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 This is for our information and not for publication.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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(9878) E. J. J. asks: 1. Will a storage battery made up of a bundle of thin lead plates separated by thin layers of asbestine paper be efficient? A. A storage cell can be made by the use of thin sheets of lead between sheets of asbestos. It would not be heavy enough to be efficient. This is the first way a storage cell was made—by rolling sheet lead between sheets of cloth. 2. What would be the surface required to give a current of 10 amperes? A. A storage cell may give 4 to 8 amperes per square foot of negative plates, counting both surfaces of the plate. 3. What would be the effect of using a stronger solution of sulphuric acid than 10 per cent? A. Too strong an electrolyte will consume the plates, and spend itself without giving any return. Sulphate of lead will be formed, and the plate will be destroyed.

(9879) F. E. W. writes: The statements and process of reasoning of your correspondent J. F. in Notes and Queries No. 9840 are so obviously and fundamentally erroneous, that I am surprised that you should print it without some editorial comment. To begin with, there is no such quantity in mechanics as "accelerating velocity." Perhaps J. F. intended to speak of *acceleration;* but if we grant that it was acceleration that was meant, then the dimensions in which it is expressed are wrong, for acceleration is not "feet per second," but *feet per second per second.* In fact, all through his argument J. F. has hopelessly confused the terms used in mechanics, and finally concluded by an attempt to subtract two forces from two accelerations—quantities which are as radically different in their nature as are volumes and areas. When we speak of a freely falling body, we do not mean one that is falling in air or other retarding media, but one that is acted upon by the force of gravity alone. It is only under this latter condition that a *constant* acceleration is given to such a falling body. To show that a ball of lead and one of cork will not reach the ground in the same time if they are dropped at the same instant, let us first see what kind of quantities we have to deal with in the solution of the problem. Without going too deeply into the question of dimensions, we define both weight and force as being the product of two factors, or

$$\text{Weight} = \text{Force} = \text{Mass} \times \text{Acceleration},$$

and acceleration is $= \dfrac{\text{Velocity}}{\text{Time}}$.

When a body is allowed to fall in a vacuum, it is acted upon by the force of gravity alone. This force is equal, by definition, to the product of the mass of the body by the acceleration therein produced, or

$$F = M \times A.$$

Now, suppose the same body to be allowed to fall in air. The resistance offered by the air to the passage of the body through it is a *force* (which we may call f) and acts in direct opposition to the force of gravity, so that the resultant force, acting downward on the body, is less than in the first case, and we may write:

$$(F - f) = M \times A'.$$

The left-hand member of this equation is obviously less than that of the preceding one, so therefore our right-hand member must also be less. But as the mass M is constant, the only factor that can have decreased is the acceleration, and therefore A' is less than A. This is the same thing as saying that gravity cannot accelerate a body so rapidly in a resisting medium as in a vacuum, a statement that ought to be self-evident. Let us consider now two balls of the same identical shape and size, but one weighing 40 pounds and the other 2 pounds. And suppose, for convenience, that each ball meets with a resistance of 1 pound when it is falling through the air at some uniform velocity $= v$, say. Then when the two balls are dropped in a vacuum, we have, by substitution in our first equation,

$$40 = m_1 \times a_1 \text{ for the heavy ball, and}$$
$$2 = m_2 \times a_2 \text{ for the light ball.}$$

The masses m_1 and m_2 being proportional to the weights of the balls, the accelerations a_1 and a_2 are equal to each other, and the balls fall in equal times.

Now, if dropped in air, when the balls are falling at the velocity v, we will have:

$$(40 - 1) = m_1 \times a_1' \text{ for the heavy ball, and}$$
$$(2 - 1) = m_2 \times a_2' \text{ for the light ball,}$$

From this we see that

$a_1' = 39/40a_1$ and $a_2' = 1/2a_2$.

