inches. See any book upon leveling or geodetic surveying for the mathematics of this. The fact that the surface of still water is a convex surface shows that the surface of the earth is convex, since water covers about three-quarters of the earth's surface. It is said that an Englishman a few years ago wagered that no one could prove that the surface of the earth was convex, and put the money in the hands of the editor of a sporting paper. A surveyor took up the wager and set stakes of the same height in a lake a mile apart, and proved that the middle of three stakes was eight inches above the two on either side of it. The editor decided that this was proof and paid over the money. 2. If so, who made the survey, and when? A. Every survey which runs a level for any number of miles demonstrates the convexity of the earth's surface. The survey to establish the length of the meter in France about 1780 is such a survey. All the work of the United States Coast and Geodetic Survey is such work. The laying out of the great irrigation canals in the West and the surveying of public lands of the United States are also examples. The pendulum method is also complete as a demonstration of the shape of the earth. 3. Are there any demonstrable proofs of the earth's rotation upon its axis? A. The terrestrial proofs of the earth's rotation upon its axis are equally conclusive. The principal ones are the eastward deviation of bodies dropped from a great height, the Foucault experiment with a long pendulum, and the gyroscope. Besides these may be mentioned the deviation of projectiles to the height in the northern hemisphere, the trade winds, and the rotation of cyclones. All these are discussed at considerable length in the work of Young referred to above. If our correspondent is not convinced by these demonstrations he would hardly be convinced "though one rose from the dead." 4. Are there any demonstrable proofs that the earth moves around the sun? All the proofs given in Young's, Newcomb's, or Proctor's works are astronomical that must depend for their truth on something that is assumed, and as a proof founded on an assumption is no proof until the assumption is proven, I want a demonstrable proof that is not founded on an assumption, if there be such an one. A. From the nature of the case, there can be no terrestrial proofs of the earth's revolution around the sun. This is an astronomical fact. The aberration of light and the parallax of the stars are explicable only by the earth's revolution around the sun. These have satisfied astronomers for nearly a century and will still be deemed satisfactory. They may be "founded on an assumption," but an assumption is entirely legitimate, and proof for the assumption will establish its truth as certainly as proof of fact from which a law may be deduced, will establish that law.

(9184) S. R. says: Referring to your note No. 9036, A. W., June 6, and note No. 9086, A. M. W., July 11, regarding the coloration of glass as observed at high altitudes, and your request that some reader might throw some light on the subject, I have to say that at this place, which is an old mining camp, situated at an elevation above tide of 5,200 feet, it would be an impossibility anywhere in the neighborhood to find a piece of what was originally *white* glass that is not now of a violet tint, ranging according to length of exposure from a light amethystine tint to a very deep purple, excepting only such fragments as have recently been thrown out. In your answer to 9036 you say, "We should look for the cause of the discoloration" [it is rather a *coloration*. S. R.] "of the glass to some substance in the region rather than the altitude." In this you are no doubt correct. I have submitted some samples of the glass to a Washington scientist, with the suggestion that as radium has the property of coloring glass a purple or violet tint, there might be a pitchblende or uranium in this section. He thought, however, that the coloration was due to something used in the manufacture of the cheaper kinds of glass, such as a mineral of some kind. As the subject appears to have excited some interest, I take the liberty of sending you by mail a small box of fragments of glass, showing the various purple tints to which the glass has been colored by exposure. I might state further that there is but little soil, so little that there is only a very sparse grass to be seen after heavy rains, which quickly dies out. It is all rock, rock, rock, principally porphyry. There are found here gold, silver, copper, zinc, and I believe also bismuth, with some other minerals. Bismuth is, I believe, possessed of some properties similar to uranium. I do not know that I have thrown any light on the subject, but I hope others may, as it has excited much curiosity here.

(9185) A. C. J. says: In SUPPLEMENT No. 1440, of August 8, 1903, in the article "The Size of Atoms," at the end is mentioned Prof. Osborne Reynolds' Rede lecture on a new theory of gravity. Will you please tell where this lecture may be found published? A. The matter in question was quoted from the Engineer, London, to which we shall be obliged to refer our correspondent for information regarding Prof. Reynolds' Rede lecture, on a new theory of gravity.

