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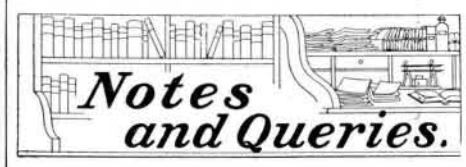

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

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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(8509) G. F. writes: In letting the air out of my hot-water heating radiators to-day, I found on applying a match to the air that it burned readily and strongly, giving a blue and partly white flame. The radiators are filled with city water, which is taken from a well about 400 feet deep, the last 35 feet being in sand rock. Why does this air burn? Is there any danger in using this water in the radiators? A. A small quantity of inflammable gas is often found to issue from the air vents of radiators. It is principally hydrogen, supposed to be liberated by the oxidation of the iron in the heating apparatus. It is harmless.

(8510) W. C. T. asks: 1. In issue of October 26 was an account of lifting magnets lately brought into use for moving heavy pieces of metal. What expenditure of magnetic or electric force occurs in lifting 100 pounds ten feet high? A. There is the same expenditure of magnetic force in lifting 100 pounds of iron by a magnet as by any other method. 1,000 foot-pounds are required to lift the weight. 2. What I wish to know is whether a working magnet loses force or not by reason of work. A. The magnet loses no force by lifting. 3. Is the nature of magnetism understood? Also if a magnet and an electro-magnet are alike in conservation of force? A. The nature of magnetism is not known. All the forces of nature are mysteries. We believe the conservation of energy is applicable to all forces. 4. About a year since there was considerable discussion about wind pressure, and it seemed to me that the subject was not thoroughly understood. My theory is that in case of a heavy wind against any object the pressure is not proportioned to the size of the object, for this reason: Let the object be the side of a house standing square to the wind. The air close to the house has no motion, and there is a wedge-shaped body of slightly compressed air which splits the wind and diverts part of its force, as anyone may discover by standing on a street corner on a windy day. A. Experiments have proved that wind pressure is in proportion to the area on both small and large bodies. The pressure is transferred to a plane surface through the banked cone against it, and the pressure at a central point on the surface corresponds with the pressure due to the velocity of the wind, which increases the density of the air in the central portions of large surfaces.

(8511) E. J. H. asks: Is there any substance through which magnetic lines of force cannot pass, or is there any way to produce a beam of magnetic force, as light is reduced to a beam on passing through a crevice? A. Iron constitutes the only screen for magnetism. The lines of magnetic force always proceed from a magnet pole and curve around to an opposite pole. The only way in which they can be made to go in straight lines is to place a second and opposite pole over against the pole from which the lines originate.

(8512) F. R. M. asks: 1. Ganot gives the velocity of sound in rubber as 100 feet per second, and in steel 16,000 feet per second. I cannot reconcile this with the formula $v = \sqrt{\frac{e}{d}}$ for as the terms are usually understood elasticity is greater and density less in rubber than in steel. Just what does elasticity mean in this sense? A. The "elasticity" employed in calculating the velocity of sound in a solid is Young's modulus of elasticity. This is the number of pounds used to stretch a bar of a square inch cross section, divided by the elongation produced in one inch of the length of the bar. Now, it requires an enormous number of pounds to produce a small elongation in a bar of steel of one inch section and one inch long. The quotient of the number of pounds divided by the elongation is a large one. It requires a small number of pounds to stretch a bar of india rubber quite a distance. The quotient found as before is small. In other words, rubber is not very elastic as compared with steel. Nor do we use rubber as we use steel for its elasticity. You will find this in Ganot; the reference is on the same page as the figure you quote for rubber. 2. In Fizeau's experiment on the velocity of light, why does not the returning beam destroy the one that is going to the mirror, and so produce darkness? Would this be the case if the beam were a single ray? A. Waves must cross each other in opposite phases to produce extinction. In the case of light the effect of interference is to produce bands of light and darkness. very difficult to see except with special apparatus, and in a dark room. When the waves have crossed they move on as before. Interference of waves does not stop the waves. Water waves cross each other, interfering as they do so, and then flow forward as before. So also do light waves. 3. In an organ pipe how can waves pass in opposite phases without destroying each other? In other words, why does not the formation of a node destroy completely the wave from each direction? A. The above answer applies to this question also. A node is a point in a stationary set of waves. The waves are passing and repassing through the node. 4. Ganot says violet rays are 76×10^{13} per second. Lodge, quoted in Fahie's "Wireless Telegraphy," says 76×10^{14}; and in Kerr's "Wireless Telegraphy" it is given as 76×10^{10}. Which is right? A. We do not know. They only differ slightly. We should have more confidence in Ganot. The wave length is the important factor. This divided into the velocity of light gives the number you quote. 5. How is it proved that light waves are transverse vibrations? A. The phenomena of light better accord with the theory of transverse than of longitudinal vibrations.

