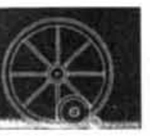
C. S. asks: Will you please send me the name of any work treating in detail on the construction of balloons? I wish to know of what quality of silk, the kind of varnish, formula for cutting the segments, etc. If it is feasible, I intend to construct a balloon capable of carrying 30lbs. of apparatus, and make continual record of atmospheric phenomena, with the rise of a captive balloon at an elevation of 3,000 feet. Answer: General instruction in regard to form and mater al, cutting, varnishing the silk, with formula for weight in relation to bulk, etc., will be found in the article Aerostation in Good and Gregory's "Pantalogia," also, but not so full, in Vol. I. Partington's "Philosophy"; also in article Aerostation in Encyclopedia Londonensis; the last, perhaps, is the best. See also Simpkin's "Aerial Navigation," London, 1845; Wise's "Aeronautics," an American publication, and Glaisher's "Up in a Balloon." All of these books are probably in the State Library at Albany. Experiments with captive balloons sustaining self recording meteorological instruments would be full of interest. We fear, however, that the first heavy gale would sweep them away.

W. G. C. asks: Would it take more power to prevent water escaping by a ¼ inch hole at the bottom of a pipe, 6 inches in diameter and 100 feet high, filled with water, than it would require to prevent water escaping by a ¼ inch hole at the bottom of a pipe, ¼ of an inch in diameter and 100 feet high, similarly filled? Or, again, would it require a different power to prevent water from escaping from a ¼ hole at the bottom of a pipe 100 feet high, and tapering in its diameter from 4 inches at the top to ¼ of an inch at the bottom, the pipe being full of water? Answer: The required force would be the same in each case, as the pressure of a liquid at an orifice is proportional to the head of water above it, and bears no relation to the size or form of the containing vessel.

M. R. asks: 1. Will a horse pull a heavy load up hill easier on low or on high wheels, and why? 2. Weight of vehicle being the same, which pulls easier, a load divided over 4 wheels or over 2 wheels, and why? Answer: 1. Within ordinary limits, a horse should pull the heavier loads with high wheels, because in running over an obstacle, as at A, the larger wheel distributes the forward effort to better advantage, in "prizing" itself and load over it, than does the smaller wheel. Should the horse be attached directly to very large wheels, by short traces or chains, there



A

would be a tendency to raise him from his feet, and thus to prevent the effective application of his strength, which might, in extreme cases, more than compensate for the anticipated gain. 2. On soft ground, 2 wheels would cut in more than 4, the same load being carried, and thus would require more effort. On hard roads, we should expect 2 wheels to do best, as the weight of 2 wheels and their friction would be avoided.

H. B. J. sends a mineral. "I took it from a lump of quartz which was full of small seams and pieces. The specimen was originally larger than an egg. Is it copper?" Answer: It is a valuable copper ore, containing about sixty per cent of copper, the rest being sulphur and iron.

E. C. D. sends us a stone, and asks what it s and if it is an indication of coal in the vicinity. Answer: The specimen is carbonaceous shale, but it does not promise the existence of coal in the neighborhood, neither does it decide against it. A fragment of rock gives no evidence one way or the other, as the same rock is found both above and below the coal measures. The geological sequence of the strata must be observed.

I. P. H. sends us a mineral specimen found in hematite. He asks what it is, and if it will affect the iron in the blast furnace. Answer: It is an infusible argillaceous rock, and will simply increase quantity of slag.

C. G. C. encloses two samples of minerals and wishes to know what they are called in geology and of what they are composed. Answer: Both specimens are feldspathic products, the soft, pliable one being kaolin, much used in porcelain manufacture.

H. D. asks: 1. What is caustic ammonia and how is it prepared? What is the expense of it? 2. What is the cheapest way to manufacture hydrogen gas for balloon purposes? Answer: Caustic ammonia is the aqua ammonia of the druggist, and costs from ten to twenty cents a pound according to purity and concentration. It is manufactured by heating quick lime and sal ammoniac together and absorbing the gas in water as it comes off. The cheapest hydrogen upon the whole is made by acting upon scrap iron or zinc by dilute sulphuric acid. We advise our correspondent to read up on both these questions in almost any elementary treatise on chemistry.

