EVOLUTION.

Professor J. S. Newberry, of Columbia College, lately delivered a lecture before the New York Academy of Science on the subject of "Evolution."

The lecturer took the opportunity of presenting to his audience a careful *résumé* of the various shades of opinion of those who are arrayed in antagonism on this much discussed question. These were arranged under four groups.

The first, that represented by Mr. Darwin, who claim that all the complex and symmetrical forms of the fauna and flora, the animal and plant life of the present day, are derived from simple initial organic points, with the doctrine of the survival of the fittest.

Secondly, those who follow the leadership of Dr. Charles Bastian, who go a step further back, and claim that the initial point of life developed according to the Darwinian hypothesis is a life germ produced from inorganic substances. Of this class are the materialists or Abiogenesists; while Huxley, Darwin, and the most distinguished of modern biologists are Biogenesists; that is, they disclaim any knowledge or comprehension of life, except as the progeny of pre-existent life.

Thirdly, the group of thinkers of which Professor Asa Gray is a type, who accept the theory of evolution as an explanation of the method by which an inscrutable power has produced all the phenomena of creation. Its adherents see in the theory nothing inconsistent with the existence of a supreme Deity or with revelation.

And lastly, the class of which Professor Dawson, of Montreal, is the champion, who reject all forms of evolution as inconsistent with revelation and true science.

Professor Newberry next expressed his intention of stating some of the facts which geology offers to the sincere inquirer after light on this subject, rather than to advocate either one theory or another. In commencing this branch of the subject he observed that in past ages a series of rock formations has been made which inclose relics of animals and plants that lived in former times.

These series of rocks contain a more or less history of the changes which took place on the earth's surface through millions of years anterior to the advent of man.

The fossils of the Paleozoic and Mesozoic ages are about all extinct. It is only when we come to the Tertiary or Neozoic age that we meet with the remains of living forms.

What we call our terra firma is really a type of instability, for under the constantly acting process of contraction, the crust of the earth is constantly being moved and folded, and that somewhat irregularly, so that in all ages some portions of the land have been going up, other portions down, and wherever the surface passed below the sea level the water would flow in and deposit upon it one or another of the kinds of sediment which we find in the series of rocks. Sediments are still forming from the shells and skeletons of animals which inhabit the sea, and which in death sink to the bottom.

In each age there has been a subsidence of the land, which has permitted the sea to flow over and deposit over the submerged surface sediments which contain in greater or less numbers the remains of the animals and plants then living. This rock history is incomplete, because not all the forms of life which existed would be preserved, partly because many were perishable, and chiefly those that inhabited the seas or drifted into them would not leave any relics behind them. This history, though more complete than would be at first supposed possible, is confessedly defective, and has been but partially read. Great areas of the earth's surface have yet been unstudied by geologists.

While the subject is to be greatly illuminated by future discovery, there is very little probability that the general conclusions of paleontology will experience any important modification.

In tracing the appearance of the various forms of life upon the earth, Professor Newberry commenced with the mammals, which began their existence, so far as we know, in the Trias, but throughout the Mesozoic ages held an altogether subordinate and insignificant position.

The reptiles occupied the sea, the land, and the air, for they were swimmers, walkers, and fliers, the sea reptiles resembling the whales as we know them, and the sea serpents as we imagine them to exist at present.

The Professor next referred to the first bird so far as is known, the *Archeopteryx*, and described its form and those of the flying dragons or pterodactyls of the Jurassic and cretaceous periods

In the Tertiary, the vegetation was apparently more luxuriant and beautiful than that of the present day, for the grandest and most interesting of our living forest trees, the great Sequoias of California, the redwood and the mammoth trees, our tulip trees, magnolias, sycamores, and cypresses, are the lingering remnants of the magnificent forests which covered our continent even to the Arctic sea.

The Tertiary has been well named the age of mammals. Brute force then ruled the world; for man, its present master, had not yet appeared on the stage.

During the ice period the climate of Greenland was brought as far south as New York, and broken sheets of ice held all nature in the embrace of death for thousands of years. Whole races of animals and plants perished, but those forms that were driven far south survived, and ultimately moved northward with the amelioration of the climate, and were attended by a new element in the history of the world—primitive man.