(8513) A. F. O. asks: In installing an electric stereopticon requiring from 7 to 18 amperes obtained from a commercial 220-volt wire, I am told that I must reduce the current by means of an adjustable rheostat. Could it not be done as well and more cheaply by means of a shunt? A. A rheostat is generally employed in controlling an arc lamp for the stereopticon. The drop of voltage in the arc is about 50. The rest of the drop is in the rheostat. If 15 amperes are to be provided for, a rheostat of at least 12 ohms will be required. These are to be had from all dealers in lanterns, etc. See our advertising columns.

(8514) G. W. H. asks: 1. In regard to a fluorescent fluid, you very kindly informed me in your issue of July 24, to use a solution of quinine, with a little acid, hydrochloric or citric, with a violet-colored glass. As I have not been successful, will you kindly tell me the proportions to use? A. No particular proportions are required. Dissolve as much as the water will take. Of course you understand that the effect must be seen in a dark room, with the light from the lantern falling upon the paper wet with the solution, or the bottle containing the solution. 2. Also can you inform me what fluids I can use, and the color of glass for each, to produce red, blue or black color on white paper? A. The color of the paper has no effect upon fluorescence. 3.

(Continued on page 98)

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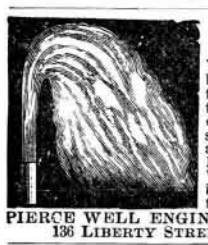

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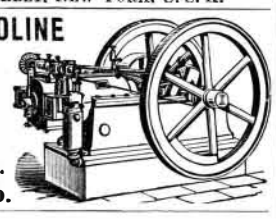

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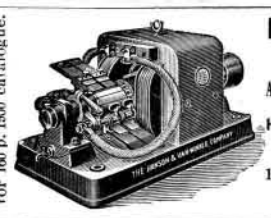

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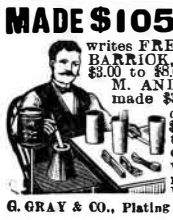

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What fluid and color of glass to obtain results on red, blue or green paper? Is there any liquid to produce a phosphorescent glow on paper, visible only through colored glass? A. We do not know any such liquid. 4. Where can I procure an authentic work on this subject? A. Wright's "Light," price $2.00; Dolbear's "Art of Projection," price $2.00; and Wright's "Optical Projection," price $2.25, are the books which treat of the practical manipulations of fluorescing experiments.

