

## Business and Personal.

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Spy Glasses and Telescopes of all kinds and prices. Lenses for making the same, with full directions for mounting. Illustrated priced circular free. McAlister, Manufacturing Optician, 49 Nassau St., New York.

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Electric Gas Lighting Apparatus, applied to public and private buildings. The latest improvements. A. L. Bogart's patent. Address 702 Broadway, N. Y.

Patent Taper Sleeve Fastening and Wooden Pulley Works are now in full operation. Orders solicited. Satisfaction guaranteed. A. H. Gray, Erie, Pa.

Small Fine Gray Iron Castings a specialty. Warranted soft and true to patterns. A. Winterburn, 16 and 18 De Witt St., Albany, N. Y.

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Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 43 Cortlandt St., N. Y. Experimental work.

Silk, Cotton, and Flax Strength Testers, from 1 lb. to 120 lbs. Manufactured by Norris, Steam Gauge Maker, Paterson, N. J.

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Patents at auction. See advertisement, page 365.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 366.

The best Burglar Alarm in the world. Agents wanted. Geo. W. Lord, 229 Church St., Philadelphia, Pa.

For sale.—Large lot of Tools in Sewing Machine Manufactory. Send for list. W. Shearman, 132 N. 3d Street, Philadelphia, Pa.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Vocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

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For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

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

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

All nervous, exhausting, and painful diseases speedily yield to the curative influences of Pulvermacher's Electric Belts and Bands. They are safe and effective. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

## Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editors select from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN.

CAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

N. A. R. will find directions for browning gunbarrels on p. 11, vol. 32. This also answers G. D. M., who can clean brass shells by the process described on p. 102, vol. 25.—M. L. is informed that a recipe for root beer is given on p. 138, vol. 31.—A. D. B. is informed that there is no simple rule for the proportions of a screw propeller. He should read the subject up in the special treatises devoted to it.—O. B. S. does not give sufficient data as to his boiler.—L. T. F. and many others will find rules for calculating the horse power of engines on p. 33, vol. 33.—H. will find directions for whitening ivory on p. 10, vol. 32.—M. W. will find directions for making hard plaster of Paris on p. 43, vol. 34.—T. J. McN. should read our article on lightning rods on p. 144, vol. 31.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—M. A. A. will find something on cancelling postage stamps on pp. 83, 135, 266, vol. 36.—M. F. F. will find directions for removing freckles on p. 347, vol. 32.—E. R. C. will find directions for mounting chromos on p. 154, vol. 27.—E. J. L. will find a description of a galvanic battery suitable for medical purposes on p. 196, vol. 27.—W. H. C., J. J. Q., C. A. S., J. D. H., I. P. W. S., I. K. B., W. L., G. N. T., N. T., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. A. asks: 1. How thick must a tube of cast steel be to hold 1,000 lbs. pressure per square inch? A. These questions are too indefinite. The thickness of the tube will depend upon its size. 2. Through  $\frac{3}{4}$  inch hole, how many gallons water would be forced out per minute with a pressure of 1,000 lbs. per square inch? A. The discharge through the orifice will depend upon its shape and location.

(2) A. J. C. asks: How can I make a pattern by which to cast a cam wheel having upon its outer edge three equal eccentrics? Motion is given by two levers, one above and the other below, the levers having upon each one a roller which presses upon the outer face of the wheel, thus giving three strokes of the levers for each revolution of the wheel. A. Make the outline of the cam such that all lines drawn through the center will be equal.

(3) B. I. L. asks: How many lenses, and of what sizes and foci, are required to make a camera obscura for copying pictures? A. It requires but one, and it is not material about its size and focus. One 2 inches in diameter and of 18 inches focus will answer very well.

(4) J. B. H. asks: 1. On p. 186, vol. 36, in reply to J. N. A., you say that a horse power to 1.5 lbs. coal is among the best results. Will you state what class of boiler will accomplish this result? A. The figure represents exceptional results with marine engines having very efficient boilers, and giving a horse power with the consumption of 14 or 15 lbs. of steam an hour. 2. I suppose that the heat given up by the condensation of any given amount of steam would, if all used, evaporate an equal amount of water into steam. Is this true? And, if true in theory, about how much result in evaporation can be gotten from the condensation of a given quantity of steam? A. You will find this matter discussed in nearly any modern treatise on the steam engine.