(9186) P. E. J. asks: When the elements cæsium and rubidium are placed in water they decompose it with the liberation of H. which takes fire, but does Cs give the flame a blue color, or Rb a red? In nearly all books on chemistry I find that the element erbium has never been isolated. On looking through Merck's Index, 1896, a catalogue of nearly every chemical known, I find it thus: "Erbium (E) metal, dark gray powder." Also tell me if this element is not like didymium, which has been split into different elements? A. Cæsium was named from the blue lines which its flame gives in the spectrum, of which there are two. The word cæsium means sky blue. Rubidium in a similar way gives two dark red lines. The word rubidium means dark red. Both are from the Latin. With reference to erbium, Remsen's "College Chemistry" says: "A final statement cannot be made as yet. It is even questionable whether it is an element."

(9187) L. F. B., Jr., says: Would you kindly tell me where I can get data and formulas for small plunger pumps for circulating water in small quantities? What is the allowance of efficiency, and what is good practice for relation of stroke to bore? A. A good practice does not allow the speed of a plunger pump to exceed 100 feet per minute. For very small pumps the speed should be considerably less than this if smooth action is desired. The relation between the stroke and the bore of the pump is immaterial, provided the displacement of the plunger per stroke is kept constant. Ordinarily the stroke is determined by the requirements given above regarding the speed, or the diameter is determined by the pressure requirements. For a steam pump the diameter of the steam cylinder and the steam pressure control this. The efficiency of a small plunger pump is seldom over 50 per cent, and in case of a very small pump would be considerably under this figure. Without knowing the exact size and character of the pump, it is impossible for us to give you more exact information on this point.

(9188) H. H. says: Can you furnish me with formulas for both the solution and the wax used by electrotypers? A. Gutta percha, or impermeable plaster, or one of the following mixtures may be used for the purpose: White wax, 200 grammes; spermaceti, 30 grammes; stearine, 250 grammes; plumbic carbonate, 30 grammes.

(9189) B. W. R. says: I want to call your attention to a little matter here with wheels and irrigation canals. We have a canal 16 feet wide with a fall of two feet to the mile. We run 7,000 miner's inches of water therein, which makes it about four feet deep. We have undershot wheel in the ditch. Any one of these wheels, 16 feet long and 16 feet in diameter, is raising 25 inches, 250 gallons per minute, 25 feet high. In one place in the ditch we have four of these wheels working close together, that is, just barely working clear of each other. There is no difference between the speed and power of either of these four. The water in the ditch is not raised, that is, not booked up above the first wheel. Now, then, if we were to put 16-foot wheels all the way along the ditch, and each one of them were to do as well as either one of the four mentioned, and let them all raise water from a side ditch so as not to diminish the quantity of water in the power ditch, we should have power enough to raise many times the water in this ditch. I know something about what theory claims will be done with these wheels, and yet we all know what they are really doing. How am I to account for the discrepancy? Figure this out before laying it aside. We could put 300 of these wheels in the mile ditch. They would raise 7500 gallons of water 25 feet high, which would be 90,000 gallons 2 feet high (or the fall of the ditch in the mile). This would be accomplished in one minute, while it would take fifteen minutes for the same quantity of water to pass through the ditch. In other words, the ditch at the side which carries the water to be raised would have to be many times larger than the power canal. I am telling you what is actually taking place here every day in the irrigation season and is not attracting much attention. No matter what our books may say about power generated by water in streams, there is a matter here worthy of discussion and observation. A. The explanation of the apparent paradox which you give in your recent inquiry is very simple; you have undershot wheels 16 feet long and 16 feet in diameter, raising 250 gallons 25 feet high per minute. Four of these wheels do not, apparently, affect the level of the water in the ditch in which they are running. These wheels get their power from the water because of its velocity as it flows to the ditch. This velocity is gradually acquired as it falls, and after the water has reached a given velocity, you may place in your ditch enough wheels to absorb the power equivalent to the energy of the water due to this velocity. If you add more wheels than this, you will get no additional power, but will simply reduce the velocity of the water in the ditch. If you were to put in 300 wheels, as you suggest, the velocity of each wheel would be so much less than the velocity of your present wheels that you would not be able to generate anything like as much power per wheel as you are doing now, and the sum of all the power generated from the entire 300 wheels would not exceed the energy in your stream.

