(24) J. A. C. asks: Does the electric current used in sending a message to Europe or elsewhere return again to the instrument from which it emanated, either by a wire or by the ground? If the wire is dispensed with, does the current return by way of the earth in a direct line, and, having an affinity for the place from which it came, pass by all other attractions in its passage to that? A. The current does not return through the earth, but is absorbed by it at each end, thus causing a movement in the wire the same as if the ends were joined. It was formerly supposed that the current returned through the wire, but this has been proved to be incorrect.

(25) M. M. M. asks: By what method and under what conditions can the power of a permanent steel magnet be kept exactly the same for any length of time? A. The most effective way is to place a bar of iron across the poles.

(26) W. M. J. asks: 1. Would good varnish or paraffin make a good insulator for wire intended to be used in the helices of a relay? A. Silk or cotton would be better. 2. In what way does insulation act upon the condition of a magnet other than to separate one wire from another in the coils? A. Insulation of the wires is only intended to separate them, and prevent any conduction between the layers.

(27) E. C. C. says: 1. I am about to make an electro-motor. What metal must I use on which to wind the magnetic coils? A. Iron. 2. What kind and size of wire must I use? A. No. 14 copper wire.

(28) N. W. L. says: You state that grease or paint applied to the cells of a telegraph battery will prevent creeping. Having been annoyed by the creeping of our battery, and acting on the hint, we applied butter to it, that being the only grease at hand at the time. Since the application the battery does not creep, but the current is a great deal weaker. Is the butter the cause? A. No. Probably the battery needs fresh water.

(29) W. L. asks: 1. What bright large star is in the northeast, not very high, at about 6 P.M.? A. It is Capella, the principal star in the constellation *Auriga*. 2. What bright bluish star is high overhead to the westward? A. It is Vega, but more frequently called Lyra. It is the principal star in the Harp. 3. What large star is near *Orion* on the west side? A. It is Aldebaran, the largest star in the constellation *Taurus*.

(30) W. P. H. says: 1. I have in my possession two glass disks 2 inches in diameter, made by Chance & Co., of Birmingham, England. One consists of hard crown glass and one of dense flint. With these I wish to make a plano-convex achromatic objective: what should be the radii of curvature for the surfaces of the disks in order to have a focus of 10 inches? A. If the flint is of medium density, the curves of the crown may be 3·4 inches radius. The flint glass should be double concave, one side to fit the crown, the other side of 25 inches radius. If the flint is very dense, the curves may be of 3·5 inches radius for each side of the crown, and 26 inches for the long side of the flint. 2 What would be the negative and positive foci of the disks? A. The focus of the crown will be the radius, that of the flint $\frac{1}{5}$ its radius.

(31) C. M. B. says: I have a soapstone griddle which, by accident, was thoroughly greased. How can I extract the grease? A. Wash it carefully with hot potash lye, and rinse with clean cold water until all trace of the alkali has been removed.

(32) R. F. S. asks: 1. What are the diameter, focus, and shape (plano convex or double convex) of the eye lens for a good microscope, and is it achromatic? A. The lenses of the eyepiece of a microscope are both plano-convex, made of single pieces of glass. The field lens is usually larger and of longer focus than the eye lens. 2. What is the diameter, focus, and shape of the field lens, and is it achromatic, and what is the proper distance between the eye lens and field lens? A. For medium powers, the field lens may be of 2 inches focus and the eye lens of 1 inch focus, set 1½ inches apart, with the convex sides toward the object. As they correct each other, the combination is achromatic. 3. What is the proper shape of an achromatic objective, plano-convex or double convex? A. The best objectives for high powers are made of three separate leoses, each lens of two kinds of glass. The best form for a single lens of one piece of glass is a double convex, whose radii are as one to six.

(33) I. J. asks: How shall I clean the lenses of optical instruments? A. Breathe on the glass, and wipe with chamois skin or the nap side of cotton flannel. Paper of any kind would be very likely to scratch the glass. This also answers A. F. O.