Taking the geological record so far as it goes, Professor Newberry pronounced it authentic and credible, containing no personal equations, but automatic and necessarily true. The progress of life upon the globe bore evidence, in his opinion, that it was the expression of a law; in other words, that it is the operation of forces as distinctively determinative as those which produce and guide the motions of the heavenly bodies. The parallelism of the progress of life through the geological ages with that of the growth of an individual from a germ is so close that most students of paleontology are inspired with the conviction that the life forms of the different ages are links in a connected chain; in other words, that the later forms are derivations from those which preceded them.

This is evolution, and therefore most geologists are evolutionists, and they believe that evolution is not only exemplified in the progress of life, but that it is a law of nature.

"We now come," said Professor Newberry, "to the question of questions—What is the cause that has produced the progress of life? One group of geologists, with Mr. Darwin, believes that external influences have alone produced the diversity of animals and plants. Another group believe that the influence emanated from within the organism, and has been an essential feature in its life and growth. External circumstances have a most potent influence, as Mr. Darwin has shown; but we may well question the adequacy of the agencies he invokes to produce all the effects he claims for them. There are many facts which it is impossible with our present lights to reconcile with his theory."

Professor Newberry next indicated some of the difficulties which up to the present time have prevented him from accepting, in all its lengths and breadths, Darwinism as the theory of the Universe, and have compelled him to hold the law of evolution, not as a creed, but as a conviction.

There are the breaks in the chain of life, which, till they are filled, forbid the cautious scientist to accept as demonstrated the derivation of the later forms in all cases from the earlier.

Professor Huxley explains the persistent types of life by saying that if the spontaneous variations of a species do not give it an advantageous form or structure, that variety has not been perpetuated, or no profitable variation has been hit upon. Upon this Professor Newberry remarked:

"To my mind this explanation is inadequate, because I cannot conceive that a highly organized animal with a complicated structure like the nautilus should pass through the revolutions of the globe without being more affected than it has been by external circumstances, unless the life that inspired it was more potent than all surroundings and gave it independence of circumstances. That external circumstances alone could produce such a symmetrical and continuous development of organic forms, is something that with our present knowledge seems to me highly improbable. Geology up to the present time has not a word to say as to the origin of man. The theory that we are descended from apes is a speculation indulged in, based on anatomical resemblances in the living animals. No ape-like man has been found fossil, nor any man-like ape. Remains of monkeys and of savage types of men have been found; but even the Neanderthal skull was of average capacity, and, as Huxley says, might have contained the brain of a philosopher. No geologist professes to have proved anything like a connecting link between man and apes, and until such shall be discovered geology must be silent on the subject."

We fear that our readers on looking over this abstract of Professor Newberry's lecture will have a feeling of regret, that one so eminently capable of taking the highest views of this most important subject, should have almost confined his remarks to rudimentary observations and the antiquities of the subject.

The history of evolution and the geological record are now known to every schoolboy, and it would appear that Professor Newberry must have had but a moderate opinion of the members of the New York Academy of Science, if he thought that a rehearsal of some of the first elements of geology, and an outline of the Darwinian theory, would be news to the scientific academicians.

If those holding leading positions in the scientific world shirk the responsibility of clearly pronouncing their personal views upon subjects they voluntarily discuss before learned bodies, it gives a color to the meretricious statements of those who are now loudly proclaiming that scientists speak with a *suppressio veri*.

New Inventions.

Mr. Jacob Leutzinger, of Hillsborough, Mo., has invented an improved Brake Block Holder for wagons, which consists of an arrangement of flanged plates, having interior projections for preventing the brake block from slipping, which are clamped together by bolts, and secured to the brake bar by a recess or lug.

A Device for Calculating Percentage, intended for lessening the labor involved in computing taxes and similar fixed percentages, consists of a table formed in radial columns, over which a pivoted indicator is moved, the arrangement being such as to show at once the amount of tax upon any given sum. This device is the invention of Mr. J. L. Knight, of Topeka, Kan.

In a new Animal Trap, invented by Mr. David McGuire, of New Garden, Mo., the cage slides upon a central upright rod, is detached and falls when the trigger, holding the bait, is actuated, and is kept from being lifted from the bottom of the trap by a spring catch.

An Ointment for use in skin diseases has been patented by C. J. Beattie, of Pueblo, Col.

