cause, when firing downward the bullet is accelerated by gravity, and the trajectory will be a smaller curve than in horizontal firing, requiring the breech sight to be low. When firing upward, the bullet is retarded by gravity, making the trajectory a greater curve than in horizontal firing, requiring the breech sight to be high. In shooting at game on the water, however, it is necessary to aim under the bird, as there is an optical illusion.

(46) W. A. G. asks: Are there any coal gas machines that are small enough for one or two families, and what price? We have here good coal for $1.75 per ton. A. We have not heard of any coal gas works or machines for a few lights. Naphtha and oil gas machines are made of suitable sizes for factories and hotels. Air gas machines, made by vaporizing gasoline and mixing the vapor with air, are numerous in this market, and of suitable size for small establishments.

(47) C. C. H.—For a durable drive way, a bed of asphalt and coarse sand two or three inches thick, laid upon a well rammed bed of broken stone three or four inches thick, is the best. A concrete bed of Portland cement and gravel laid upon broken stone is also good. The tar from a gas house, mixed with sand and laid upon broken stone well rammed and covered with a thin coat of loose sand and rolled, and given a few days to dry and harden, makes a very cheap drive way.

(48) C. E. De P. asks: 1. Where can I obtain the monoxide of copper, or how can I prepare it? I tried to do it by precipitating a solution of sulphate of copper with a solution of potash, but the precipitate instead of being black powder is a green insoluble substance. What is the trouble? What is the cheapest way to get it? A. Copper monoxide is prepared by calcining metallic copper at a red heat with full exposure to air, or, more conveniently, by heating the nitrate to redness, which then suffers complete decomposition. 2. What is the process of coloring kid gloves? What is the coloring material that is used? A. The gloves are generally stuffed with cotton, and the coloring matter applied by means of a sponge or cloth. 3. How can the gloss be best removed from photographs before coloring? A. To accomplish this, rub the picture with a little finely pulverized pumice stone, applying it by means of a buff badger.

(49) B. W. asks: Will a 4 inch pipe draw any more water out of a reservoir running down a hill 400 feet, than it will running down 33⅓ feet, each having same head over mouth of pipe? A. We understand you to mean the head above the point of delivery; if this is correct, your 400 feet of pipe would deliver slightly less than pipe 33⅓ feet.

(50) S. P. B. writes: In No. 6, SCIENTIFIC AMERICAN, vol. xxxii., of 1877, your paper gives a notice of the building at that time of a "two foot cheap railway," between Billerica and Bedford, N. H. Did this road prove a success? What is its capacity in freight? A. This road, proving unsuccessful, was abandoned.

(51) C. B. U. asks: 1. Can the string of a piano be made to vibrate hard enough to endanger its strength by *continually* striking its key note on some other instrument near by. Again, can a bridge (suspension) be made to vibrate by striking its key note on a musical instrument near it, so as to endanger its strength? A. The induced vibration of the string of the piano would, we presume, in time be sufficient to endanger its strength, although it will be less in volume than that from the strings of the initial instrument. Theoretically, yes.

(52) A. D. H. asks how to remove pimples from the face. A. The removal of pimples depends largely upon a correct diagnosis of their condition and a knowledge of their cause. Therefore, we would recommend consultation with a competent physician in regard to your difficulty. A receipt for the removal of comedones is given on page 52 of the SCIENTIFIC AMERICAN, for January 26, 1882.

(53) R. B. asks: 1. If the pressure per square inch of a boiler is 90 pounds, will the pressure in the water glass be 90 pounds per square inch also? A. The water gauge glass should and does have the same pressure as the boiler per square inch. If not, something is wrong. 2. Does an engine of 10 horse power with 9 in. stroke take more steam than a 10 horse power engine with 12 in. stroke? A. A 10 horse engine should take the same quantity of steam at 9 in. or 12 in. stroke. The diameter of the cylinder should vary inversely as the stroke for the same power. 3. Will a box of an engine that knocks because it is too loose become heated? A. A knocking box will be more liable to heat than a properly fitted box, the knocking having a tendency to throw out the oil and make the box dry. 4. Will a large shaft heat quicker than a small one, running at the same speed? A. If you take simply the weight of the two shafts into consideration, the large shaft will heat more quickly than the small shaft at same speed, because it has a greater weight, and contact surface rubs at greater speed. If, however, the shafts sustain considerable weight, so that the difference in the weight of shafts themselves becomes an unimportant factor in the problem, then the conditions are changed, and the smaller shaft will heat more rapidly than the larger, owing to the greater weight per square inch of bearing surface upon the former.

(54) A. W. asks if a Plante storage battery consisting of 40 pounds of sheet lead, having 7,000 square inches of surface, is capable of running one incandescent lamp for one hour? A. The battery referred to would run a small electric lamp for an hour. It would not, however, run one of the ordinary high resistance lamps.