(5) H. H. F. asks: Is the use of alum in bread and cakes, at the rate of a teaspoonful to a loaf of moderate size, injurious? A. Yes. The presence of alum in bread, in any proportion, is very objectionable.

(6) E. L. W. asks: 1. Can you inform me how metal stencil plates are prepared? A. Stencil plates are usually made of hard brass. The letters and characters, if small, are usually stamped out with suitable dies; but when large, the work has to be done by hand cutting. 2. Are they treated with hydrochloric acid? A. Not that we know of.

(7) J. D. E. asks: What are the curves and positions of the lenses of the Huyghenian eyepiece? A. There are two plano-convex lenses with their plane sides towards the eye. Their aperture is  $\frac{1}{4}$  of their focal length. The field lens is of 2 or 3 times longer focus than the eye lens. Their distance apart is one half of the sum of their focal lengths; that is, if the focus of one is 1 inch, of the other 2 inches, the distance apart is  $\frac{1}{2}$  inches. A diaphragm a little smaller than the aperture of the eye lens is placed between the lenses at the focus of the eye lens. For a medium power, the focus of one may be 1 inch, of the other  $\frac{1}{2}$  inch, etc.

(8) W. J. G. asks: How many lenses and of what sizes and foci are required for a photographic camera to take pictures 4 x 6 inches? A. It requires an achromatic combination of flint and crown glass. The diameter is not material, say 1 inch, with a focal length of about 8 inches. The smaller the lens, the sharper the picture.

(9) F. W. G. says: In a very severe thunderstorm last summer, a large brick house here was struck by lightning. An "American District" telephone wire was connected with one of their boxes in the house. Parties at the house claim that the wire brought the lightning to the house. I say that the house would have been struck anyway, and that the wire was a protection. Who is right? A. It is most probable that the wire had nothing to do with the matter. A discharge which would damage the house would, in all probability, have fused the wire.

(10) P. M. S. asks: Can you give me some information about rosin oil? A. When rosin is distilled, it yields about 74 per cent of liquid distillates. The first portions are mobile, yellow, and strong smelling, and are known as essence of rosin (colophonone). Later in the distillation the viscid fluorescent rosin oil (or pinolin) passes over. This body is used in paints, for the

manufacture of printer's ink, in making soap, and as a cheap lubricant.

(11) W. E. B. says, in answer to G. S. W., who asked if there is any rule for dividing a circle into 3, 4, or more equal parts by parallel lines: He will not probably find any general rule for this purpose; but I find by calculation that the chord of an arc of  $149^{\circ} 16' 30''$  cuts off a segment whose area is about  $\frac{1}{1000}$  in excess of one third the area of the circle, and the chord of an arc of  $132^{\circ} 21'$  cuts off a segment whose area is about  $\frac{1}{1000}$  in excess of one fourth the area of the circle. These values are probably sufficiently accurate for all practical problems.

(12) A. E. F.—A good recipe for silver writing fluid is the following: Mix 1 oz. finest block tin in shavings with 2 ozs. mercury till they become perfectly amalgamated. Then shake up in a stoppered bottle with enough gum water to give proper consistency. The writing, when dry, will have the appearance of silver.

(13) H. S. asks: How is manganese obtained from the ore? A. Metallic manganese may be obtained from pyrolusite—the peroxide of manganese—by smelting at the highest heat of the blast furnace. It is, when free from carbon and silicon, a soft, easily tarnishable metal, resembling iron somewhat in appearance; and it has a specific gravity of about 7.2. It sells in small quantities for about \$1 per lb. Manganese has six oxides, of which the dioxide is the most important. This occurs in Nature (in a nearly pure form) in the mineral pyrolusite, which, broken into lumps or powder, is commercially known as black oxide of manganese or simply manganese, the latter name being incorrect. The black oxide is worth from \$10 to \$20 a ton in New York. See p. 226, vol. 35.

(14) L. G. asks: 1. What is the greatest force, as expressed in horse power, which has as yet been obtained by means of electricity, and please tell me what is the name of the inventor? A. Professor Page, as long ago as 1850, constructed electro-magnetic engines of between 4 and 5 horse power. 2. As this power is very feeble, could I, by means of several engines working separately and giving the maximum power each is capable of, and working together on the same driving beam, obtain as great a power as desired, costing less and with less weight than from a steam engine of same force? A. No system of magnetic engines has yet been found as economical as the steam engine.

