ual, with its very numerous and elegant illustrations-tables and general data, is about the most important addition to the literature of the subject since Bunsen's work was published. The earlier book marked the creation of an exceedingly accurate standard analysis that has never been displaced and has hardly been improved in the many years since it was published. The present book describes the far quicker and almost as accurate methods first introduced by Dr. Hempel. The work in every way is a worthy presentation to the English-speaking gas engineers and chemists of Hempel's classic researches.

DIE PRAXIS DER MOMENT-PHOTOGRAPHIE AUF DEM GEBIETE KUNSTLERISCHER UND WISSENSCHAFTLICHER THAETIGKEIT. By L. David and Charles Scolik. 12 plates. 449 illustrations. Pp. 459, text. Wilhelm Knapp, publisher, Halle a. d. Saale, Germany. 1892.

This publication, printed in German, treats in a very comprehensive manner on the practical workings of instantaneous photography and the results obtained thereby relative to artistic and scientific research. The volume is divided into sixteen chapters, which give a complete description of the present state of the art, and with the help of 16 plates—reproductions from original photographs—fully illustrate the results obtained by the best apparatus and methods in use. The various apparatus and the practical arrangements necessary for producing good work are amply illustrated and described in an excellent manner and testify to the authors' thorough knowledge of the subject under consideration. The chapters treat on the results obtained by instantaneous photography, cameras, objectives, shutters, methods for measuring exposures, means for obtaining correct exposures, finders, illumination of objects, production of negatives, methods for obtaining series pictures, the stroboscopes or instantaneous figures, instantaneous pictures of various kinds, including projectiles, sound waves, balloon photography, lighting, etc., detective cameras, stereoscopic apparatus, and selection of detective or hand cameras.

THIRTEENTH ANNUAL REPORT OF THE BUREAU OF STATISTICS OF LABOR AND INDUSTRIES OF NEW JERSEY. For the year ending October 1, 1890. Trenton, N. J.: The Trenton Electric Printing Company. 1891. Pp. xvi, 474.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(4013) W. E. W. asks about crystallized boron, its demand and price per gramme or ounce. If there is a concern that makes a specialty of manufacturing it, would it be enough in demand to take the place of the diamond in some of its uses in the arts? A. Boron hitherto has been only a chemical curiosity. If produced in quantity it might have value, but nothing could be safely predicated concerning its introduction. It is said that it is harder than the ruby, or nearly equal to the diamond.

(4014) B. P. B. asks: Please inform me if at any period of the year the sun setting in Alaska will be rising in Maine. Also if the south pole is as cold as the north pole, and if a compass be taken below the equator, will it still point north? A. From the 10th of June to the 2d of July the sun shines on the most northern parts of Alaska during the whole twenty-four hours of the day, and during this time shines on Alaska near the horizon when rising in Maine. We have no means of knowing the difference in temperature at the poles. The probability is that the south pole is the coldest. The needle points the same or has the same polarity north and south of the equator, but dips in opposite directions; the north end dips in north latitudes, and the south end in south latitudes.

(4015) B. A. C. writes: I have constructed a telegraph line about a mile in length, but I am unable to tell how many batteries to use. There are only three stations on the line. Will you kindly give me information? A. The rule is to make the resistance of the battery equal to the resistance of the line including that of instruments.

(4016) A. D. D. asks: 1. What is the cause of the detonation when a fuse burns out in the fuse box of an electric car? A. The fusion is so sudden as to amount practically to an explosion. The noise is produced by the impact of the air, as in the explosion of a fulminate or of powder. 2. If the mechanism of the throttle valve in a locomotive should in any way get out of order, how could the engine be stopped at once, if running at the rate of about 20 miles an hour? Could the air brakes stop it? A. The engine could be reversed, or the reversing lever could be put in a central position, thus preventing the valves from acting and excluding steam from the cylinders.

(4017) J. S. writes: I have been making a magnetic key similar to one described in "Experimental Science," Fig. 465, but cannot make it induce any noticeable current in a detector such as described on page 395. What points is it likely that I have overlooked? A. Possibly you expect too much from the key. Try it in connection with a magneto bell. If your magnets are strong, and if you have used a sufficient length of fine wire, the key should operate. 2. How and by what means can this key be made to give a shock? Should the circuit outside the key be of same resistance as the two bobbins, and should the terminals be connected to handles? A. Connect the terminals of your coils with handles formed of metal tubes. Moisten your hands when you take the shock.

(4018) W. Mc. P. asks: 1. What is the principle of the Babcock fire extinguisher? A. The large vessel is charged with water and sodium bicarbonate. Above it a corked bottle of sulphuric acid is supported. A short hose with stop cock and nozzle connects with the liquid. To use it a handle is turned, breaking the acid bottle. The acid falls into the solution and sets free enough carbon dioxide to generate high pressure in the vessel, which is tightly closed. On turning the stop cock a jet of water is expelled which is a little more efficacious than ordinary water on account of the sodium sulphate dissolved in it and the carbon dioxide carried with it. 2. Do chemists in general believe that there is but one element? A. It is hard to say. William Crookes, of England, is one of the prominent believers in the original element or "protyle."