Mr. S. A. Brumbaugh, of Harrisburg, Pa., has invented a Coupling for soft metal pipes and hose, which consists of a short tube, with ratchet threaded conical ends, which fit into the ends of the pipes to be coupled. A central collar has apertures to receive a spanner.

A Stirrup Supporter, the invention of Mr. L. F. Johnston, of Pocahontas, Ark., has a spiral spring, contained in a slotted rectangular case, so arranged that the stirrup straps pass over a sliding plate at the upper and movable end of the spring.

In a new form of Wheelbarrow, invented by Mr. Wm. Eckert, of Jersey City, N. J., each side bar is made of a continuous piece of angle iron twisted about one fourth of a turn at its forward end, in such a manner as to present one of its flanges for the reception of the bearings of the wheel, and the other for the support of the box of the barrow. Wooden handles are attached to the rear ends of the side bars.

Mr. Isidor Kann, of New York city, has invented a Hair Crimper, in which the bent wire or hair pin has a notch or loop formed in its bend to receive the eye of the binding wire and prevent it from slipping.

Messrs. A. Milne and A. Jourdain, of Newark, N. J., have invented a Watch Crown which dispenses with the usual brass core. It has an inner shell or section of suitable thickness, to which a steel socket is attached, and an outer covering shell.

In a new Shutter, invented by Mr. Asher Bijur, of New York city, the slats are adjusted at any inclination and retained in position without any visible slat rod. The mechanism is arranged on the inside of one stile of the shutter frame, and is thus protected from corrosion. The slats swing in end journals in a detachable frame, and motion is communicated by short crank arms connected by a rod and counterbalanced.

A Reversible Latch, consisting of a sliding bolt acted upon by a spring, and operated by a cam of the spindle socket, has been invented by Mr. C. H. Labelle, of Keeseville, N. Y.

Mr. August Hoen, of Baltimore, Md., proposes to provide street lamps with Reflectors, which may be adjusted at various angles for deflecting and thereby utilizing the rays of light which would otherwise escape upward in an oblique direction.

Mr. Daniel Hayes, of New Orleans, La., has invented an improved Mode of Stowing Cotton Bales in the holds of vessels. The inventor proposes connecting the two opposite upper and lower surfaces of two adjacent bales by hooks and an adjustable chain, while under the pressure of the jack screw.

A Chest Protector, invented by Mr. G. F. Jackson, of Minneapolis, Minn., consists of a chamois pad, formed by the combination of a front and a back pad, to be used singly or in connection with an under vest of suitable material.

A Marking Device, intended to take the place of stenciling and brush marking, has been invented by Mr. W. T. Morgans, of Liberty, N. Y. The invention consists of a stock having a groove in its curved face for receiving types, together with suitable clamping devices for retaining the latter in place.

Mr. Martianus Ross, of Abilene, Kansas, has patented an improved Bootjack, the essential features of which are the addition of a rigid heel piece at the rear end, to prevent the foot which holds the jack in position from slipping, and a rounded-off bow or toe piece, which bears on the toe of the boot to be removed.

A Window Blind Stop, invented by Mr. W. B. Surdam, of Fort Dodge, Iowa, consists in the combination, with the blind slats and their connecting bars, of pivoted levers arranged on the blind frame, and operating levers passing through the casing, in such manner as to furnish a secure locking device.

Patent No. 200,000, of the United States Patent Office, covers the claims of Messrs. Mortimer Shea and J. McC. Hamilton, of Nashville, Tenn., relating to an improved Carbureting Apparatus for enriching illuminating gas, mixing and thus diluting it with air in suitable proportions, carbureting air, and thus making gas from gasoline or other volatile hydrocarbons, and for other purposes.

Mr. T. P. Magruder, of Rushville, Ill., has invented an improved Gate Latch, which is semicircular in form and provided with a lug through which passes a screw whose arrangement with reference to the latch guard, or other fixed abutment, adjusts the latch so that it will always strike on the bevel of the keeper, and thus enable the gate to latch easily when swung shut.

A new Temporary Binder, or file for letters, receipts, and other papers, has been invented by Messrs. J. W. Shoemaker and Samuel Dodsworth, of Leavenworth, Kansas. It has a combination of fixed vertical tubes, which hold the papers, and needles having transversely apertured heads, whose shoulders rest on the top of the tubes, while the shanks of the needles extend down into the tubes; these are arranged on a plate of suitable material, one edge of which is turned up at right angles to form a gauge for evening the papers.