T. H. P. says: Last spring we put up a small 7 x 12 engine, the boiler being an upright one, 6 feet high and containing 37 flues. We fed with cold water until winter, when the freezing of the pipes caused us to adopt another plan. We then placed our feed barrel below the level of the engine bed, and run the exhaust into the barrel to heat the water. This works very well so far as heating the water is concerned, but it has the disadvantage of collecting the tallow used for lubricating the cylinder; and after passing through the pump, it is forced into the boiler. We use neither filter nor mud drum. What would be the best way of cleaning this grease out of the boiler? How would it answer to use lye and convert it into soap, and then blow it off? If this would answer, how much ought to be used? What would be the best method of cleaning the feed pipes, which are coated inwardly with greasy matter? We want to use the boiler for about 6 weeks more, only. Answer: Try using crude mineral oil for lubrication, as recommended recently by one of our correspondents in this column. If that does not answer, we should use a worm heater. We should suppose that economizing in the use of tallow might give good results in more ways than one.

J. T. B. asks: 1. What is the proper rule for determining the sectional area for the rim of a fly wheel suitable for any power of engine? 2. What is the rule for determining the sectional area of a lever crank of any length, suitable for any given power or pressure on piston? 3. What is the rule for sectional area of an engine bed suitable for any pressure on piston, and any length of crank? Answers: 1. Answered in article on fly wheels, on page 177 of this issue of the SCIENTIFIC AMERICAN. 2. Multiply the pressure on the crank pin by the distance from the center of pin to point at which the thickness is required and by 17; divide the product by 100,000 times the square of the depth in a line perpendicular to both the lines of the shaft and of the crank. The result is the probable thickness of web with which a crank will just break. To be safe, take a pressure on the crank pin at least six times as great as the anticipated pressure. 3. Multiply the area of piston by the steam essure and divide by 3,000. The quotient will be the ast allowable sectional cross area of the bed.

C. S. C. sends a mineral specimen and would like to know its value and what it may be used for. Answer: It could be used in making brick and coarse pottery.

E. P. C. encloses four mineral specimens for examination. Answer: No. 1 is indurated clay. No. 2 is the same, but purely argillaceous. No. 3 is compact limestone. No 4 is siliceous limestone, containing minute crystals of pyrites. You have been bor ng through the Trenton or Lower Silurian limestone and entered the calciferous formation. You must be very near the granite or underlying rocks. If you do not strike water the moment you reach these, you should give it up. We presume the strata in your region dip southeast; but not knowing their precise disposition at Wequiock, it would be idle to prophecy at this distance. Keep on till you touch granite.

E. B. asks: 1. If the spectrum of iron shows 65 lines, does this indicate that iron consists of sixty five terrestrial elements? 2. Can it be ascertained what particular line the color substance of flowers and leaves will throw in a spectrum, by burning leaves, etc., in a fresh state? Answer: 1. It is generally supposed that the number of lines and their position in the spectrum is characteristic for each metal. All of the iron lines belong to iron, the potassium lines to potassium, etc. The number and location vary for each metal. There are only 65 terrestrial elements, all told, and iron is one of them. 2. The absorption bands produced by the colcring matter of plants have been studied and described by different authors. When the leaves are burnt, the coloring matter is destroyed, and the lines on the spectrum are there produced by the mineral constituents of the ashes.

H. N., Jr., asks: What will remove red ink from writing paper? Answer: The red ink is readily removed by hydrochlorite of soda, which can be purchased under the name of "Javelle water." Chlorine water and a solution of bleaching powder will also destroy the color.

J. H. S. asks: Where can I find a reliable mechanic's companion? Answer: See our advertising columns.

H. A. W. says: In this county, Edgecombe, N. C., there are many locations in which accurate surveying cannot be done in the ordinary way with a compass, on account of the great variation of the needle, due to local causes. These difficulties are most generally met with in the neighborhood of marl beds; and a variation of one half degree in stations but a few yards apart is not unusual in attempting to run lines in close proximity to one of these beds. With only one exception, I have always found marl in locations where the needle was seriously affected. This is a flat sandy country, and no iron ore was ever found in it, to my knowledge. The true explanation of this variation of the needle is of practical importance to the people of this section. Marl is of great value as a fertilizer for our lands; and if the fact could be established that the mineral deposits, causing this variation of the needle are found in all marl beds in this section, and only there, then much trouble and expense incurred in looking for marl deposits might be saved by the use of proper instruments. Answer: The deviations of the needle, are some times due to magnetic currents in the earth, but more generally to deposits of iron. Any marl that acts on the needle in the manner described must contain considerable iron, or there may be beds of iron beneath it. It is not probable that a "diviner's rod" or any kind of instrument can be devised for pointing out marl; but in mineral explorations for iron the magnetic needle has been successfully employed by Major T. B. Brooks, of Michigan. This explorer, who has had great exper ence in the use of the compass, thinks that the thickness of rock or earth which covers the iron deposit may be determined by using a dip compass and solving the triangle thus observed. While the deviations of the ordinary needle compass are so great as to interfere with the accurate running of lines, the solar compass, invented by Colonel Burt and used in all the western surveys, can be employed.