(15) J. E. S.—Your relay for submarine telegraphy might be used on lines of moderate length; but for very long lines the mirror instrument is the best.

(16) F. S. says: 1. I wish to construct a telephone. Can I be prevented from making and using the instrument by patent or other cause? A. You can make one for experiment, but could be prevented from using it after its successful working. 2. What number and length of wire should be used in the coils? A. Altogether about 190 feet of No. 24 copper wire will answer for short circuits. 3. How and of what material should the sounding plate be made? A. It can be made of thin iron. A very good description of the apparatus is to be found in Prescott's "Electricity and the Electric Telegraph." 4. Do you think a good mechanic could construct one that would work well from these directions? A. Yes.

(17) J. F. says: For gumming envelopes I use mucilage composed of 2 ozs. dextrin, 1 oz. acetic acid, 1 oz. alcohol, 5 ozs. water. I am not satisfied with it. The adhesiveness is not sufficient. It is more adhesive without the alcohol. A. A strong aqueous solution of reasonably pure dextrin (British gum) forms a most adhesive and cheap mucilage. Alcohol, or rather diluted wine spirit, is usually employed as the solvent where the mucilage is to be used for gumming envelopes, postage stamps, etc., in order to facilitate the drying, and acetic acid is added to increase the mobility of the fluid. The strong aqueous solution is more adhesive than that prepared with alcohol, for the reason that it contains a greater proportion of the gum. To prepare this, add an excess of powdered dextrin to boiling water, stir for a moment or two, allow to cool and settle, and strain the liquid through a fine cloth. The addition of a little powdered sugar increases the glossiness of the dried gum, without interfering greatly with its adhesiveness. The sugar should be dissolved in the water before the dextrin is added.

(18) F. B. says: On p. 187, vol. 36, C. V. W. says that  $\frac{1}{2} \text{ chord}^2 + \text{height}^2 = \text{radius of the circle}$ .

Can this be true? I have tried it several times with a graduated beam compass, but cannot make it so. A. The rule is correct. Probably, you have made some mistake in applying it.

(19) J. H. F. says: I bought a small engine, nominally of  $4\frac{1}{2}$  horse power. The dimensions are as follows: Steam chest 4 x 5 inches, cylinder  $8\frac{1}{2}$  x  $4\frac{1}{2}$  inches, stroke 7 inches, upright boiler is about 6 feet high, with water space 4 feet 5 inches, and 2 feet in diameter. I have made several attempts to run a corn mill, and have tried 12, 16, and 18 inch burrs; it will pull them if they are fed sparingly, but if fed in the ordinary manner they stop the engine. If running fast, pulling the mill, the piston rod or the rod running from eccentric to slide valve bends and quivers from top to bottom. This rod has no knuckle joint, but is made thin in one place to give it the right motion. I notice that running at good speed with 60 lbs. of steam a man can stop it by simply bearing his weight against the pulley. Please tell me what power the dimensions indicate, and give me your opinion in regard to the unsatisfactory manner in which it works. A. From your account the engine does not seem to be very well constructed. We advise you to test it with a friction brake, and see how much power it can exert steadily, and how much steam is required.

(20) F. L. says: 1. How should I treat a leak in a flue of an upright boiler? When I let the water out, by the blow-off cock, I can hear the air escape out of the flue. When I have a fire under the boiler the flue does not leak at all; but as soon as the fire is out the leak begins again. A. Such a leak can doubtless be made tight by caulking, if a slight expansion is sufficient to stop it. 2. What is the best way to refit a pair of safety valve seats, the valves on which do not set very

closely, and stick somewhat, after being opened by a high head of steam? A. You can grind them in with oil and brickdust or emery. 3. To have two safety valves on the boiler, is it proper to have both valves set at the same weight, or should one be a little heavier than the other, say one for 60 lbs. and the other for 70 lbs.? A. If each is large enough to relieve the boiler, they might be set as you suggest. 4. What is the cause of knocking in steam pipes? A. It is caused by water in the pipe, or condensation and sudden changes of temperature. 5. Would it not be a good plan to have hand holes in the outside shell of the boiler at the level of the crown sheet, so as to be able to clean the crown and flues with a hose? A. This arrangement is sometimes adopted.