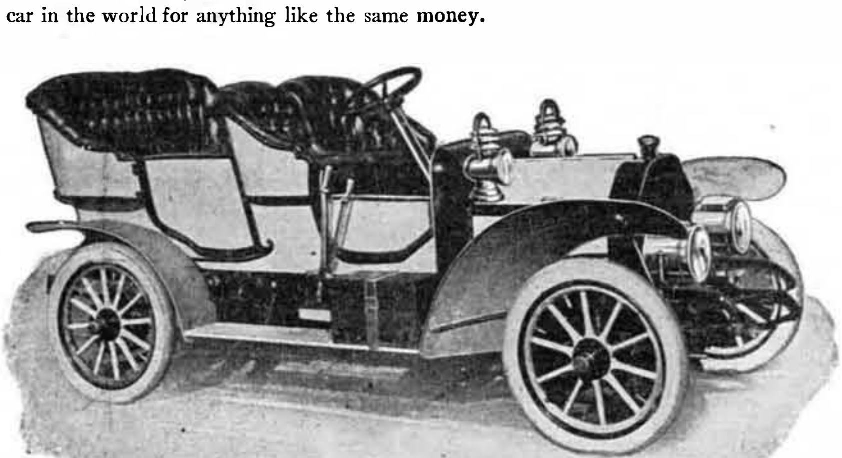
Therefore the percentage decrease in the acceleration due to gravity is only 2½ per cent for the heavy ball, while for the light ball it is 50 per cent. Therefore the heavy ball is accelerated most, and falls the faster. It is thus clear that the retarding force of the air due to the passage of the balls through it, which is assumed to be the same on each ball, is not a quantity that can be subtracted from a velocity, as J. F. would have it, but one that enters the equations of motion in an entirely different way. A. There is perhaps no proper defense for having printed Query 9840 without a refuting comment, but it was done to show a type of reasoning which very often comes to our desk. Indeed, this matter of falling bodies retarded by the atmosphere is probably the most prolific in our correspondence, only a very small portion of which gets into print. The demonstration you give is probably quite too technical for the average reader of Notes and Queries, whom we are always obliged to keep in mind in deciding what to insert in the column. The new expression for acceleration, "feet per second per second," is correct, but in the editor's experience with classes it is in no way an improvement over the older mode of expressing the same fact, if indeed it is not really a block to understanding. To meet the needs of those whom we must keep in mind, who are not versed in mathematical mechanics, we must avoid the equation as much as possible, and make our explanations in words. This is not as satisfactory to the mathematician, of course, but we are confident that it meets the needs of our average reader.

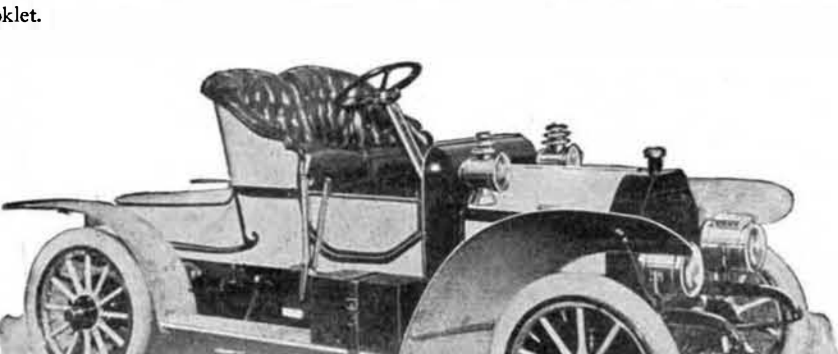
(9880) J. R. W. asks: Please explain the following phenomena in the Notes and Queries department of the Scientific American: About four years ago, at 3 o'clock P. M., two friends and myself witnessed the falling of a meteor near Springfield, W. Va. The sun was shining and we were looking toward the east. A mountain about 1,000 feet higher than where we were standing lay one mile east of us. The meteor was brilliant red, and about the size of the planet Mercury. When first observed it seemed about 500 feet higher than the top of the mountain. It fell nearly vertical, and seemed to drop on the mountain about one-third way down from the top, and was so plain that we located where it seemed to fall, by a tree. On examining the place no trace of it could be found. A few days after I read an account of a large meteor falling in Clark County, Va., on the same day and hour. Do you think the meteor we saw was the same one that fell in Clark County? The distance is 40 to 50 miles. A. It is very easy to believe that the meteor described as seen above a mountain top was in reality 40 miles away. There is no possible way to estimate distances in the sky, in the line of sight. An error is most easily made in judging the distance of such an object.

(9881) M. L. C. asks: How could I arrange so that I would get electric sparks by sliding a silken cushion (or any other material) along a glass rod back and forth? A. It is not possible to obtain sufficient electrical energy by rubbing a glass rod with a rubber held in the hand to produce sparks. A plate swiftly rotated as in the various machines is needed. The best which can be done with a rod and rubber in the hand is to have the rubber of silk or woolen and lined with some strips of tinfoil connected to a wire which extends out so that the electricity which is generated may be conducted to the place where the spark is desired. Of course, the best way to get electric sparks is by the electrophorus. The making of this is easy. You can find out how to proceed by getting St. John's "How Two Boys Made Their Own Electrical Apparatus," a fine book which we send for $1.

(9882) W. E. B. asks: Please inform me, through Notes and Queries, what material is needed, and how to construct the so-called water-pail forge. A. The materials needed to construct a water-pail forge are a pail, some salt water, and some sheet lead. Place the sheet lead so as to nearly or quite cover the bottom of the pail, and have a strip extend up out of the salt water, so as to attach the positive wire to it. The negative wire is attached to the piece of metal to be heated, and the metal is dipped into the salt water. Instantly a flash of light occurs, and in a second or two it is white hot. The forge cannot be worked with much less than 220 volts.

