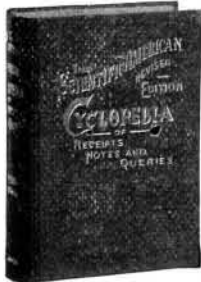


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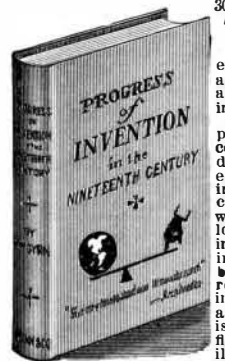
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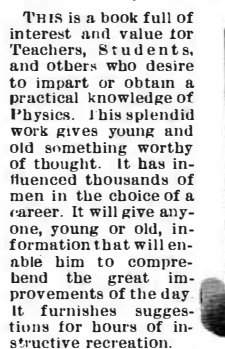


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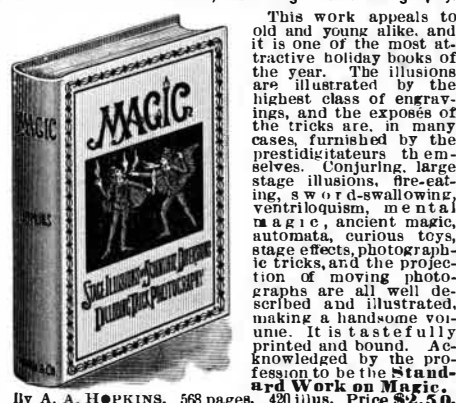
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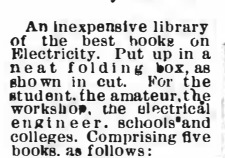
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(8489) J. G. M. asks if cast iron balls and cones can be cast so as to wear, and if they cannot, kindly state what other material can be used besides steel. A. Cast-iron balls and cones are not suitable for bearings for vehicles or machines. Nothing is better than truly finished steel balls and bearings, hardened.

(8490) D. L. O. asks whether or not it was ever the general practice to build locomotives with inside cranks in this country. Kindly give the date at which inside cranks were most generally used, and state roughly the extent to which the practice of building this type of locomotive was carried. A. Locomotives with inside cranks were the prevailing type with American builders commencing about 1831, and their building continued until about 1845. They were in use mostly for switching engines as late as 1860 and possibly later. The outside crank type were also built and in use during the early period of locomotive service in the United States, and began to displace the center crank type for passenger service about 1842.

(8491) C. B. H. asks: 1. I have a good knowledge of the rudiments of electrical engineering and am desirous of completing the study as far as possible without the aid of an instructor. Will you kindly inform me what books you would recommend, also the prices and the order in which they should be taken up? A. Starting from a thorough knowledge of elementary electricity, embracing all that is contained in a book of the scope of Thompson's "Elements of Electricity," price \$1.40 by mail, you should then proceed to the study of the dynamo, lighting systems, distribution systems, power systems, etc., in the direction of practical work. At the same time a study of currents, theoretically, should be carried on. Thorough work should be done upon the mathematics of the alternating current and the machines used in its distribution. You would do well to begin with Hawkins and Wallis' "Dynamo," and take next Crocker's "Electric Lighting," two vols., price \$3 each. Steinmetz's "Alternating Currents," price \$2.50, is the standard book on the theory of this subject. Kapp's "Transformers," \$4, might follow this. For the electric railway there are many valuable books. Crosby and Bell, price \$2.50; Dawson, \$12.50; Bell, \$3, may be named. The work thus laid out as a beginning only ought not to be carried on "by the book" alone. It ought to be taken in a laboratory where the article which is the subject of study at the time can be before the student and be handled, tested and investigated. Even a night course at one of the excellent institutions offering such courses in New York city would be far better than a book course taken without an instructor. 2. I should also like to know the method employed in figuring charges for light and power and how the wattmeter is read. If different manufacturers' instruments require

(Continued on page 15)



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(8492) W. H. P.—See reply to C. B. H., above.

