

interior was covered with beautiful crystals, nearly a centimeter in length. These crystals were right prisms with a square base, iridescent upon the surface, strongly magnetic, and were nearly as hard as steel. The formula Fe_3P very accurately corresponds with the analysis of this phosphide.

SOLUBILITY OF OXIDES IN ALKALIES.

M. Prud' Homme has published the fact that some oxides which are insoluble, or but slightly soluble, in an alkali may be rendered soluble by the addition of an oxide which dissolves in that alkali. Thus chromic oxide dissolves in ammonia when a salt of copper is added, and cupric oxide dissolves in potash if a salt of chromium be present.

MORPHINE IN THE DEVELOPER.

J. Kruger, in *Licht*, suggests the addition of morphine to the ordinary sulphate of iron developer, for photographic negatives, in the proportion of 8 grains of morphine and $\frac{1}{4}$ an ounce of glacial acetic acid to 2 ounces of distilled water. One part of this liquid is to be added to eight parts of the iron developer. The latter is composed of 16 ozs. of water, 1 oz. of sulphate of iron, $\frac{1}{4}$ oz. of alcohol. The author asserts that the use of the morphine as above yields clean, brilliant, and soft negatives, and he desires that practical photographers will satisfy themselves of the correctness of his statement by actual trial.

TUNGSTEN IN STEEL.

Professor Herren has found 83 per cent tungsten and 1.73 manganese in Mushet's steel. This steel becomes soft when heated and suddenly cooled, and hard when cooled slowly, just the reverse of ordinary steel.

A CHLOROFORM MASK.

M. Demarquay states that the action of both chloroform and morphine is to lower the animal temperature, and that a combination of the two causes a decrease of $2\frac{1}{2}^{\circ}C$. It is asserted that the use of both agents combined as an anæsthetic is extremely dangerous. During an operation performed upon a patient under the double influence, it was remarked that the circulation became interrupted, the arterial blood turned black, and repeated fainting fits took place. In order to avoid these grave consequences, M. Demarquay considers that chloroform should be used singly, but not administered in the ordinary manner. He proposes, instead of saturating a compress or sponge with the agent to use a flannel mask, on which the chloroform contained in a graduated bottle is turned drop by drop. The evaporation is continuous, and the patient breathes without effort. A year's experience with this apparatus proves that by its use all struggling during the period of excitement is obviated, and that insensibility is easily and gradually attained.

PHOTOGRAPHING AN AQUARIUM.

In photographing the interior of an aquarium, the water must be illuminated by strongly reflected solar rays, which may be either transmitted or directly projected. To cause a transmission of the light into the water, recourse must be had to a heliostate mirror, placed behind the rear face of the aquarium. In front of the latter, the camera is situated, the intermediate space between its lens and the aquarium being surrounded by a pasteboard screen, so that no light is admitted to the instrument, except that directly passing through the object. By this means opaque bodies, such as shells, plants, etc., are naturally lighted by the diffusion of the rays in the liquid, which gives them the photogenic qualities necessary for their reproduction. The second mode of proceeding consists in directing the solar rays at a convenient angle on the forward face of the aquarium, on the bottom of which a mirror is placed, so that all objects contained are brightly illuminated. The water, of course, must be perfectly limpid.

WATER FREEZING AT BELOW 32° FAH.

It is generally admitted that water congeals at 0° Centigrade or 32° Fahrenheit, and that it is only in perfectly tranquil places that it can be kept liquid even at a certain number of degrees below the freezing point. *Les Mondes* mentions in this connection a curious fact, which it considers due to a supersaturation, so to speak, of the water. If in water, at a temperature of $-3^{\circ}C$. (about $27^{\circ}F$), which may even be slightly agitated without congealing, the least particle of hoar frost or ice be introduced, crystals of ice instantly form and expand through the mass, producing remarkable and beautiful effects. The eye can watch the formation of the needles of ice, see them group together and obey those mysterious affinities which produce the exquisite forms with which we are all familiar.

