Full hints to correspondents were printed at the head of this column in the issue of November 14 or will be sent by mail on request.

(12008) S. L. D. asks: In your column "Answers to Inquiries" will you oblige a 45-year reader of the SCIENTIFIC AMERICAN by stating scientists' explanation of the great weight of the earth? Astronomers say the whole weight is 5½ times that of water: viz., about 344 pounds per cubic foot. Marble and the densest granite rarely exceed 180 pounds per cubic foot. By far the largest part of the earth known to man is much less in weight than granite; for example, water, earths of all kinds, coal, all woods, etc. If astronomers are correct, a few hundred miles down and thence to the center of the earth there must be great density of matter. A. It is true that the average density of the materials on the earth's surface is not greater than three times that of water. The weight of a cubic foot of such materials then is not far from 180 pounds per cubic foot. Your inference is the only possible one, that the interior of the earth is much heavier than the surface portions. Nor is this any different from what would be expected, if once the earth were fluid. At that time the heavier substances sank to the bottom of the fluid mass, and are at present nearer the center of the earth.

(12009) E. E. W. asks: In corresponding with an electrical dealer about hand-power for running a 75-watt dynamo, he said that it could not be run by hand-power, it was too large. This dynamo at 1,400 R. P. M. will furnish 15 to 20 volts; at 2,000 R. P. M. will furnish 40 to 50 volts. In a circular I have there is a 75-watt dynamo advertised. This dynamo will furnish an alternating and direct current at the same time or separate. It will run as a motor on a direct current and at the same time furnish an alternating current to light lamps by. In all other respects it is the same except in design. The questions in my mind are why cannot the first dynamo be run by hand-power if the one can that I last described? Does it take more power to run a dynamo as you increase the amount of current or the voltage? If a dynamo is run at a higher speed than it was designed to run, would there be a higher voltage or amperage? A. A 75-watt dynamo can be run by hand, by one-man power, for a while. It is one-tenth horse-power. And a strong man can exert more power than that for a short time. It matters not how the 75 watts are made up—1 ampere at 75 volts, or 3 amperes at 25 volts, or any combination which gives 75 for a product. Power is in watts, and these are the product of volts and amperes. If the speed of a dynamo is increased the volts are increased, but the amperes remain the same. All the amperes flow which the resistance allows to flow. The volts depend upon the rate of cutting lines of force by the revolving armature. This is increased by increased speed. But if 1,400 turns per minute give 15 volts, 2,000 turns per minute can only give 22 volts, and not 40 volts as you give it.

(12010) J. A. B. asks: 1. What are the underlying principles of cloud electricity, that is, where do the clouds obtain their electrical energy, and how? A. The mode of the production of electricity in the atmosphere is not yet well understood. No theory completely explains all the facts. 2. What is the cause of lightning and thunder? A. Lightning is due to an electric discharge between two oppositely electrified masses of clouds. Thunder is the sound produced by the shock of the air rushing back again into the space through which the lightning has just passed. 3. Why are not all clouds accompanied by lightning? A. All clouds do not produce lightning because they are not sufficiently electrified to pierce the air between them and the earth. 4. Do all clouds possess electricity? A. All clouds are electrified, so is the air at all times. 5. Are lightning clouds laden with electricity before there is any lightning flash, or is lightning caused by the friction of the clouds? A. Thunder clouds are more highly electrified than other clouds. Light from the electric discharge is due to the heating of the air through which the lightning flashes. 6. What are clouds? A. Clouds are composed of drops of water in the air. These drops always fall, as do any other drops, but they may evaporate and disappear before they reach the earth. They may be kept up by currents of air under the clouds, raising them and keeping them from coming through to the earth. Otherwise it would rain every time a cloud passes overhead. 7. Steam circulating in pipes condenses and again becomes water. Then why is it that steam escaping into the cold atmosphere rises and finally becomes invisible? Why does it not condense and fall back to the earth in the form of water? A. Clouds are not vapor or steam, but actual drops of water. Steam when it comes out of a pipe and is seen as a cloud is no longer steam but drops of water. If these drops disappear, it is because they evaporate into the air. They often fall as water, wetting the ground below. You would profit by reading some good book on meteorology. Waldo's "Meteorology" is good. We can send it for $1.75 by mail.

NEW BOOKS, ETC.

THE STEAM TURBINE. By James Ambrose Moyer, S.B., A.M. New York: John Wiley & Sons, 1908. 8vo.; pp. 370; 225 ill. Price, $4 net.

It is the aim of the author to give what practical engineers and students desire to know about the steam turbine and not merely a *résumé* of as much of thermodynamics and mechanics as is necessary coupled with particulars from manufacturers' catalogues. The result, while essentially a book for the engineer is eminently practical, more for the designer and builder than for the theoretical mathematician and sufficiently lucid to be interesting to the amateur. Nothing could be clearer, for instance, than the author's explanation of the difference between impulse and reaction turbines in the accepted commercial sense of those names, a distinction so confusing to many on account of the misleading nature of the terms, practically all successful turbines using both impulse and reaction in their exact sense. The summary of the difficulties of design for gas turbines is also admirably clear. The rapidity of recent developments is perhaps best shown by the introduction almost without comment of entropy diagrams laid out in lines of constant superheat instead of in constant temperature and by the quite unimpassioned assumption that no reciprocating engines will in future be used for large electric power plants. The presentation of the most important statements in bold-faced type is an innovation reminiscent of advertising circulars, but is useful in making the subjects visible at a glance.

PEERLESS ALASKA. Our Cache Near the Pole. By Charles Hallock, M.A. New York: Broadway Publishing Company, 1908. 16mo.; pp. 224. Price, $1.25.

This is Mr. Hallock's latest work, written in his 75th year. It is a timely and very entertaining volume of 250 pages, comprising a comprehensive outline of the physiography, ethnology, natural history, products, railroads, government enterprises, experimental farms, and economic resources of Alaska and its development from cession to date, and furnishes a useful and trustworthy *vade mecum* for intending homesteaders, miners, mushers, commercial fishermen, sportsmen, missionaries, and all persons interested in its settlement and advancement. There is an introductory send-off by Rev. Sheldon Jackson, of the U. S. Bureau of Education, vouching for its accuracy and scope.

LABORATORY ARTS. By George H. Woollatt, Ph.D., F.I.C. New York: Longmans, Green & Co., 1908. 12mo.; pp. 192; 119 diagrams.

This is a teacher's handbook, adapted particularly for the science teacher who has to take care of and repair his own instruments. The work is thoroughly practical, and is based upon the personal experience of the author in caring for his laboratory apparatus. The book abounds with useful suggestions, which clearly show the resourcefulness of the author. The purpose is not to show the standard trade methods, but the best way for the man of limited skill and a poor equipment of tools to make the necessary repairs.

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