(4019) E. R. E. asks: Can you explain the phenomenon of a wagon or carriage wheel turning backward when it passes over an icy or slippery place? I have witnessed it many times, and to-day, as a heavily loaded coal wagon passed along, one of the rear wheels, as it touched a slippery place, several times reversed about one-eighth of a circle. I can easily see how it might stop when the friction of the tire on the ice or soft clay was less than that of the hub on the axle, but why should it rotate backward? A. The only explanation we can make is to suggest that the wheel was not round or a perfect circle or that the axle was not central, when in very slippery places it would slip forward or back upon its shortest radius.

(4020) F. H. R. asks: What amount of electric current would be required for heating 100 feet of No. 30 German silver wire up to 212° Fah.? A. 0·43 ampere, requiring a difference of potential of 59 volts for its maintenance. These figures are necessarily only approximate.

(4021) J. S. H. asks for the method of finding the mantisse of logarithms. Most mathematical works on the subject of logarithms state the use of tables of logarithms, but not the construction. A. The original calculations of Briggs and his collaborators are still at the basis of our tables. The calculations are very laborious and cannot be explained within our limits. In the Encyclopædia Britannica, 9th edition, vol. 14, page 777, you will find the explanation desired.

(4022) C. H. M. asks: 1. Has there ever been any theory advanced in respect to the significance of Bode's law for planetary distances? A. Bode's law is only an approximate relation, and breaks down in the case of Neptune. It is regarded as a mere coincidence, there being no reasonable explanation of its numerical relation to the distances of the planets. 2. What is the explanation of the fact that whirlwinds are in their direction of gyration contrary to watch hands in the northern hemisphere and in direction of watch hands in the southern hemisphere? Is it attributable to magnetic influences? A. The equator is the central line dividing the relative directions of the winds and whirlwinds in the northern and southern hemispheres. The motion of the earth is the cause of the general circulation of the winds. Hence the northern and southern influence will be alike, as illustrated in the trade winds, which blow westerly and toward the equator in both hemispheres. The same conditions that produce the whirling storms are alike both north and south of the equator. Hence they must rotate in reverse order. 3. Suppose the earth to be of homogeneous material and of its present dimensions and density, where then would be its densest portion? Would it be on a spherical plane taken at one-fourth its diameter? Its density would be *nil* at its center; then its densest portion would fall somewhere between its center and its circumference. A. The densest part of the earth would be at the center, from the pressure of the surrounding mass under the influence of gravity, but the force of gravity would disappear at the center. 4. Is it not true that if there were mechanical motion enough in the universe, gravity would be annihilated? As centrifugal force overcomes gravity, then gravity must be the result of insufficient centrifugal motion. If there were sufficient force—motion—to atomize and distribute all the matter of the universe equally in space, gravity would be extinguished, would it not? A. Gravity is a constituent of all matter and cannot be annihilated. It is the force of gravity that has brought the universe out of chaos.

(4023) W. E. S. asks: 1. What is the difference between the electricity used for illuminating purposes and static electricity generated by friction and collected in a Leyden jar? A. Static or, more properly, frictional electricity has a very high E. M. F. with very small amperage. Whereas electricity generated by dynamos and batteries has E. M. F. varying from a few volts to several thousand, but always with more amperage than electricity produced by friction. 2. Is it galvanic or static electricty used in executing criminals in the State of New York? A. Galvanic or current electricity.

(4024) W. P. B. asks: Can you please give the value in cubic feet and in gallons of the statute inch of water of Colorado and of California? Also same values for the miner's inch. A. We do not know of a "statute" inch of water. The name indicates that it is a State law. An inch of water as described in deeds of water privilege and approved under court practice in various States is the quantity that will flow through a 1 inch square hole in a given thickness of plank under a given head, 2 inches and 1½ inch being the usual thickness. The usual head is 4 feet, but various heads are specified. The miner's inch most used is a 1 inch square hole through a 2 inch plank, with its center 6½ inches below the surface, and is equal to a delivery of 1·57 cubic feet per minute, or 11·77 gallons. The head varies somewhat among different water companies in California, as 9 inches head, 7 inches head, 6½ inches head, all measured from the center of the opening.

(4025) J. C. F. A. asks: If the ordinary steam engine only produces in power about 30 to 35 per cent of the energy of the coal, how is the loss of 65 to 70 per cent divided between the boiler and engine? How much of the theoretical force of steam is lost in converting it into power through the ordinary high pressure engine? A. In ordinary boilers from 20 to 25 per cent of the fuel passes up the chimney. Of the balance, from 8 to 10 per cent is utilized in ordinary high pressure engines. In condensing and compound engines, 11 to 12% of the total heat units may be realized.

(4026) F. W. S. asks: What amount of pure gold is required to be added to raise 100 dwt. of 18 karat gold to 20 karat gold. Please give rule and example. A. Your 100 dwt. of 18 carat gold contains 75 dwt. fine gold and 25 dwt. alloy. To bring this up to 20 carat, you must add enough fine gold to make the proportion of one-fifth or five times the alloy, which is 125 to 25, or add 50 pennyweights to your 100 of 18 carat, or 50 per cent.