TO CASE HARDEN WROUGHT IRON—To case-harden wrought iron, take prussiate of potash, finely pulverized, and roll the article to be hardened in it, if its shape admits; if not, sprinkle the powder on it freely, while the iron is hot. This is applicable to iron axletrees, by heating the axle red with heat, and rolling it in the powder spread out for that purpose, turning it up quickly and pouring cold water upon it, then dip it in cold water as quickly as possible. The axle can be used for years without showing wear.

To protect delicate drawings in pencil or chalk, such as are easily smudged if roughly handled, and to give them more permanence and solidity, it is well to coat them with ordinary collodion, sold by all dealers in photographic materials. The same may, if desired, be used with an admixture of paraffin stearine or castor oil, and affords then an excellent coating. Pencil sketches are in this way rendered clearer, and may therefore, be copied the more easily when so treated.

Facts for the Ladies.—Mrs. Rika Levy, New York, has supported herself and family for fourteen years with Wheeler & Wilson's Lock-Stitch Machine, without any repairs, and the machine is still in good order. See the new improvements and W. O.'s Lock-Stitch Ripper.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

A New Machine for boring Pulleys, Gears, Spiders, etc. etc. No limit to capacity. T. R. Bailey & Vail, Lockport, N. Y.

Form of Wheel teeth, 50c. E. Lyman, C. E., New Haven, Ct.

Patent for Sale—Tivnan's improved Water Gauge. For particulars, address Charles Tivnan, Box 583, Holyoke, Mass.

For 2, 4, 6 & 8 H.P. Engines, address Twiss Bro., New Haven, Ct.

For Sale, Car Wheel Press—and McKenzie Blower, in fine order. Address Mansfield Machine Works, Mansfield, Ohio.

Hand Lathes. C. F. Richardson, Athol Depot, Mass.

I will Remove and prevent Scale in any Steam Boiler or make no charge. Engineer's Supplies. Geo. W. Lord, Philadelphia, Pa.

Soluble Glass, Water Glass, Liquid Quartz, Silicates of Soda and Potash for Concrete Cements, Fire and Waterproofing, manufactured by L. & J. W. Feuchtwanger, Chemists, 55 Cedar St., New York.

Oxide of Manganese, highest test, from our own mines, for Steel manufacturing, Patent Dryer, Paints and Glass, at lowest prices, by L. & J. W. Feuchtwanger, 55 Cedar St., New York.

Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

Wanted—Circulars of Makers of Wooden Pumps. F. Moon, Newberry, S. C.

Hydraulic Jacks and Presses—Second Hand Plug Tobacco Machinery. Address E. Lyon, 470 Grand St., New York.

Steel Castings "To Pattern," from ten pounds upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

Gatling guns, that fire 400 shots per minute, with a range of over 1,000 yards, and which weigh only 145 pounds, are now being made at Colt's Armory, Hartford, Conn.

For 15 in. Swing Engine Lathes, address Star Tool Company, Providence, R. I.

Machinists; Illustrated Catalogue of all kinds of small Tools and Materials sent free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Manufacturers of Machinery, or any patented article which they desire to introduce into the New York market, will find a capable agent, with the best of references, by addressing S. C. Hill, 51 Courtlandt Street, New York.

Ashcroft's Original Steam Gauge, best and cheapest in the market. Address E. H. Ashcroft, Sudbury St., Boston, Mass.

Heydrick's Traction Engine and Steam Plow, capable of ascending grades of 1 foot in 3 with perfect ease. The Patent Right for the Southern States for sale. Address W. H. Heydrick, Chestnut Hill, Phila.

The Berryman Steam Trap excels all others. The best is always the cheapest. Address I. B. Davis & Co., Hartford, Conn.