(34) H. S. asks: What is the magnifying power of the home-made compound microscope, described in your issue of October 30, 1875? A. If the tube or body of the home-made compound microscope be 12 inches in length, the magnifying power would be about 100 diameters. The same eyepiece, with an objective of ½ inch focus, would give a power of about 200 diameters; then by lengthening the body, the power may be easily increased to 300 or more. A common and convenient way of determining the power of a microscope is to focus an object of known size, and place a rule on the stage outside, then look with one eye at the object in the microscope and with the other at the rule. It will readily be seen how large the object appears to be on the rule, and this gives the approximate magnifying power

(55) H. M. says: I am getting up a small engine and boiler to drive a yacht. If my boiler will furnish steam to fill a 3x3 cylinder, and I put in 6 cylinders each 3x3, cut off each at $\frac{1}{8}$ stroke, and use the steam expansively the rest of the way, could you recommend such a course? A. We cannot recommend the plan.

(36) R. J. F. asks: Is it possible to improve an object glass of a telescope by change of figure, if the fringes around objects are equally colored with green and purple? Would the thickness of the glasses make much difference? A. Telescopes are usually made of a double convex crown and a concave flint. In small objectives, of less than 3 inches diameter, the flint is usually double concave, and in large glasses, concavo-convex. The following curves for a 6¼ inch objective, of 8 feet focus, answer very well: Outside curve of crown 50 inches radius, contact curves $29\frac{4}{10}$ inches, and the back convex side of flint 140 inches. This combination forms an achromatic lens, which will get rid of your trouble.

(37) R. M. asks: How must the lenses be set, and of what size and focus must they be for the home-made microscope, recently described by you? I want it to magnify from 1,000 to 1,500 times. A. The lenses must be set as described in the article. The focal length of the objective should be about ⅛ of an inch, and of the field lens of the eyepiece 1½ inches, and the eye lens ½ inch. Then, by lengthening or shortening the body, a power of 1,000 or 1,500 may be obtained.

(38) J. B. says: I am building a machine showing the earth turning on its axis at an inclination of 23½°, the moon revolving around the earth, and all around the sun. Is there such an apparatus in existence? A. There are very perfect instruments for showing the movements of the solar system. They are called planetaria. 2. Would it be best to make it vertical or horizontal? A. For the sake of convenience they are made vertical. They cannot be made correct, but only approximately so. 3. Do the planets return to the same places in a year? Will they be seen next year in the same place on the same day at the same time? A. The planets never return to the same place on the same day of the year.

(39) W. H. D. L. says: If milk is not properly cooled, or is confined in a tight can before the animal heat has passed off, it soon becomes tainted. Would bacteria or some similar organisms be present in such a case? A. Yes. 2. What must be the magnifying power of a microscope to reveal such organisms? A. A power of 200 diameters shows the animalculæ in stagnant water; and no doubt it would be all you would require. A less power, even, might answer your purpose.

(40) S. D. T.—You could not see anything in a mirror attached to a kite, because of the constant movement of the mirror and the highly magnified condition of the light coming from the mirror to the observer.

(41) E. R. asks: Does any one manufacture cast steel that can be tempered? A. All cast steel can be tempered.

(42) T. C. asks: It is asserted that water, in running out of a basin through a hole in the bottom, takes a rotary motion, and, when unmolested, the circular motion is always one way, namely, the same as the hands of a watch laid on its back. Is this true? A. We think not.

(43) F. R. B. asks: Can I arrange a small compound microscope so as to throw an enlarged image on a screen, as a stereopticon does? A. You cannot do it, on account of the high magnifying power, small field, and want of sufficient illumination.

(44) C. T. P. says: Please inform me which is the proper way to run a belt, with the grain or the flesh side next to the pulley. A. The grain side.

(45) W. H. P. says: I am running a 50 horse power tubular boiler, but have not got draft enough at times. The main flue is of iron, 2 feet in diameter, and passes up through the roof of the building about 4 feet, and then on a level (17 feet) to the chimney. Will a jet of steam help the draft? If so, how large should it be, and where should it enter the flue? A. A jet of steam in the iron flue will help your draft without damaging the chimney. The size of your jet must be determined by experiment.

(46) T. W. C. says: I have a boat, 50 feet long by 18 feet beam by 3½ feet depth. What should be the dimensions of engine, boiler, and feep pump respectively? She is to have a stern wheel, and her engine is to work at high pressure. A. You might use two engines, with cylinders 7 by 12 inches, and a vertical boiler 5 feet in diameter and 8 feet high. Feed pump should be 2½ inches in diameter and of 12 inches stroke.