W. M. K. says: It is a well known fact that musical notes are produced by the regular vibrations of the air, so many vibrations in a given time producing a given note; and the higher the number of vibrations in a given time, the higher will be the note produced. These notes of different degrees of hight and duration, combined and arranged in certain ways, compose music; and these vibrations acting on the nervous system through the organs of hearing are capable of producing various emotions. As these effects are produced by vibrations acting on the nervous system, would not the same results be obtained by electric shocks acting on the nervous system and corresponding in number and arrangement to the vibrations of the air? Has the subject been experimented on, and with what results? Answer: In the mechanism of the ears, there are a great number of nerve filaments which traverse the organ and are known under the name of Schultze's bristles. These slender threads catch waves which come to them with the rapidity of rifle bullets and render the vibrations fit for reception by the brain. There are 3,000 bristles, each one of which has its own pitch and is thrown into vibration when the proper note reaches it. It does not follow that electricity could be interpreted by the same apparatus, unless sound was produced. Electric shocks are one thing, sound waves are quite another, and there is probably no analogy between them.

C. E. says: Will some surveyor, civil engineer, or astronomer please inform me through your columns the difference (by actual observation) between true north and magnetic north, for this year, in the city of New York? The variation changes from year to year, and day to day, and our correspondent can determine it for himself with a theodolite according to instructions given in books on surveying.

W. C. A. says: When it is stated that a book is 8vo., how am I to know length and breadth in inches, thus impressing upon my mind the size of the book? Answer: Usual 8vo size is 9½x6 inches or a little less. Royal 8vo. is about 11x7, but it may be a little smaller or a little larger.

G. B. L. asks: 1. Are inserted teeth, for circular saws for sawing logs into lumber, better than solid teeth? 2. Can the number of teeth in the saw be diminished, say to one fourth or one sixth of the number generally used, with good results? 3. When the lower half of a cylindrical boiler only is exposed to fire and the lower water gage is half the radius above the line of fire surface, is there danger of explosion should the waterfall below the lower gage, unless it falls below the line of exposure to fire? In other words, can water be converted into an explosive gas, under the circumstances described, the heat being transmitted to the water line through two or three courses of brick? Answers: 1. Inserted teeth are largely used and, properly constructed, are found advantageous in ordinary work. 2. We are hoping to obtain the results of experiment on this point, and are as yet unprepared to give a satisfactory answer. 3. No.

D. M. C. says, in reply to H., whose horses are troubled with corns: I am a horse shoer and have had some experience with corns in horses' feet, and think the cause is the shoe bear ng too hard on the heel. I treat them with the best success by taking a farrier's knife, and cutting them out, as deep as possible, without cutting to the quick; then, holding the foot upside down, I put in a few drops of turpentine, holding it a few minutes to soak in. Then I take oakum soaked in tar and fill the hole, to keep out dirt and gravel. Fit the shoe with a stiff heel, so that it will not bear on the heel of the foot. Corns seldom trouble after being treated in this manner, and soon disappear entirely.

H. S. T. replies to A. H. S., who enquires for a rat and mouse proof filling for his walls: I have seen dry saw dust used with every success; the vermin soon get disgusted in trying to get through it. It is also the best thing that can be used to guard against cold.

A. W. T. says, in reply to H. J. H: To give metal articles a lustrous black coating. The inside bottom of a cylindrical iron pot, about 18 inches high, is covered half an inch thick with powdered bituminous coal. A grate is then put in and the pot filled with the article to be varnished. The lid is then put on and the pot heated over a coke fire. When the bottom of the pot has been heated for fifteen minutes, the coal has been mostly converted into coke. The pot is then removed from the fire, and, after standing ten minutes, it is opened for evaporation and the articles will be found coated as desired. This coating will stand considerable heat, and disappear at beginning of redness. It is adapted for iron, steel, tinned iron, brass, zinc and pottery. Smaller articles like hooks and eyes may be coated by heating them, in a sheet iron drum like a coffee roaster, with small pieces of coal until they present the desired appearance.