Mr. C. C. Schwaner, of Winterset, Iowa, has invented an improved Trace Carrier, which is claimed to prevent the eyes of the traces from being detached, and to be so arranged that the lines or tail cannot catch upon it, while the traces may be readily taken out of the carrier when they are to be applied to the whiffletrees.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Notes & Queries

E. L. C. is referred to p. 396, SCIENTIFIC AMERICAN, December 22, 1877.—C. L. P.—As we understand you, it does not appear to necessarily make much difference.—W. C. is referred to SCIENTIFIC AMERICAN January 7, 1866, pp. 22, 23; September 29, 1877, pp. 195, 196; October 6, 1877, pp. 207, 212.—J. S. D.—See SCIENTIFIC AMERICAN, January 30, 1875, pp. 64, 65.—D., F. & Co.—We do not recommend special manufactures in "Notes and Queries."—J. G. P.—See SCIENTIFIC AMERICAN, January 19, 1878, under head of minerals.—W. H. C., P. M. Co., and others.—We do not give addresses in this column.—T. J. S.—See SCIENTIFIC AMERICAN, February 2, 1878, pp. 64, 65, 71.—C. B. M.—Write to the Secretary of the Navy and to the Congressman from your district.—F. I. should consult some standard treatise on the subject. The explanation would require more space than we can give it in these columns. There are tables in print complete enough for most purposes.—J. M. L., and others.—Insert a notice in the "Business and Personal" column.—W. W. M.—It will be perfectly safe, if the old boiler is in good condition. —F. L. can obtain explanations from the publishers.—M. C. F.—Consult any modern arithmetic.—J. S. H.—If you have a chimney high enough to give a good draught, we think you will find the proposed mode of setting satisfactory.—H. V.—From your account it looks as if there were a leak either in the pump packing or in the connections. A check valve, it seems to us, would be of no advantage.—W. P. R. will find the information in any good modern geography.—A. does not furnish sufficient data, but it appears safer to use wrought iron for any pressure.—W. F. B.—You might make the machine in the manner shown in the sketch, so far as we can see.

(1) W. G. W. wishes to know how to get rid of cockroaches. A. A mixture of red lead, Indian meal, and molasses will be eagerly eaten by them and will soon exterminate them. Paris green, phosphorus, or arsenic are sometimes used, but are very dangerous. Borax, to which cockroaches have a great antipathy, will drive them away.

(2) J. R. B. asks: What is the method of skeletonizing the leaves of ferns, etc.? A. These skeletons are usually prepared by soaking the leaves in blood-warm water until the thin membranous parts have become sufficiently softened by putrefaction to be easily washed out. Dip the remaining portion in a dilute aqueous solution of sodium sulphite, and dry slowly on a piece of bibulous paper in the air.

(3) H. B. writes: In a recent article in the SCIENTIFIC AMERICAN concerning the Barclay street fire, it is stated that a considerable quantity of chlorate of potash was stored in the building, and it occurs to me that the secret of the explosion might perhaps be found in the fact that a mixture of this salt with loaf sugar becomes explosive when it is acted upon by a third substance that has the property of liberating the oxygen contained in the chlorate, as, for instance, sulphuric acid. The finer the particles, the more perfect the union and more rapid the explosion. An investigation into the articles commonly in use by confectioners might possibly discover some substance which was capable of producing this effect. As two of these substances were present in the building this theory seems fully as plausible as those that have been presented, if not more so. A. True; but the third substance—a concentrated acid—was wanting. The hypothesis, as well as that involving undue friction in compounding the chlorate lozenges, was, we believe, fully considered and disposed of in the investigation.

(4) B. W. asks: How can human skin be tanned? A. Either by the ordinary tannic acid bath or by the alum process. 1. Roll the clean skin up with a thick layer of ground hemlock bark between each convolution, cover it with water in a suitable vessel, and allow it to remain thus until the gelatinous tissues have become converted throughout. 2. Soak the skin in water, scrape off the epidermis, pass through and then digest for 10 minutes in a boiling bath composed of 1 lb. salt, 5·2 lbs. alum, and 6 gallons of water; then add 6·7 lbs. wheat flour and the yolks of 21 eggs to the warm alum bath, and digest with the skins for a day or more. The proportions are for 40 skins. The skins to be dried on stretching frames in the air, moistened with water, rubbed, and after a few hours ironed.