(8515) G. C. writes: In Notes and Queries of December 7 (8470) J. O. J. asks what is the true theory of the inflow and outflow of wind that obtains in the caves of South Dakota. Permit me to say that the true solution is to be found in the operation of the laws of gravitation, or in other words in barometric conditions rather than thermal. To illustrate: Let us assume that there is an equilibrium in the specific gravity of the air within and without the cave. A sudden change takes place in the outer air, its specific gravity being increased; the more weighty air from without will rush through the narrow entrance to the cave to maintain the barometric conditions within and without; and *vice versa*, when the air within the cave is heavier than it is outside, there will be a corresponding outflow. The velocity of the in and outflow will be in the ratio of the atmospheric changes taking place, and the existence of space within determining the volume of air to be forced in and out. The foregoing theory is, I think, fully demonstrated by the flowing and ebbing of the tide. Here is a narrow entrance to a wide and extended inlet: on the rising of the tide without, the water is forced with great force through the entrance until the surface of the water within is on a level with that without. There will be a corresponding outflow with the receding of the tide. Gravitation in both cases is the motive force. A. We presume our esteemed correspondent is aware that a change of temperature changes the density or specific gravity of the air, as he terms it, just as a change of barometric pressure does; and that the change due to heat is much more rapid and effective than the change in density due to a change of barometric pressure. A change of 15 deg. of the thermometer produces almost exactly the same change of density in the air as a change of an inch in the barometer. We have a change of 15 degs. in the thermometer almost every day between night and day. A change of an inch in the barometer is usually much more than a day in taking place. The change of pressure between the interior of a cave and the external air would appear to be dependent upon the change of temperature to a higher degree than upon the change of the pressure of the air as shown by a barometer.

(8516) A. writes: 1. Can I trouble you for an explanation of the cold produced by a body moving through the air, e. g., railway train, bicycle, fan? A. The sensation of coolness produced by rapid motion through the air is the same as that produced by a rapid motion of the air past one, as in fanning, sitting in the breeze, or in a draft of air. It is caused by the evaporation of perspiration, sensible or insensible, from the surface of the body. The moving air carries off the perspiration and brings a new supply of drier air into contact with the skin. This takes up its quota of moisture and moves on. The evaporation of the moisture from the skin is carried on by the heat of the body. When the action is rapid, the body is cooled more than when it is slow: hence in a breeze we feel cooler because the heat is taken more rapidly from the body to evaporate the moisture upon the surface of the body. It must be borne in mind that no water is evaporated except by heat. 2. Also, cold of combination of salt and snow? A. Salt by a chemical property has a strong affinity for water, and is able to melt ice, even at a temperature below the freezing point of water. The ice, however, cannot melt except it takes heat from some other body to melt it. This abstraction of heat cools the surrounding space. Thus ice cream is frozen by salt and ice.

(8517) M. M. asks: Will you please advise me as to the weight per horse power of a modern storage battery? And also, the weight per horse power of Mr. Edison's new battery? A. The number of pounds per horse power of a storage battery varies with the rate of discharge. With a slow discharge it is less for the same cells than for a rapid discharge. A rule has been given as follows: 0.53 ounce lead peroxide, and the same weight of spongy lead per ampere hour for a 10-hour rate of discharge; 0.62 ounce for a 5-hour rate; 0.70 ounce for a 3-hour rate; and 1 ounce for a 1-hour rate of discharge. This would give about 50 pounds per horse power at 10 hours discharge, and nearly 100 pounds for a 1-hour discharge. Manufacturers give various other figures for their cells. These are given in Foster's "Electrical Engineers' Pocket Book," just issued, price $5 by mail. The Edison storage cell is not yet before the public, and we presume no one knows what the number of pounds per horse power is for it.

(8518) R. H. M. writes: Replying to J. T. R. in Query 8461 you say that the same quantity of rain goes into the rain gage

(*Continued on page 99*)

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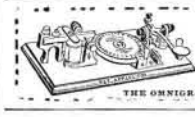

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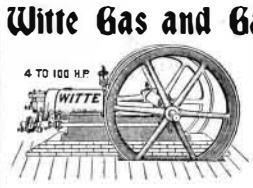

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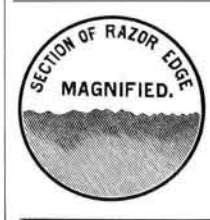