W. G. W. says that S. W. P., who enquires on page 154 about learning phonography, should go to the fountain head for the surest instruction. The inventors' own pure and simple system is the easiest to learn, the most reliable in reporting, and is unmistakably legible in every word. His name is Isaac Pitman, Paternoster Row, London, and his books can be obtained through any bookseller. "The system is taught in my neighborhood very successfully, and is being introduced into the junior schools as an eminently useful educational auxiliary."

B. G. replies to J. S. L., who wants to know how to have good water in his well: I have the best pump water in the neighborhood; my plan was the following: Empty the well, suspend (by a string) a coarse canvas bag, with three or four good sized lime stones and one or two lumps of charcoal in it. Have the string long enough to nearly reach the bottom of the well. In a week or two, take out the charcoal, throw back the lime stones into the well with five pounds of soft coal. Put a round or square wooden shoot up at the back of the pump; carry the shoot up higher than the pump for free ventilation. If the pump is out of doors, put a "tee" on top; if under cover, a fine wire gauze will do. J. S. L. can cover up his well, and I think he will have no more trouble in getting a drink of good water at home.

W. T. B. says, in answer to D. H. S., Jr., who asked how to remove the taste of smut from wheat: To remove taste and smell from smutty wheat, dry your wheat thoroughly, so that the dust of the boll, when broken, will not adhere to the grain. Then run it through your smutter, and back your bins, and, if the air does not purify it in a few days, sprinkle on as much water as you need to toughen the hull of the wheat before grinding, adding one part bromo-choralum to twelve parts of the water.

W. T. B. says, in answer to O. K., who asked if a burrstone could be driven with a quarter twist belt direct from shaft to spindle: I have used the quarter twist belt direct from shaft, for running millstones, successfully. But for 4½ feet stones, I used a twelve inch belt, which I think small enough for the capacity of that sized stone, namely, 25 bushels wheat or 50 bushels corn per hour. The distance between shaft and spindle was twenty feet.

J. M. says that D. can color his extract of lemon with tincture of curcuma. The tincture can be made by putting 1 ounce pulverized curcuma in one pint alcohol; mix, and it is ready for use, but it becomes stronger by standing. Half an ounce of the tincture is sufficient to color one quart of the extract of lemon.

P. A. B. says, in answer to F. C: Heat your screw driver to a cherry red heat, to two inches from the end. Dip in cold water one inch, then rub the point on a piece of brick or anything that will make it bright. When the color at the point comes to a light blue, dip in water.

N. J. F. says, in reply to P., who asked how to make Grecian paintings: Mix equal parts balsam of fir and common turpentine (both should be colorless); shake well and put away in a warm place for a day or two, shaking occasionally. Select a photographic portrait with clear lines and soft shadows, put it into water for a few hours, when the photographic print, if mounted, can be removed from the card. Wipe the paste off carefully and wash well. Then to each side and to the top and bottom, paste strips of paper; the edges should lap very little. After the paste has dried and the strips adhere firmly to the photograph, place the latter in the center of a frame or stretcher, to which paste the other ends of the strips of paper. This suspends the photograph in the center of the stretcher. Then with a large soft brush dipped in spirits of turpentine, moisten the back of the photograph and immediately pour on the varnish above described; rub it with the finger over the entire surface of the back and continue to do so till the picture is seen as distinctly on one side as on the other. Then put away to dry where no dust can mark it. When perfectly dry, prepare a pallet of oil colors mixed with poppy seed oil (to prevent drying too rapidly). Then on the back, lay the hair color smoothly over the hair, the flesh color smoothly over the entire face, excepting the eyes and lips; over the eyes put pure white, over the lips the proper shade of red. Paint the drapery according to fancy, allowing for the colors to sink in drying. When perfectly dry, if cracked, go over again with the same colors and shades; if not cracked, paste (with common flour paste) smoothly to a piece of card board; press till dry, then sponge the face, and, with a little clarified linseed oil on the tip of the finger, go over the picture. Prepare a pallet of colors for the finishing touches. Deepen the shadows, raise the high lights, put a natural flush on the cheeks, paint the pupils of the eyes the proper color, put in the light with pure white, deepen the shadows and raise the lights of the hair. Give a few spirited touches about the lips and mouth, touch up the drapery, and you have "a thing of beauty" which will be a "joy forever." I neglected to mention that the background should be painted on the back of the picture and the whole surface of the back covered with color before it is pasted to the card board.

