, D. C.