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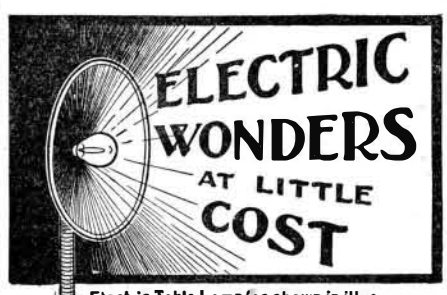

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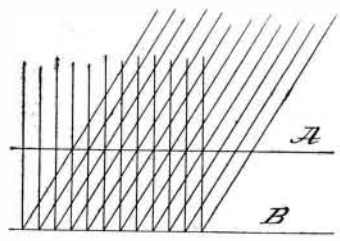
whether the drops fall obliquely or vertically, because in the former case the drops are nearer together. I do not seem to see it that way. I submit a diagram showing how it looks to me.



The drops of water in the same horizontal plane will be the same distance apart, whether they fall in slanting or perpendicular direction. The drops also pass between the two planes, A and B, in the same time, whether they pass in a slanting or straight direction. Manifestly, tilting the gage would make a difference because in so doing you would change or shorten the plane of the opening; changing the direction of the rain drops in the manner specified, however, does not change the number passing through a given opening in the same plane. A. The rain gage seems to have excited more interest than any other problem which has arisen in a long time. We will give a final word upon the subject. If rain falls vertically, and one inch of rain falls to the ground, the rain gage will show one inch of rain. That all are agreed upon. Now our additional statement is *if one inch of rain falls to the ground, at any angle of slope, a rain gage placed on the ground at that place will catch one inch of rain.* We do not see any escape from this conclusion. The cut in answer 8461 shows that fact. In order that an inch of rain should fall at a slant, the lines of the drops must be nearer together than if the rain fell vertically. There is no escape from that conclusion. If one inch of water falls upon a square foot from a storm and falls at a slant, the lines of rainfall will be nearer together than if it fell vertically from the cloud. Do not confuse the question. It is: With a given rainfall, will the drops be nearer together when the rain falls at a slant? It will be admitted by all that a rain gage set at the surface of the ground catches all the rain that the ground would receive if the gage were not there. Any other conclusion than this would be indefensible and inconceivable. The presence of the gage makes no difference (as has been before pointed out in the discussion) except for the eddies of the wind produced by the recess of the mouth of the gage. If one inch of rain falls upon a square foot, a rain gage set at that place will catch it; and if the rain falls at a slant, the lines of the drops will be nearer together than if it fell vertically.