(55) R. M. asks: 1. Whether "rotten wood ashes, principally from beach and sycamore," are valuable as fertilizer on red clay land, in which there is a mixture of gravel? A. Wood ashes are always valuable as fertilizers. 2. Would the refuse of a lime kiln having been exposed to the weather for a long time have value as a fertilizer? A. The lime kiln refuse is good in itself, and better mixed with muck. 3. My wife fails of success in using the bread recipe of "S. H.," in the SCIENTIFIC AMERICAN of Feb. 2, 1884. Is anything left out in the published recipe? A. The recipe of S. H. is the old-fashioned "salt rising," where yeast is not at hand. It is the production of yeast and bread sponge at the same time. If the conditions are observed and the flour is good, there need be no failure.

(56) S. R. writes: 1. What is meant by the pitch of a toothed wheel? A. The pitch line of a wheel is the circle upon which the pitch is measured. The pitch is the distance between the centers of the teeth upon the pitch line. 2. And the simplest way to take the pitch of any wheel? A. In properly constructed teeth the pitch line should be seven-tenths of the distance from the bottom to the top of the teeth. Thus, seven-tenths of the depth of one tooth multiplied by two, plus the diameter of the wheel at the bottom of the teeth, is the pitch diameter. This sum multiplied by 3·1416 gives the pitch circumference. This sum divided by the number of teeth gives the pitch. 3. Is it practical to line a horizontal engine without taking the piston out of the cylinder; if so, the best way to do it? A. It is practical to line a horizontal engine without taking out the piston, but it requires a practiced eye to work with outside lines. Lay a line over the center of the piston by plumbing down to center of head and rod; another line at the side of the piston on a level with the centers of head and rod. Measure your centers from each line, and set shaft and crank pin—the engine bed being first made level both ways, and the shaft bearing centers also made level with your center alignment.

(57) G. H. E. asks: Why are not dry gas meters used in place of wet ones? A. The dry meter is now the standard meter used by the great gas companies. The wet meter requires much care, and is liable to freeze in cold weather.

(58) E. Le D. asks how to clean nickel plated goods, so as to keep them bright? I have an Albo carbon cluster light (gas) in nickel, and I suppose the heat keeps it dull. A. Too much polishing with powder will soon destroy the nickel plating. Wipe thoroughly with a cloth moistened with kerosene oil as often as necessary. Occasionally add a little whiting or chalk to the cloths. If any parts are not burnished that require to be cleaned, a small brush with chalk and soap water will make the work quite clean.

(59) W. A. M. asks: 1. If an engine with an oscillating cylinder 1½ in. bore and 3¾ in. stroke would drive a boat 12 ft. long by 2 ft. 9 in. beam? A. Probably about 5 miles per hour, if the boat is of good model. 2. What size boiler would suit the above engine? A. Boiler should have about 43 sq. ft. fire surface.

(60) J. F. H. asks: Which of the two exhausts do you consider the best—a single or double nozzle—for a locomotive, or in fact for any kind of double engine? If you have preference for either, will you please state why? A. If strong draught is required a single nozzle is best, as it can be central to the chimney, but it must be borne in mind that with one nozzle, for exhausting from two engines, whatever be the back pressure produced, it affects *both* engines more than a double or twin nozzle.

(61) F. W. C. asks: Will a 3 in. pipe 50 rods long supply sufficient water for 2 rams, one using a 1 in. feed pipe, one a 2 in. feed pipe? A. What head is there on the 3 in. pipe, or how high is the reservoir which receives the water from brook above that which supplies the ram? If this is 8 ft. or more, 3 in. pipe is sufficient.

(62) W. S. M. asks for a receipt for sticking brass ornaments on to vegetable ivory? A. The following cement, which is recommended as satisfactory in attaching any metallic substance to glass or porcelain, will undoubtedly be satisfactory to you: Mix 2 oz. of a thick solution of glue with 1 oz. linseed oil varnish or ¾ oz. Venice turpentine; boil them together, stirring them until they mix as thoroughly as possible. The pieces cemented should be tied together for 2 or 3 days. See also receipts given on page 131, SCIENTIFIC AMERICAN for March 1, 1884.

(63) J. B. McC. asks if there is a composition that, put on rusty shafting, when taken off will take the rust off with it? A. Dip or treat the shafting with a solution of one part of sulphuric acid in ten parts of water. On withdrawing the articles from the acid solution, they should be dipped in a bath of hot lime water and held there until they become so heated that they will dry immediately when taken out. Then if they are rubbed with dry bran or sawdust, there will be an almost chemically clean surface left, to which zinc will adhere readily.

(64) W. H. H. asks: Can you state the name of the vessel which first crossed the Atlantic between England and America by steam? A. The American steamer Savannah went from Savannah, Ga., to Liverpool in 1819. This was the first steam propelled vessel to cross the Atlantic.

(65) S. E. asks: What is the drawing and lifting power of the strongest magnet? A. You do not say whether you mean permanent or electro magnet. There is scarcely any limit to the size an electro magnet can be made. Without knowing something of what you require we cannot help you.

(66) B. asks: What is the greatest speed ever attained by an ice boat, and if it attains a greater speed than the rate at which the wind blows at the time it is propelled? What explanation can be given for the fact that boat goes faster than the wind? A. With a twenty mile per hour breeze ice boats have run, on fine ice, at the rate of 70 miles an hour. If you squeeze a suitable wedge between thumb and finger, you will find the wedge to move further and faster during the squeeze than the fingers that impart the movement. On the same principle the ice boat, which is the wedge, may be driven three times or more faster than the propelling wind, when the latter acts against the inclined side or sail of the boat. If the wind were directly abaft, the boat would not go quite so fast as the wind.