(9883) J. W. asks: 1. What is the increase of velocity of a falling object per second? A. The velocity of a falling body increases 32.16 feet or 980 centimeters each second of its fall. 2. How long would it take an object to fall 3,000 feet? A. The time required to fall freely through any distance is found by the formula $S = \frac{1}{2}GT^2$. In this formula, $G = 32.16$; S is the space, and T is the required time. To solve your problem, put 3,000 feet as the S and solve for T. 3. What is the speed at which an object will take fire through friction with the air? A. The speed at which an object will take fire from friction against the air varies with the density of the air. It is not speed which determines the matter simply, but time which must be taken into account. See books of astronomy for this under meteors, since these take fire and shine by reason of the friction against the air as they fly swiftly through the air.





NEW BOOKS, ETC.

Modern Turbine Practice and Water-Power Plants. By John Wolf Thurston. New York: D. Van Nostrand Company, 1905. 8vo.; pp. 244. Price, $4.

Modern turbine practice is thoroughly described in this book, whose object is to give such information with regard to modern turbines and their proper installation as is necessary to the hydraulic engineer in designing a water-power plant, and no attempt has been made to treat the designing of turbines. The writer has designed turbines both in America and in Europe, and has been connected in engineering capacities with water-power developments aggregating nearly 200,000 horse-power, having been in charge of the hydraulic work during the planning and construction of some of the most important developments in Canada. He has had an excellent opportunity to study the subject from the point of view of the turbine builder and of the turbine user. In the first part of the book the author points out the direction in which improvement is to be sought in the present American turbine practice. On account of the great importance of the steam turbine and its close relation to the hydraulic turbine, the writer has included a chapter on this subject. It is an excellent work, and will prove of great value to the hydraulic engineer.

The Industrial Problem. By the Rev. Lyman Abbott. Philadelphia: George W. Jacobs & Co., 1905. 12mo.; pp. 196. Price, $1.

This book contains the lectures on Christian sociology given under the auspices of the Rev. William L. Bull Lectureship during the present year. The four lectures by Dr. Abbott are on the Industrial Problem; the Political Solution—Regulation; the Economic Solution—Reorganization; and the Ethical Solution—Regeneration. It is unnecessary to state that these lectures are in Dr. Abbott's most characteristic style, and that they contain much of interest on this, the greatest problem of our day.

Précis d'Hydraulique. La Houille Blanche. By Raymond Busquet. Paris: J. B. Baillière et Fils, 1905. 12mo.; pp. 317, 49 illustrations. Price, $1.50.

This work from the pen of Prof. Busquet has for its aim the placing at the disposal of all engineers, and others interested in the use of water power, of the principles to be followed in the construction of hydraulic power plants. M. Busquet first states the primordial laws of hydraulics which must be followed in plants of this character, and he then follows this with a discussion of the flow of liquids through pipes and in open canals. The latter part of the work describes various forms of turbines and waterwheels, and there is a closing chapter on the "Creation of a Water Power." The book, while more or less technical in character, does not go into mathematics beyond the solution of ordinary arithmetical problems, and the employment of the first principles of geometry.

Sugar and Sugar Cane. By Noël Deerr. Manchester, England: Norman Rodger, 1905. 8vo.; pp. 396. Price, $3.

The present work is an elementary treatise on the agriculture of sugar cane and on the manufacture of cane sugar. As there is no recent work in English covering the cane-sugar industry, the author hopes that this compilation may be of use to the English-speaking community connected with the industry. The book is a most comprehensive one, and will certainly be of the greatest possible value to growers, crushers, and refiners. It is a book which we can recommend.

Les Fours Electriques et Leurs Applications Industrielles. By Jean Escard. Preface by Henri Moissan. Paris: Vve. Ch. Dunod, Editeur, 1905. 8vo.; pp. 511. Price, $4.50.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending January 23, 1906.

AND EACH BEARING THAT DATE

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

Abdominal supporter, N. Grose	810,407
Agricultural implement, J. U. Cornelison	810,622
Air brake pipes, safety coupling section for, W. J. Hofstatter	810,862
Air treating apparatus, F. White.. 810,450,	810,451
Anchor, guy, L. D. Pitcher	810,807
Animal trap, F. Ballentine	810,518
Antikicking attachment, F. J. Brady	810,520
Automatic carrier and self-dumping device, Sylstad & Rude	810,586
Automobile, L. B. Gaylor	810,636
Ax holster and guard, J. G. Busch	810,614
Axle and wheel structure, combined car, L. P. Fertig	810,525
Bale tying machine, C. M. Cagle	810,521
Barrette fastener, G. W. Dover	810,475
Balloting box, W. W. McCollum	810,790
Beach making device, G. C. Dwight	810,630
Bed and similar furniture, collapsible, F. C. Schofield	810,573
Beds, crib attachment for, W. R. Clark	810,718
Bedstead end piece, metallic, W. F. Bernstein	810,699
Beer, Pasteurizing, H. Gronwald	810,745
Bell ringer, R. M. Crosby	810,725
Bicycle attachment, A. P. Santini	810,814