Wanted—Copper, Brass, Tea Lead, and Turnings from all parts of the United States and Canada. Duplaine & Reeves, 760 South Broad Street, Philadelphia, Pa.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co.

T. R. Bailey & Vail, Lockport, N. Y., Manf. Gauge Lathes.

Diamond Carbon, of all sizes and shapes, furnished for drilling rock, sawing stone, and turning emery wheels or other hard substances also Glazier's Diamonds, by John Dickinson, 64 Nassau St., New York.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Brown's Pipe Tongs—Manufactured exclusively by Ashcroft, Sudbury St., Boston, Mass.

American Boiler Powder Co., Box 797, Pittsburgh, Pa., make the only safe, sure, and cheap remedy for 'Scaly Boilers.' Orders solicited.

Gear Wheels for Models. Illustrated Price List free. Also Materials of all kinds. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Windmills: Get the best. A. P. Brown & Co., 61 Park Place, N. Y.

Ashcroft's Self-Testing Steam Gauge can be tested without removing it from its position.

The Berryman Manf. Co. make a specialty of the economy and safety in working Steam Boilers. I. B. Davis & Co., Hartford, Conn.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

Boynot's Lightning Saws. The genuine \$500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, \$6. E. M. Boynot, 80 Beekman Street, New York, Sole Proprietor.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro. 414 Water St. N. Y.

Better than the Best—Davis' Patent Recording Steam Gauge. Simple and cheap. New York Steam Gauge Co., 46 Courtlandt St., N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

For hand fire engines, address Rumsey & Co., Seneca Falls, N. Y.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N. J. Also 2-spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

COPIES OF PATENTS.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office \$1.

A copy of the claims of any patent issued since 1836 will be furnished for \$1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

Address Munn & Co., Patent Solicitors, 37 Park Row, New York City.

Notes & Queries.

We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

- 1.—TURNING WIRE ROLLS.—What is a good plan for turning or cutting taper wire rolls?—C. E. A.
- 2.—SILICATE OF SODA.—Is water glass again soluble in water or oil after once becoming hard?—W. K. L.
- 3.—TINNING PINS.—How are pins and other small brass articles tinned?—G. W.
- 4.—VARNISH FOR BOILER HEADS.—What is a good varnish for a locomotive boiler head?—C. G. S.
- 5.—AN ELECTRIC VACUUM.—Has science ever determined what substance, species, or condition of matter constitutes a vacuum or void in electricity?—D.
- 6.—PURIFYING BICHROMATE OF POTASH.—How can commercial bichromate of potash be rendered chemically pure?—G. B. M.
- 7.—PURIFYING ZINC.—How can commercial zinc be made chemically pure? The zinc is to be used in the hydrogen test for arsenic and antimony.—G. B. M.
- 8.—LIGHT FOR MAGIC LANTERN.—How can I make a light suitable for a medium sized magic lantern? Gas or oil makes too much smoke.—A. R.
- 9.—OIL PROOF WOOD.—What cheap and harmless substance can I use on small wooden boxes to make them hold oily substances without the grease soaking into or through the wood?—W. K. L.
- 10.—HARDENING WOOD.—Can anything be applied to wood to render it hard enough for a cylinder or roller for a printing press? Can wood be used for such a purpose, and is it already so used? If so, what is the kind of wood?—S.
- 11.—BREAKING STRAIN ON IRON RODS.—What weight will break an iron rod, of $\frac{1}{2}$ inch diameter and 40 feet length? The rod is to be fastened rigidly at the ends, and the weight suspended in the middle.—D. R. R.
- 12.—REMOVING INK STAINS.—Is there any chemical that will remove ink from paper without discoloring the paper?—W. W. W.
- 13.—CEMENT TO RESIST THE ACTION OF BRINE.—Is there any cement or pitch that will do to line a vat to hold brine, the temperature of which will range from 25° to 110° Fah.?—P. Q.
- 14.—FREAK OF BOILER.—A boiler has something that jars or thumps inside it, as I can feel by placing my hand on some of the pipes. There is some scale at that end where I hear it; the last sheet, a little from the bottom, is from 1-16 to 2-16 of an inch thick. Is that the trouble? If so, how shall I remove it?—C. H. C.
- 15.—COMBUSTIBLE PAPER FOR CARTRIDGES.—How is the paper for sporting and other cartridges made? What combustible solution is used to cause the paper to ignite from the percussion cap?—B. F. R.
- 16.—A RUBEFACIENT WANTED.—Last year a sickness left upon my face a mark more original than agreeable. My right cheek is as red as a cherry, while the left remains with its usual color. As it is impossible to remove the red mark, I should like to know if there is any way in which I can render my left cheek as red as the right.—A. T.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries however, when paid for as advertisements at \$1.00 a line, under the head of "Business and Personal."