(9190) E. O. L. says: Can you inform me what kind of a preparation to use to cover iron work, nail heads, and bolts to keep the rust from coming through the white paint? I want something to use in boat work around salt water. A. If you were to cover your iron work, nail heads, bolts, etc., with the black asphaltum varnish that is ordinarily used for iron work aboard ship, and cover this with white lead paint, we believe that you would have less trouble from the rust coming through. Rust will not so readily penetrate a paint which contains varnish as it will the ordinary lead in linseed oil paint. There is, however, nothing that we know of that will absolutely prevent the trouble you speak of.

NEW BOOKS, ETC.

GERMINATION DE L'ASCOSPORE DE LA TRUFFE. Par M. Emile Boulanger, Pharmacien Licensié ès Sciences. Rennes-Paris: Imprimerie Oberthur. 1903.

RADIUM AND OTHER RADIO-ACTIVE SUBSTANCES. Polonium, Actinium, and Thorium, with a Consideration of Phosphorescent and Fluorescent Substances, the Properties and Applications of Selenium and the Treatment of Disease by the Ultraviolet Light. By Wm. J. Hammer. New York: D. Van Nostrand Company. 1903.

Readers of the SCIENTIFIC AMERICAN SUPPLEMENT will doubtless recall the admirable series of papers by Mr. William J. Hammer, on the radio-active substance, and on selenium and the Finssen light. In this comprehensive paper Mr. Hammer presented all that is now positively known of radium, the practical utilization which has thus far been made of selenium, especially by Ruhmer, and the remarkable results obtained by Finssen of Copenhagen, with the ultraviolet rays in the cure of skin diseases. Mr. Hammer's book is noteworthy for its compactness as well as for its comprehensiveness.

THE FIGHTING CHANCE. By Gertrude Lynch. New York: Smart Set Publishing Company. 1903. 12mo. Price $1.25.

Just to prove that prefaces are sometimes read not only by the public to whom they are addressed, but even by book-reviewers, let it be said here that Miss Lynch's preface is an admirably studied bit of irony that cleverly hits the average reader in his most vulnerable spot—his careful disregard of the introductions to the books he reads. Miss Lynch's novel itself tells in a sparkling, epigrammatic style the story of a house party composed of men and women, all bent upon attaining a certain object. Starting with the catch-phrase that each one has a fighting chance in reaching the goal, the book tells how that fighting-chance is utilized. In the end a clever *ingenue*, after having succeeded in accomplishing the very task which she had set for herself, is undermined by her own cleverness, and does what every woman eventually does—falls in love with the man who is least able to gratify her ambitions.

The Warner Library of the World's Best Literature is at last within easy reach of every American home. This enterprise was effected by the "Public Opinion Club." The first edition, published a few years ago, was offered only at subscription rates, and at a high price. The New Memorial Edition contains many beautiful illustrations in color, a course of systematic reading, and other new features have been added. The present Warner Library is an improvement in every respect over the earliest. It is a splendid array of *de luxe* books, taking note of every author and every worthy literary production from the earliest days of writing up to the present time. Nowhere else can a complete survey of the world's literary thought be obtained. It is impossible in a brief notice to indicate the remarkable scope of the Warner Library. But, if the inquiry coupon given with the advertisement in a previous issue is sent in, it will bring handsome specimen pages and full particulars.

SUBJECT LIST OF WORKS ON ARCHITECTURE AND BUILDING IN THE LIBRARY OF THE PATENT OFFICE. London: The Patent Office. 1903. 18mo. Pp. 164. Price 25 cents.