(8493) J. C. H. asks: Will you please inform me whether there is any book treating on electrical resistance and its principles. If so, can you furnish it, and at what price? I am aware that this is treated of in various works but I want the most complete treatise I can find. A. There is no separate treatise upon electric resistance. It is fully treated as to theory in such a textbook as Thompson's "Elementary Lessons," price \$1.40 by mail. The various data of metals, methods of measurement, etc., are given fully in Foster's "Electrical Engineers' Pocket Book," just issued at \$5.

(8494) T. H. S., O. H. L. and others.—Several of our esteemed correspondents have taken exception to our statement regarding the fall of rain into a rain gage. One suggests that a gage would not catch any water if the wind blew so hard that the drops were driven horizontally. We should reply to that, neither would any rain fall upon the ground in that case. A rain gage would certainly catch all the rain which reached the ground in that case. The reason for the misapprehension upon this subject seems to be that our correspondents do not realize that the lines of the rain are nearer together for the same amount of rain, as for example one inch, when the lines of the rain slant. Suppose that from a rod threads are hung at equal intervals, and fastened at the same intervals to a second rod below. These threads will represent lines of rain falling vertically. Now take hold of the lower rod, and draw it aside, holding the threads taut. The upper rod, and the lower as well, will still be horizontal as before. There will be the same number of threads between the two rods, but they will be nearer together. So will the lines of rain, if a breeze springs up while it is raining. A singular mistake is often made by people which arises from a similar cause. If a person goes out in a rain when it is calm, and walks fast, he often thinks it has begun to rain harder, because he is hit by more drops. His walking is equivalent to a wind in the opposite direction, and the rain drops seem to slant and to be brought nearer together. He therefore thinks it is raining harder. Our answer to Query 8404 gives a simple way of understanding the matter. We think anyone who carefully studies that answer should come to the right conclusion, that if gages were set each with an opening one foot square, so as to cover all the ground under a storm, all the rain which fell in the storm must be found in the gages, and each gage would have the rain water in it which fell upon its square foot. If less fell upon one square foot than upon another square foot, the gage would not have as much rain in it as others. We do not maintain that there is the same rainfall in all parts of a storm. Eddies of the wind may even turn the rain drops so that they rise from the earth for awhile, but we do maintain that a rain gage catches the rain which would fall upon the same area. If the gage were not there. This is absolutely true except for the eddies which the gage itself causes. If a gage is on a high tower, the tower itself causes much larger eddies of the wind, and the gage suffers from its lofty position. In a proper location, however, eddies have only a slight influence, and the gage acts in a normal manner. Rain gages have been set in the ground so that the upper edge was even with the surface of the ground, to prevent the formation of eddies by the gage. The Weather Bureau, however, does not require them to be sunk in this way.

(8495) C. G. W. says: Will you kindly inform me through your Notes and Queries column how I can artificially color a meerschaum pipe? A. Ordinarily the pipe is boiled for coloring in a preparation of wax which is colored, and a thin coating of wax is held on the surface of the pipe, and made to take a high polish. Under the wax is retained the oil of tobacco, which is absorbed by the pipe, and its hue grows darker in proportion to the tobacco used. A meerschaum pipe at first should be smoked very slowly, and before a second bowlful is lighted the pipe should cool off. This is to keep the wax as far up on the bowl as possible, and rapid smoking will overheat, driving the wax off and leaving the pipe dry and raw. A new pipe should never be smoked outdoors in extremely cold weather. Fill the pipe and smoke down about one-third, or to the height to which you wish to color. Leave the remainder of the tobacco in the pipe and do not empty or disturb it for several weeks, or until the desired color is obtained. When smoking, put fresh tobacco on the top and smoke to the same level. When once burnt the pipe cannot be satisfactorily colored, unless the burnt portion is removed and the surface again treated by the process by which meerschaum is prepared. The coloring is produced by action of the smoke upon the oils and wax which are superficially on the exterior of the pipe, and are applied in the process of manufacture.

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