A. S. says, in answer to S.'s question of making sulphate of nickel: Dissolve metallic nickel in a glass flask nearly filled with a mixture of 8 parts of water and 1 part of sulphuric acid; set the flask in a sand bath apply moderate heat until a more or less dark green solution has been obtained, which, after settling and clearing, should be decanted off in a porcelain evaporating dish. Set the dish into a sand bath, apply moderate heat and evaporate slowly until a thin skin is formed on the surface of the fluid, then remove the dish from the sand-bath and let it rest undisturbed in a cool place for 24 to 48 hours, during which time crystals of sulphate of nickel will be formed on the sides and bottom of the dish; pour off the mother lye from the crystals, and put the latter in a glass or porcelain funnel provided with a paper filter through which the last portions of the mother lye may pass and the crystals dry. Preserve the crystals in a well closed glass or stone ware vessel. Sulphate of nickel by itself, without being combined with other salts, will not make a good plating solution. Another mode of preparing sulphate of nickel is by dissolving metallic nickel in diluted sulphuric acid by the action of a galvanic battery.

J. D. H. says: It seems clear to me that the answer to "J. L. B.'s" question, why a glass jar on a wet cloth may be filled with hot liquids without breaking, is simply this: The water in the cloth retards the heating of the bottom of the jar and thus obviates that sudden unequal expansion of the parts of the jar which would otherwise take place. Would not setting the jar in a vessel containing a little water answer the same purpose?

COMMUNICATIONS RECEIVED.

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

On Our Present Knowledge of the Sun. By G. W. T.

On a Method of Supplying New York City with Salt Water. By J. P.

On the Transplanting of Trees. By A. K. S.

On Distinguishing Fibers in Mixed Goods. By C. S.

On the Government Works at Hell Gate. By M. G.

On the Collection and Reduction of Photographic Wastes, such as Silver and Gold. By C. L. L.

On Boiler Strains and Perpetual Motions. By J. C.

On the Laundry. By J. K. D.

On the Cause of the Gulf Stream and other Ocean Currents. By J. P. W.

On Positive and Negative Forces. By E. B.

On Phonography and Phonotypy. By E. B. S.

[OFFICIAL.]

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February 25, 1873,

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

24,199.—GAS REGULATOR.—E. H. Covel. May 14.
24,200.—HYDROCARBON APPARATUS.—E. H. Covel. May 14.
24,227.—CULTIVATOR.—R. M. Melton. May 14.
24,531.—GAS RETORT.—W. Beaument. June 11.
24,588.—HAY MAKING MACHINE.—J. C. Stoddard. June 11.
24,661.—RAILROAD FROG.—G. P. Sanborn, W. Mansfield. June 18.
25,014.—CUTTING WOODEN WARE.—G. R. Hay. July 23.
25,199.—FEEDING PAPER.—R. M. Hoe. August 6.

EXTENSIONS GRANTED.

23,060.—ELECTRO-MAGNETIC FIRE ALARM.—M. G. Farmer.
23,097.—CHAMFERING BARRELS.—H. Littlejohn.

DESIGNS PATENTED.

6,456.—OTTOMAN.—C. J. Conradt, Baltimore, Md.
6,457.—OTTOMAN.—J. D. Ladd, New York city.
6,458.—CHAIR FRAME.—E. Seymour, C. E. Shattuck, Clinton, Iowa.
6,459.—FONT.—A. E. Van Wert, Binghamton, N. Y.

TRADE MARKS REGISTERED.

1,142.—EYE SALVE.—W. T. Blow, St. Louis, Mo.
1,143.—PEARL WHEAT.—J. B. Clow, Allegheny City, Pa.
1,144.—HARNESS COMPOUND.—S. E. Cox & Co., N. Y. city.
1,145.—PICKLES AND SAUCES.—Crane & Co., N. Y. city.
1,146.—CUTLERY.—N. Joseph, San Francisco, Cal.
1,147.—SALVE.—G. Long, Keytesville, Mo.
1,148.—BAKING POWDER.—Moody Bros., Indianapolis, Ind.
1,149.—PLOWS.—E. Remington & Sons, Ilion, N. Y.
1,150.—GIN.—W. P. Sanger, New York city.
1,151.—PILE REMEDY.—M. H. Stoner, Skaneateles, N. Y.
1,152.—PRINTED PUBLICATIONS.—D. Williams, N. Y. city.

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