All reference to back numbers must be by volume and page.

C. M. K. asks, what space will the oxygen and hydrogen, evolved by the decomposition of a cubic inch of water, respectively fill? Answer: The oxygen will fill a space equal to 800 cubic inches, and the hydrogen, 1,600 cubic inches.

PROPELLER.—Cannot a propelling wheel be made from a flat circle of iron or steel, cut into segments, which are left attached at the center, the segments being twisted obliquely to the axis?—A. T. of Pa. Answer: Yes. But the plan is not new.

THE WORLD'S ANTIQUITY.—What does Professor Thurston mean by saying, on page 212 of your current volume, that "a hundred thousand years this wonderful water power has been uninterruptedly in existence"? Does he intend it as a statement of fact, or is it a hyperbolic figure of speech? The Hebrew text of the Scriptures states that the creation took place 4,004 years before the Christian era, and the Septuagint, 5,872 years.—H. E. G., of N. H. Answer: It is now a common belief, among men of science as well as among some theologians, that the periods or stages of the creation, described by Moses as seven days, cannot possibly be seven of our days of twenty-four hours each. And if the word "day" is a figurative expression, it may be taken to signify an epoch of any length, and so harmonize with the known facts of the inconceivable antiquity of many of the works of Nature. Professor Thurston no doubt judged the time he mentioned by a personal inspection of the work done by the water on the rocks of Niagara.

FRICITION.—Is it practically a fact that friction decreases as speed increases: that is, would the cross head of a stationary engine wear less if it were run at 600 feet per minute than if it were run at 200 or 300 feet per minute, the engine doing the same amount of work?—W. F. C. S., of Ohio. Answer: It is laid down by all the modern authorities that friction is proportional to the pressure forcing the surfaces together, but it is independent of the velocity with which one body is drawn across the surface of the other, that is, that it requires the same amount of energy to surmount the friction, or to make a body pass over a given distance of the surface, whatever may be the velocity of its motion. (See Nichol's "Physical Sciences," article "Friction," and Professor Willis, page 258 of our current volume.) It follows from this that the friction or wear of any part of a machine will be proportional to the distance travelled, whether the same be done in a long or short time. The common notion that the friction diminishes as the speed increases has been attributed to experience in cases where the pressure is so slight as to allow of some occasional separation of the surfaces when the velocity is high.

CENTRIFUGAL FORCE.—What is the law governing centrifugal force? Having the weight and velocity of a body, and the diameter of the circle it describes, how can I determine its outward pressure?—C. H. C. Answer: The centrifugal force varies as the square of the velocity and is in inverse ratio to the distance of the body from the center of the circle; but if the figure described be an ellipse or other non-circular curve, the calculation must be made as for a circle which is tangential to the point at which the moving body is. The following is a formula: Multiply the square of the number of revolutions per minute by the diameter of the circle in feet, and divide the product by the constant 5870; the quotient is the centrifugal force in pounds when the weight of the body is 1 lb. Thus a body, revolving in a circle of 4 feet diameter at the rate of 110