I inclose an illustration of a fountain in which (without any apparent pressure) the water rises above its own level. Will you explain the reason? A. The principle concerned is that of Hero's fountain, described in most elementary works on natural philosophy. It depends on the transmission of the pressure sustained by a body of water in one vessel to that in another by means of the elasticity of the air.

(5) C. T. H. writes: I intend building a dry room to dry animal scraps. Would it be better to have plenty o. ventilation, and so arranged as to have a good circulation of fresh air passing through the room, or should I have just enough ventilation to carry off the damp vapors? A. Plenty of ventilation is best.

(6) C. H. S. asks: In what part of the drying room of a laundry should the ventilators for carrying off the steam (or rather the evaporation) be placed? A. At the bottom near the floor.

(7) J. W. asks: 1. Which is the stronger and will stand the weather better, a pressed brick or a hand made brick? A. The pressed brick is the stronger, and will stand the weather better than the common brick, when equally well burnt. 2. Can a man lay as many pressed brick a day as he can hand made brick? A. No.

(8) G. P. H. asks: Is it practicable to irrigate a tract of land lying about 100 feet above the level of a river? The land very gradually recedes from an elevated point, 200 feet from the river, where a reservoir could be made. What power and pump must I use to irrigate about 25 or 50 acres of this land? A. It is practicable to do so, but before the kind of pump and size can be determined, it will be necessary to have some further data, as, first, the kind of soil; second, the amount of rainfall; and third, the nature of the crops to be raised.

(9) A. S. writes: My dwelling house is situated on the most elevated point of my farm, the ground sloping gently therefrom on all sides; at a distance of about 900 feet from my house a small creek flows through the farm, which is mostly fed by three never-failing springs close together at this point. I am about excavating for, and having a small fish and ice pond, of about 80 x 200 feet, and from 2½ to 6 feet in depth, constructed in such a manner that all the springs will flow directly into the pond, while the rain water of the creek will flow past. In the attic of the house are two tanks holding about 20 bbls. each, besides another tank holding about 15 bbls., which is used for supplying the house with hot and cold water according to modern improvements; this tank is in turn supplied with water from the cisterns by a force hand pump, and works very satisfactorily, and with but little labor. The top of the two large tanks is about 38 feet above the ground about the house, and this surface is about 40 feet above the level of the water in the pond. I am also about constructing a small fountain in front of my house which I intend to supply with water from these tanks. What is the best, the cheapest, and the most satisfactory mode of filling the tanks with water from the pond, so as to keep the fountain playing at least during the spring, summer, and fall months? I will further add, in case a ram should be suggested, that a fall of 3 feet can be obtained for a distance of the first 10 feet, and about 1 foot for every additional 10 feet in distance; but I doubt very much whether that would be sufficient fall for the work required, and besides in very dry seasons, although the springs never fail, yet they get very low, and will probably not yield more than a barrel an hour each. A. By setting the ram in a pit in the ground, the requisite descent for the supply pipe can be obtained, provided a low point can be secured to which to drain the waste water. The ram will then throw the water to the required distance and elevation, if you provide pipes of a sufficiently large diameter for the purpose. Let the orifice in the ram be enlarged to 2 inches in diameter, and the pipes be of the same size. Sometimes two rams are set connected by proper valves to the same pipes, so that one may be repaired without stopping the supply of water.

(10) S. S. asks: What is the largest gun evermade? A. The 100 ton guns made in England for the Italian navy are the heaviest thus far, but still larger ones are projected.

(11) J. W. M. asks: Can a locomotive, on a straight and level track, pull a train attached to it by a connection 100 yards long as easily as by the ordinary coupling; and can an engine drive a circular saw, distant 100 feet, as easily as if the latter were only 10 feet from it? That is, does distance add resistance? A. As we understand your question, neglecting the weight and rigidity of the lengthened connection, there will be no difference in the two cases.

(12) A. A. G. asks: What is the most successful method of preventing wrought iron from rusting, when laid in the ground? A. Galvanizing, we think.

(13) J. F. asks: What will be the effect on a boiler of water containing 19 grains of sulphate of lime and 2 grains of vegetable matter to the Imperial gallon? A. Scale will be formed, unless you purify the water.