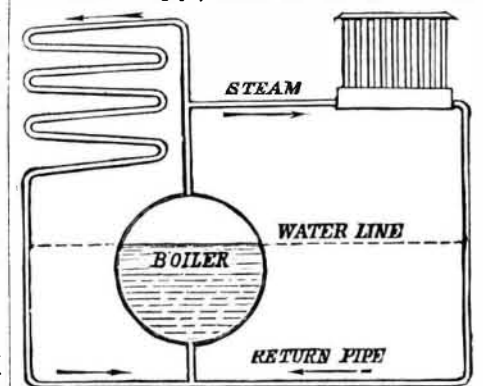
Will the rubber waterproof garments that ladies wear on damp days do to make a balloon? A. It might be made to answer very well if there was a demand for it. 2. How is this rubber material made? A. If you wish to experiment, it would be better to obtain samples from manufacturers than to attempt to make it.

(21) J. K. W. asks: What is the trouble with a double acting pump, which, in pumping from the cistern with the long suction pipe, if run very slowly (about 20 revolutions per minute) will work; but when the speed is increased to 100 revolutions, it seems to drop the water and the speed increases to 500 or 600 revolutions per minute, and it does not pump. A. The trouble is probably caused by the collection of air in the pipe. If so, it can be remedied by the use of a cock or valve.

How can I burn naphtha in a boiler furnace? A. We believe that there are special devices in the market for this purpose. Insert a notice in our Business and Personal column.

(22) J. E. asks: Can you inform me of any varnish for insulating No. 36 copper wire. I have used shellac dissolved in alcohol, but it would not answer. A. You cannot hope to thoroughly insulate helices of such fine wire by merely varnishing it. The wire must be covered with silk, cotton, or some other similar insulator. On cotton or silk covered wire, a strong solution of shellac gives very good results, and is very commonly employed. Fused paraffin wax is sometimes used, and is one of the best of insulators.

(23) C. G. L. says: You advise the use of a trap to return the water of condensation from the radiators to the steam-heating boilers. A trap of any kind is worse than useless, if the apparatus is for heating only, and all the radiators are above the water line of the boiler. It is only necessary that the pipes be of suitable size, and that all pipes and radiators shall incline toward the return pipe, which enters the boiler below



the water line. The water must stand at the same level in the boiler and return pipes, returning as fast as the steam condensed. I have known a boiler to be run for several months without the addition of any water; and in well constructed apparatus, the loss would be but a few gallons per month. The cracking and thumping often complained of is probably caused by water remaining in the pipes. This can frequently be remedied by raising any depressions in the pipe, where the water is trapped, or by taking the water from such depressions to the return pipe by a drip.

(24) J. N. says: 1. I wish to make a boiler which when finished will be exactly 30 inches high by 14 inches diameter. I intend making it of  $\frac{3}{4}$  inch wrought iron, and the boiler heads of  $\frac{1}{2}$  inch cast iron. Will the cast iron heads stand enough pressure to run a small engine, size 3 x  $1\frac{1}{2}$  inches, to do light work? A. We advise you to make the heads of wrought iron. 2. How much steam can I carry? A. You can carry about 30 lbs. per square inch.

What is the best way to clean the rust off iron and polish it afterward? A. If the work is very rusty, you can use oil and brickdust or emery, and finish with a file.

(25) J. P. G. says: 1. I would like to know the difference between phosphorus and amorphous phosphorus? A. Red or amorphous phosphorus is only a modified form—an allotropic condition—of the ordinary vitreous variety. Their chemical nature is identical, though they differ greatly in their physical properties. This difference is believed to be due to an alteration in the molecular grouping. This property is known as allotropism, a word which means simply "different states." The phenomenon of allotropism is not confined to phosphorus alone, but is more or less a property of all the elements. Carbon in one condition gives us the brilliant, transparent, and nearly incombustible, diamond; in another, the black, opaque, easily inflammable charcoal or coke; while in another we have the metal-like graphite. The red phosphorus is usually obtained by heating vitreous phosphorus for some time, or nearly to, its point of vaporization in an atmosphere of carbonic acid or hydrogen. It is more passive or inert than white phosphorus; it is heavier, of a brick-red color, and is not phosphorescent. It does not oxidize at ordinary temperatures, and requires a much greater degree of heat for its fusion than the waxy or vitreous variety, into which it may be directly converted by heating to 500° Fah. 2. Which is used on the common matches? A. Both active and passive phosphorus are used in the preparation of matches; but the latter, although more costly, is coming into more general use in parlor or safety matches and the like, in which it is mixed with chlorate of potash to cause it to ignite readily by friction.