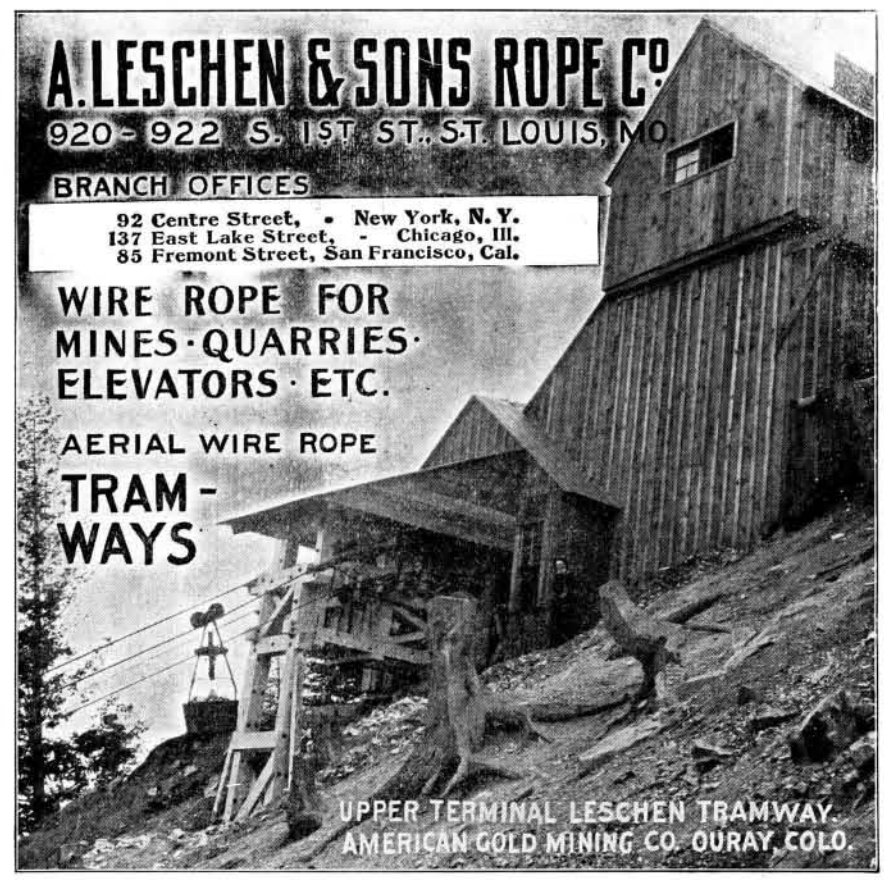
(8519) L. A. H. says: Please inform me as to whether there is a way by which the fly specks can be removed from chandeliers without taking them down. A. Have the water clean and boiling in two vessels. Dip in one water and then in the next as soon as taken from the nitric acid bath, so that there shall be no traces of acid on the fittings. Dry in box-wood sawdust while hot, and place upon a piece of hot sheet iron over a stove. As soon as all traces of water have left, quickly lacquer with very thin shellac varnish, using a camel's hair brush. You can make the lacquer by dissolving shellac in best alcohol. Do not touch the metal with the fingers before lacquering.

(8520) R. T. P. asks: Do you know of a material which is a non-conductor of electricity, which is as strong as steel, or do you know of a material which is nearly as strong? A. There is no other metal which is as strong as steel. If there were, it would not answer your purpose, since all metals are conductors of electricity. You seem to be seeking for a substance which does not exist.

(8521) H. A. H. asks: Can you inform me whether or not electricity is used on a phonograph while recording? If so, how? A. The phonograph is not an electrical apparatus, except that an electric motor is often employed to turn the cylinder. It can be turned by hand if any one prefers to do so. The phonograph is entirely an acoustic apparatns.

(8522) C. W. asks: If a rain gage was suspended on pivots like a ship's compass and having wing-like blades attached to the lower end of the gage, would it not in a high wind incline in the direction of the wind and give a more accurate record of rain fall? A. A rain gage fitted with wings to turn toward the wind would give too large a rain-fall. It would catch too much water, more than the same surface of the ground would catch. The rain gage should catch the rain which would fall upon an area of the same size as the mouth of the gage in the same circumstances.

(8523) W. A. M. asks: Will you answer through Notes and Queries whether or not the wind has any effect on a thermometer? That is if one thermometer is placed where the wind strikes the bulb, and another is placed so the wind cannot strike it, will they register the same? A. A thermometer in the wind should read lower than one in still air, unless the air is equally dry in both places. The reason is the same as for a person. A person feels cooler in a breeze than in still air because of the evaporation caused by the wind.



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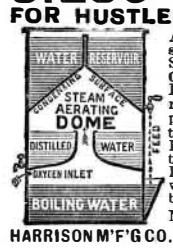

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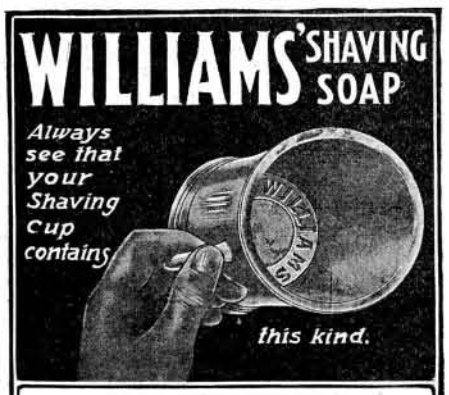

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