(47) J. M. says: Please give us the best composition of brass to be polished, so as to give it the nearest resemblance of gold. A. Mix 10 parts copper and 1 part tin. Add 2 lbs. spelter to every 100 lbs. of the brass.

(48) S. M. C. says: Bloxam's "Chemistry" p. 203, Philadelphia edition, says: In the reduction of iron ore, a large sized blast furnace consumes daily 50 tuns of ore, 30 tuns of coal, 6 tuns of limestone, and 100 tuns of air. Is not the amount of air exaggerated? The working of a blast furnace is familiar to me; and considering the size of the blowers and number of strokes per minute, I cannot conceive of this amount of air passing through the tweers in the time given. A. The statement is correct. It falls under, rather than over, the truth.

(49) S. H says: In regard to your article on "Flat Surfaces" (October 23, 1875) I would like to ask how the constants used in the formulæ are obtained? You say the factor of safety used is 8, but that seems to me to be indefinite unless we know what modulus of strength is used, and how it comes in. If you could give the formulæ in such a way as to bring in the ultimate tenacity or some other modulus easily determined for different qualities of metal, you would, it seems to me, make them much more useful to engineers. Perhaps you will inform us what different quantities are included in the constants of the given formulæ, that is to say, what modulus of strength, etc. A. The constants are those for tensile strength. It is assumed in the article that the ultimate strength is as follows: Cast iron, 20,000 lbs. per square inch. Wrought iron, 48,000 lbs. per square inch. Steel, 80,000 lbs. per square inch.

(50) A. J. M. says: I have an electromagnet of 1 inch iron, 1 foot long, having 100 feet of No. 16 copper wire on it. What amount of horse power will I require to make an electro-magnetic machine to cause that magnet to lift 100 lbs.? A. An eighth of a horse power would be ample.

(51) S. W. says: Salt of steel is the *sal martis* of the old chemists. It is common copperas, or green vitriol, or sulphate of iron.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. G. S.—It consists of manganese, with iron, alumina, and silex.—J. M.—It is made of burnt sugar and chicory.—W. A. W.—The paper was covered mostly with a pigment having clay and lime for its basis, and no poisonous matters were detected in the small scrap forwarded.—O. P.—It is bituminous shale rock.—J. E. B.—It is sulphuret of iron.—W. L. W.—It is iron pyrites, and is worth working if the quantity is very large and the cost of mining small.—C. P. C.—It is carbonate of magnesia.—J. M. R.—It is yellow hydrated sesquioxide of iron on micaschist.—E. S. B.—It is galena, with a trace of silver.—A. M. C.—It is gold.—H. J. R.—If the specimen referred to was inclosed in a box (unlabeled) marked "Fine Steel Cutlery," it is iron pyrites.—C. F. H.—No. 1 is pyrites (no gold detected). No. 2 is an inferior kaolin. Use Dana's "Mineralogy."—J. F. F.—They are fragments of quartz and amethyst, with magnetic iron sand.—P. J. M.—We were unable to detect any foreign substance with the gelatin.—W. D. C.—It is calc-spar and hornblende.—A. J. H.—Both are oxide of iron.—J. H. P.—Nos. 1 and 2 are quartz rock with small scales of mica. No. 3 is bituminous slate.—E. P. McL.—No. 1 is iron filings. No. 2 is red jasper.

A. C. S. asks: Can you give me a recipe for removing black smoke marks off a brick wall? We do not want to paint the wall.—W. A. K. asks: Can any one inform me of a good way of heating street railway cars.

On page No. 396 of this paper will be found an advertisement of a new recipe book, just published, which will be found a useful companion for reference by every one.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a New Method of Ventilation. By L. B. G.
On Instinct. By C. T.
On the Formation of Planets. By H. L.
On Bankers' Safes. By S. M. L.
On the Wagner Free Institute. By W. H. W., and R. G.
On Explosive Oils. By J. R. C.
On Spectral Lines and Atomic Weights. By A. H. McK.

Also inquiries and answers from the following:

A. K.—J. R. T.—J. B. O.—S. W.—N. F. F.—R. M.—J. G.—D. A.—J. G.—G. N. T.—F. G. S.—J. D. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes rubber tires for traction engines? Who sells machines for bending cold iron bars? Who sells carrier pigeons? Who makes screw-cutting dies, made to the Whitworth thread? Whose is the best engine governor?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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