(4027) G. L. H. asks: 1. How many cells of the Fuller battery will be required to run the simple motor No. 641? A. It will require about 20 cells. This battery however is not very well adapted to the motor referred to, on account of the small zinc surface. 2. How long will batteries run steadily with one charging? A. Owing to the low resistance of the motor, the battery would probably run down in two or three days. 3. Could I make them in the form of the large plunge battery, using a number of wooden boxes painted with P. and B. battery compound? A. Yes. 4. What book will give me the different resistances of wires in copper, German silver, etc.? A. Sloane's "Arithmetic of Electricity," $1 by mail, contains this information. 5. Where can I find the arithmetic of dynamos and motors, that is, the relative resistances of the armature and field, also the winding of machines to conform to circuits of different E. M. F. and amperage? A. In the above named book and in Hering's "Dynamo-Electric Machinery," $2.50 by mail.

(4028) Inquirer writes: I am interested in Mr. Wightman's method of fixing the paste for the positive plates of storage batteries. Now, will he kindly write again and explain best method for the negative plates?

(4029) W. J. A. asks: What is the accepted theory as to the origin of the salt in the ocean? And is it increasing or diminishing? A. It is generally conceded that the saltness of the sea was at first partially derived from the combination and precipitation of the vapors of its constituents during the earliest of the geological ages, and that the disintegrated azoic rocks continued to furnish the chlorine and sodium in gradually lessening quantities, which during the present age is said to be scarcely perceptible by analysis.

(4030) M. A. L. says: Would be pleased to have you state the composition of the strongest known castings. The tensile strength of same. Also, supposing a tubular steel shaft 2½ inches diameter outside by ¼ inch thick by 2 feet long, resting in a suitable bearing, and a pulley 4 feet diameter attached to each end, one pulley made fast. What safe working load could be suspended on the circumference of the other pulley? What load would it take to break the shaft? The same in composition. The same with a solid shaft 1¾ inch diameter in steel and composition. A. Nickel steel is claimed to be the strongest metal. Tensile strength about 100,000 lb. per square inch. The steel hollow shaft will break with a load on the pulley from 900 to 1,000 lb., according to quality of steel. A solid steel shaft 1¾ inch, about 3,500 lb. The composition shaft, 2½ inches, ¼ inch thick, about 150 lb., variable according to composition and hardness.

(4031) Reader, Selma, Ala., asks why the drift wood keeps in the center of a rising stream, and why it goes to the banks when the stream begins to fall? A. The high and steep banks at Selma retard the stream at its edge and cause a whirl that sets the surface toward the center of the stream during high water. As the stream falls, the current becomes slower and more under the influence of the bottom, when the drift wood begins to spread toward the banks.

(4032) G. L. F. asks: 1. How much pressure per square inch will a boiler stand, of following dimensions: diam., 12 to 14 inches; thickness of shell, 1-8 to 3-16 inch; about 3 feet long, with locomotive type fire box? Boiler well riveted. A. It is a very slim basis upon which to judge of the pressure that your boiler will carry from the data that you give. The strength of the cylinder may be satisfactory, but the locomotive fire box is an unknown quantity in all its details, and this is the life of the boiler. If the fire box is as strong in proportion as the cylinder and properly stayed, it might be safe for 50 lb. working pressure. 2. In firing boilers with petroleum, which is best—a steam or hot air blast? A. You should have an air blast to start with; after steam is up, the steam blast is most convenient and proper. 3. Can the hand power dynamo illustrated in "Experimental Science" be made to run one 16 candle power electric light, by using power to run dynamo? If so, what wire should be used on armature, etc.? A. It will not. Two 6 candle power lamps connected in parallel can be run by it.

(4033) C. E. T. says: Can you tell me the reason why the pipe leading to a steam gauge of boilers has the coil of pipe? Is there any advantage in it, or is it there for looks, or some other less important reason? A. The coil is essential to preserve the interior of gauge spring from contact with the steam, which injures the gauge. The coil gathers water by condensing the steam and makes a seal between the air in the spring and the hot steam.

(4034) J. McD. says: When the hot water faucet at sink is opened, a great rattling noise is produced in boiler, which is of copper, 40 gals., and continues until faucet is shut off again, then producing a sudden sharp click in boiler; all is quiet until hot water faucet is used again, when the above is repeated; pipes to water back in range are all run correctly and are not trapped. Hot and cold water pipes run down from sink, then under kitchen floor, 20 feet horizontally, then vertically 40 feet to other fixtures, remaining separate all the way and not joining at top. Can you suggest a remedy? A. The noise is caused by the sudden vibration of steam in the water back, caused by the reduced pressure in the water when the faucet is opened. The steam rushes into the boiler through the circulating pipe, where it comes in contact with the cooler water, and suddenly condenses with a hammering noise. A larger cold water inlet pipe from the street, and an air chamber, will be a partial remedy; perhaps the street pipe is partially closed, which is often the case where galvanized pipe is used. This will cause the hammering.