The twelfth in the Patent Office Library Series—a comprehensive little series which we had occasion to commend on other occasions.

ELECTRICAL INFLUENCE MACHINES. By J. Gray, B.Sc. New York: D. Van Nostrand Company. 1903. 16mo. Pp. 296. Price $2.00.

Prof. Gray's book deals with the historical development and modern forms of influence machines and also gives instructions for making them. The illustrations are excellent, and there is almost a total absence of familiar friends. In the whole electrical field there is no more interesting branch for experiment, and this book, which we can commend, can be profitably used as a basis.

THE VULGARIANS. By Edgar Fawcett. New York: Smart Set Publishing Company. 1903. 12mo. Price $1.

Mr. Fawcett has succeeded admirably in missing the best chance in the world of giving us a piece of biting satire. He has told with colorless, photographic accuracy the stupid adventures of three very foolish young people, left with fabulous wealth by their father, and imbued with the desire to shine in the world of society. The characters are of the type with which Americans in the East are all too familiar—Westerners, whose ignorance of the ways of the world in which they would like to live is exceeded only by their intense ambition. The situations suggested would have lent themselves admirably to satirical treatment. Yet Mr. Fawcett has contented himself with telling his story in a matter-of-fact way, that smacks more of some dull English weekly than of the "Smart Set."

A PRACTICAL TREATISE OF THE STEEL SQUARE AND ITS APPLICATION IN EVERY DAY USE. By Fred T. Hodgson. 2 vols. Chicago: T. J. Drake & Co. 1903. 16mo. Pp. 242, 230. Price $2.00.

Mr. Hodgson's remarkable work is the outcome of papers written in 1872 on "The Use of the Carpenter's Steel Square." These were among the first that were ever issued devoted entirely to describing the uses and applications of the square, and so well did they meet with the appreciation of workmen who were interested in the steel square, that the author was urged to put the papers in book form and several hundred thousand copies have been sold, indeed it is doubtful if any other technical book ever had the same sale. Now nearly everything that is known about the steel square is embodied in the two handsome volumes. The most intricate problems are solved with the aid of the steel square. It is not too much to say that a carpenter who does not possess these volumes has one of the most valuable tools left out of his kit.

THE NEW INTERNATIONAL ENCYCLOPEDIA. Edited by Profs. Gilman, Peck, and Colby. New York: Dodd, Mead & Co. 1903. Vols. VIII. and IX. 4to. Pp. 955, 953. Published by subscription.

It is very gratifying to note that in this excellent compendium the treatment as well as the authorship is almost purely American, which is rather essential in a work of this kind, which is intended for American readers. The condensation of subjects is admirable, and typographically it is excellent. The maps and plates are excellent and the illustrations are numerous. Many subjects are treated for which we have looked in vain in other works of a similar nature. The inclusion of biographies of living persons is most helpful. The farmer will find authoritative articles on agriculture, and will learn of the interesting experiments that have been conducted during recent years by the Department of Agriculture, and every profession and walk of life is similarly treated. The two volumes before us reach down the alphabet as far as "Infant Phenomenon," which is interesting, showing the remarkable scope of this encyclopedia, for it is unusual to include characters from works of fiction in a work of this kind. It will be remembered that the "Infant Phenomenon" was Ninetta Crummles, a character in Dickens's "Nicholas Nickleby."

KALEIDOSCOPE. Vol. XI. Published by the Students of Hampden-Sidney College, Va. 4to. Pp. 170. Price $2.00.

A very well-gotten-up college annual. An appreciative notice of ex-Judge Roger A. Pryor, LL.D., is included.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending September 15, 1903,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading tool, J. O. Rollins	739,028
Acetylene generator, J. M. Green	738,794
Adjusting device, L. Myers	738,928
Advertising apparatus, aerial, Ward & Young	739,127
Advertising frame, C. McGinn	739,019
Advertising machine, M. J. Jordan	738,914
Agricultural implement, D. Lubin	739,193, 739,194
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Auger, earth, A. Buntenbach	738,982
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Baling press, W. E. Tate	738,957
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