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Notes and Queries.

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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 This is for our information and not for publication.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.

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(9644) M. G. A. asks: Please answer the following questions, and settle a dispute between parties of the physics class of high school of this city. Let a ray of light passing through a highly refractive body, from a point within approach the surface, making the angle of incidence greater than the critical angle. Does not one part of a wave front, emerging from the surface before the other part, pass into the air, and traveling at an increased velocity, swing around and enter the body again, the lower extremity meanwhile remaining below the surface? Can the ray properly be said to be reflected as if the surface were a perfect mirror, or to be reflected at all? Is not the left extremity of a wave front in the incident ray, the right extremity in the reflected ray, when the ray is reflected by a mirror? Is this so in the case of the so-called total internal reflection? If the answer to the first question is not in the affirmative, please give the reason why part of every wave front does not emerge from the said surface. If the first part of the third question is answered in the negative, please explain what actually does occur. A. If any portion of a wave front of light can pass from one medium into another, the whole of that wave front can pass, and refraction will result. Total reflection takes place when the angle of refraction becomes as great as 90 deg. Then no portion of the wave can pass into the rarer medium. All is turned back into the denser medium, as may be seen by the use of a right-angled prism, receiving the light perpendicularly upon one of its equal faces. The surface at which the total reflection takes place is a perfect mirror. No mirror can reflect more light. This can be seen in a glass of water, by holding it above the eye and looking up into the water obliquely from below. The upper surface shines as bright as silver perfectly polished. The sides of a wave system are reversed after total reflection as they are after any other reflection.

(9645) C. K. B. asks: What is the cause, or where do the prevailing westerly winds of the northern hemisphere originate? How does the rotation of the earth cause the deflection of the trade and anti-trade winds of the northern hemisphere? A. The general systems of the winds are due to the greater heat of the torrid zone. This produces the inflow of air from the cooler regions on either side of the hot region. The heated and lighter air is forced up by the flowing of the colder air under it, and it flows away to the north and south in the upper layers of the air. After this air is cooled it descends, and flows along toward the poles, only to return and again take part in the general circulation of the winds. The rotation of the earth on its axis causes great changes in direction of these currents, and we have northeast and southwest winds as more or less permanent winds in different parts of the northern hemisphere. This is but a rough and general statement of the winds, but may serve as a basis for fuller reading on the subject in the physical geographies. As the current of cooler air flows along over the smooth surface of the ocean in the torrid zone north of the equator, it is passing from a region where the velocity of rotation of the earth is less to a place where it is greater. This causes the wind to lag with reference to the earth under it, and to appear to come from a point farther to the east than it has really come. It thus becomes a northeast wind, and is the northeast trades. For a similar reason the returning currents of air over the ocean become southwest winds, or the anti-trade winds.

(9646) A. W. asks: 1. In calculating horse-power of an engine, has weight of piston any bearing on amount of horse-power? Why not? A. The weight of the piston of an engine has no influence on the horse-power excepting in so far as it affects the friction of an engine. This latter is very small. 2. Could a water motor on 10 pounds pressure maintain compressed air in cylinder at 25 pounds pressure, i. e., can water motor 10 pounds water pressure compress air to give 25 pounds pressure? A water motor acting on a pressure of 10 pounds per square inch could maintain compressed air in a cylinder at 25 pounds pressure per square inch, provided the area of the piston in the water cylinder were more than two and one-half times as great as the area of the piston in the air cylinder.

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(9647) O. S. asks: I have seen two different methods for reading, by attached vernier, 1-500 part of 1 inch, as follows: 1. To divide on the scale 1 inch in 201-20, and on the vernier 25 parts, which 25 parts equal on the scale 24 1/2. 2. To divide on the scale 1 inch in 20 1-20, and on the vernier 25 parts, which 25 parts equal on the scale 19 1-20. I am a scientific instrument maker, and I have very much to do with verniers for reading 1-500 parts of 1 inch, so I ask you kindly to tell me which of these two methods is correct. A. If you wish a vernier reading to 1-500 of one inch, you should first divide each inch on your scale into 20 equal parts, and then, by means of the vernier, be able to divide each part into 25ths. There are two ways of doing this, either one of which is absolutely accurate. First. Make your vernier 24-20 of an inch long, and divide it into 25 equal parts. Each part will then equal 24-500 inch. Each main division of the scale itself equals 25-500. The difference one division on the scale and one division on the vernier, therefore, equals 1-500 of an inch, as required. Second. Make the vernier 26-20 of an inch long, and divide it into 25 equal parts. One division on the vernier then equals 26-500 inch, while one division on the scale equals 25-500. The difference between the two, therefore, is 1-500 of an inch, as before. These are the only current methods of making the vernier, provided each inch on the scale is divided into 20 equal parts. You can readily determine which of these two types of vernier will suit your purpose in any given case.

INDEX OF INVENTIONS
For which Letters Patent of the United States were Issued for the Week Ending May 23, 1905

AND EACH BEARING THAT DATE
[See note at end of list about copies of these patents.]