(67) J. E. E. writes: 1. I have made one of the dynamo electric machines as described in the SUPPLEMENT, and I am satisfied it will work well if I can get the commutator in the right position. I cannot understand how or when it should change. A. The change should take place when the poles of the armature begin to recede from the poles of the field magnet. 2. How large a machine will I require to produce a light equal to two 4 ft. gas burners? A. A machine three or four times the size of the one referred to should afford as much light as two 4 ft. gas burners.

(68) A. McD. G. writes: I have a Daniell's battery of 4 cells, with which I am trying to do some electrotyping. Construction of the battery is correct, connections all right, and a good current is produced. But instead of a plate of copper, that metal is deposited on the mould in *powder*, which crumbles on being touched. Please tell me what is the matter? A. Try connecting your battery for a quantity current.

(69) H. G. E. asks: 1. What weight per square foot would solid ice 2 feet in thickness sustain, the ice resting upon the water surface? Could a train of cars cross in safety? A. Ice 8 inches thick will bear a weight upon sledges of 1,000 pounds per square foot (Haswell). We have no doubt that ice 2 feet thick will bear a railroad train if the rails are properly laid on the ice. 2. What ratio will correctly give the horse power of a body of water of different heads? A. To compute the power of a fall of water, multiply the volume of the flowing water in cubic feet per minute by 62·5 (the weight of a cubic foot of water), and this product by the vertical height of the fall in feet. Divide this sum by 33,000 for the horse power.

(70) A. N. J. asks: What form of a solid stands the greatest twisting strain—cylindrical, prismoidal, or other form? A. The cylindrical.

(71) J. M. G. asks: 1. What is a Bunsen gas burner, and how is it constructed? A. A Bunsen gas burner is one that burns with a non-luminous flame. It is often made by slipping a tube 3 or 4 inches long over an ordinary gas burner, and drilling air holes in the tube opposite the top of the gas burner. 2. What kind of a thermometer is used for high temperatures, such as melted cast iron, lead, or tin; and what is it made of? A. Pyrometers are used for high temperatures. See our advertising columns for these instruments.

(72) F. J. H. asks: 1. What the meaning of terms, mounted in tension and arranged for quantity? A. A battery is said to be connected for tension when the positive pole of one cell is connected with the negative pole of the adjacent cell, and so on. A battery is connected for quantity when all the positive poles communicate with one conductor, and all of the negative poles communicate with another conductor. 2. How shall I arrange a bichromate of potash battery for incandescent electric lighting? A. Connect it for tension. 3. What shall I coat an oak box with to protect it from the acid of a bichromate of potash battery? A. You might soak the wood in paraffine. Better use glass jars.

(73) O. A. B. asks: What size and quantity of magnet wire should be wound on a round iron core ¼ in. by 10 in., to make the strongest magnet, for a short time, with a single Leclanche cell, prism form, telephone size? Wind the opposite ends for 2½ in. with No. 24 silk covered copper wire. Let the depth of the winding be about ¼ in. or ⅜ in.

(74) E. A. G. asks: 1. What is the value or strength of exhaust steam as compared with live steam? A. Exhaust steam to have any value as a motive power must escape from the cylinder under pressure, and will detract so much from the efficiency of the engine; but in compound engines, where the exhaust of the high pressure cylinder operates the piston of the low pressure cylinder, a great gain in economy is claimed. 2. If exhaust steam is worked three times in an engine, what is the comparative strength of the steam in the workings? A. It depends altogether upon the manner in which it is worked. We doubt the utility of the third cylinder. 3. From whom could one get a disinterested, yet practical and scientific, opinion of the merits of a newly patented steam engine as compared with other engines? A. In any of our engineering schools you will find persons who would make the required tests.

(75) W. F. L. asks: How the carbon buttons in Blake transmitters are polished? A. You can readily polish the carbon button of a Blake transmitter by using the finer grades of French emery paper. Place the emery paper face upward on a level surface and rub the button on it.

(76) C. W. C. asks: What size pipes should be used to bring 15,000 gallons of water every 24 hours 4 miles under 150 feet head? Want the smallest that would do the work. A. This depends much upon bends in the pipe and smoothness of the bore. We would not recommend pipe less than 1¾ inch diameter.

(77) C. A. W. asks: Can you inform me how the papier mache fruit, etc., as used on the stage is made? Papier mache leaves, fruit, etc., are made by pressing the moistened paper, thick or thin according to the kind of work, in moulds, and then drying in the mould. Moulds should be slightly oiled with linseed oil boiled. Fruit is pressed in halves, and glued together. There is something in SCIENTIFIC AMERICAN or SUPPLEMENT about papier mache.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. P. C.—The specimen sent has no economic value as far as we know, except to dealers in minerals. Their valuation of it, however, would be very low.

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April 1, 1884,

AND EACH BEARING THAT DATE.

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