Advertising device, J. Ovary.....	790,522
Advertising door closer, L. J. Long.....	790,636
Advertising writing table, W. H. Reiff.....	790,861
Air brake system, J. E. Shaw.....	790,808
Amalgamating plate plater and amalgamating plate cleaning compound, O. W. Zane.....	790,415
Amalgamator, T. J. A. Macdonald.....	790,445
Amusement device, J. C. Boyle.....	790,613
Annunciator, G. F. Atwood.....	790,548
Atomizer, W. Sams.....	790,318
Automobile, M. J. Davin.....	790,724
Awning winding box, J. Rickert.....	790,459

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Bell joint, J. D. Walsh.....	790,767
Balls, constructing golf, F. H. Richards.....	790,395
Bandage roller, E. F. Frost.....	790,427
Barrel, metal, H. Wehrhahn.....	790,861
Battery, W. C. Banks.....	790,866
Battery solution, P. M. Holmes.....	790,582
Beating roller, R. P. Bower.....	790,712
Bed, Burdette & Malone.....	790,720
Bed bottom, spring, S. I. Bridgewater.....	790,614
Bed, invalid, W. McLennan.....	790,588
Bed, swinging or folding, J. C. Bahr.....	790,474
Bevel and square, J. Graff.....	790,496
Binder, loose leaf, G. McBride.....	790,382
Binder, loose leaf, C. H. Brown.....	790,779
Bird cage, A. B. Hendryx.....	790,570
Biscuit cutter, M. Savage.....	790,866
Bit, M. E. Zeller.....	790,774
Block. See Building block.	
Boilers, hot water purifier for, G. Y. Bonus.....	790,816
Bolt and nut cutter, W. B. Carolus.....	790,617
Bolt blank heating apparatus, R. E. Jones, et al.....	790,302
Book cover, check, D. A. Templeton.....	790,762
Boot or shoe, composite, G. F. Butterfield.....	790,555
Boring machine, multiple bit, J. M. Garfield.....	790,823
Bottle, non-refillable, J. E. Moseman.....	790,700
Bottle, non-refillable, F. A. Heath.....	790,536
Bottle washing apparatus, D. Boyle.....	790,817
Bottles, means for guarding against the reuse of, W. B. Bostwick.....	790,281
Bottling machine, R. Pfaff.....	790,455
Braiding machine carrier, J. & G. F. McCahey.....	790,649
Brake beam fulcrum, adjustable, J. A. Matthews.....	790,736
Brake shoe, L. E. Robinson.....	790,754
Brick handling truck, J. Gleahill.....	790,495
Broom moistening and sprinkling attachment, J. P. Taylor.....	790,761
Brush handle, shaving, J. L. Erskine.....	790,622
Brush holder, A. A. Low.....	790,582
Buckle, L. Cabalka.....	790,673
Buckles, device for detachably securing bands to, Mitchell & Beach.....	790,585
Building block, O. D. Inman.....	790,436
Building block, C. W. & R. Meara.....	790,514
Building blocks, machine for manufacturing, E. H. Reed.....	790,661
Burglar alarm, J. E. Liess.....	790,343
Burlap basket, C. E. Myers.....	790,645
Button drilling machine, S. A. Brandon.....	790,554
Calculating apparatus, E. Hayem.....	790,431
Callipers, micrometer, F. Spalding.....	790,665
Camera, photographic, E. L. Hall.....	790,497
Cameras, half-tone screen holder for photographic, J. S. Ditty.....	790,290
Campbor, making, Stephan & Hunsalz.....	790,601
Candle receiving rack, S. H. Leavenworth.....	790,845
Cane loading apparatus, V. Goetz, Jr.....	790,826
Cannon, blank cartridge, M. J. Shimer.....	790,598
Car, convertible, Robinson & Witte.....	790,592
Car coupling, C. W. Rowell.....	790,593
Car dump, automatic revolving, A. Moore.....	790,586
Car folding guard, street, H. P. Vogel.....	790,766
Car, fruit, produce, and refrigerator, E. M. Phillips.....	790,851
Car grain door, railway, K. Osel.....	790,521
Car, railway, H. J. Bayard.....	790,420
Car replacing frog, C. L. Sullivan.....	790,327
Car, tank, C. L. Rogers, reissue.....	12,348
Car, tank, W. F. Kiesel, Jr.....	790,690
Car window sash balance, K. Schliepmann.....	790,321
Carburetor for hydrocarbon engines, C. P. Mingst.....	790,379
Cash registers, automatic spool carrying drawer for, Frymanne & Chambon.....	790,627
Caster, Linn & Geib.....	790,733
Casting apparatus, W. S. Weston.....	790,544
Casting machine, D. Baker.....	790,270
Cellulose, triacetate, Eichengrün & Becker.....	790,565
Cement block mold, O. S. Lamberson.....	790,507
Chair, bed, couch, or the like for use in surgical operations or examinations, P. A. Gayon.....	790,726
Channel bars, etc., straightening mechanism for, C. S. Simmers.....	790,706

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