(14) C. A. S. writes: Suppose a cannon ball were fired out of a cannon in a vertical position; when it attained the height reached by the force of gunpowder, would it return to the earth at the same velocity it ascended? A. No.

(15) E. P. C. writes: The water in a boiler of a high pressure tugboat was blown off the other day, washed and filled up the next day, and just as the fireman started the wood in one furnace and was going to start the other, he heard a report as if something had given away inside the boiler, and when he investigated the matter he found a crack in one of the side sheets about 14 inches long, taking in three socket bolts. The boiler is only two years old. Can you throw any light on the subject? A. We judge, from your account, that the mischief was done when the boiler was blown down, by allowing it to cool too rapidly, and was developed as soon as the iron was reheated.

(16) M. M. C. writes: 1. Is there not something wrong about the following formula for flywheels, taken from Rankine's "Machinery and Millwork:" $w = \frac{mg \Delta E}{v'^2}$? If v'^2 is taken to mean the square of the velocity of the rim in feet per minute, it gives an answer absurdly small; and if a second be substituted for a minute, the reverse is the case. A. The velocity in the formula referred to is in feet per second, and the formula, we think, gives correct results when rightly applied. 2. Does Rankine's "Manual of Applied Mechanics" give examples of the practical application of his formulas to the construction and designing of machinery? A. Rankine's "Applied Mechanics" simply shows the manner of determining the various formulas. The applications are given to some extent in his "Machinery and Millwork" and "Treatise on the Steam Engine."

(17) F. S. M. asks: Has common gun or blasting powder more of a tendency to throw up than in any other direction? A. We imagine the tendency is to throw in any direction in which the resistance to motion is least.

(18) I. H. P. writes: I am desirous of constructing a counter fountain, to play beside my soda fountain, and not having aqueduct water I will have to appeal to you for instruction. I see an automatic counter fountain advertised, but it does not throw a stream with sufficient force. I want a jet to play under a bell glass with such force that it will cause that peculiar ringing noise which makes such fountains so attractive. A. By using a reservoir of compressed air, you can obtain as powerful a jet as you desire.

(19) W. E. writes: Please inform me of a practical method of mixing plumbago with molten copper, tin, or lead. I am sure that it can be done, but I do not know what is put in with it to fasten it. I have tried, but it will not mix, nor does the plumbago affect the metal at all. A. Heavy pressure may possibly be more efficacious than high temperature.

(20) W. H. W. asks: How can I remove a thick deposit of scale and mud from the tubes of my boiler (locomotive type)? A. Some forms of scale can be softened and washed out by allowing the water to remain in the boiler, after the fire is hauled, until it is quite cool, and then running it out. Other kinds of scale are so hard that the only practical means of removal is by taking out the tubes.

(21) E. J. M. asks: How can I construct a barometer? Must I use alcohol, and what other substance must I use in conjunction with it that will rise and fall in the glass as the changes in the atmosphere occur? A. Mercury is the liquid ordinarily used in barometer tubes, since the column of liquid is sustained by atmospheric pressure, and would be inconveniently high if alcohol was employed. You can purchase accurate mercurial or aneroid barometers of a dealer in scientific instruments, or may try the plan described in the SCIENTIFIC AMERICAN of March 2, 1878, p. 135.

(22) H. L. writes: Two tanks stand side by side and connect through a short pipe. A pipe descends from each 12 feet, and each pipe enters an iron box in the stove. The tanks are filled with cold water, and by means of pipes and box a complete circuit of water is established. When a fire is put in the stove the water in the box is heated, and hot water passes up one of the pipes to the tank. What gives the hot water a tendency to one pipe rather than the other? One philosopher answers the question by saying that one pipe enters the box at a higher level than the other. That does not quite satisfy me. A. We think it probable that the philosopher's view of the case is correct, if the facts are as he states.

(23) H. C. M. recommends that B. P. L. (p. 140, current volume) try the following, to stop the leaks in his skylight: 20 parts white sand, 2 parts litharge, 1 part lime; mixed dry and then with boiled linseed oil. Our correspondent states that this mixture will set very quickly and make a hard cement.

(24) W. H. C. writes: I have a Selden steam pump; diameter of cylinder 8 inches, stroke 8 inches, bore of water cylinder 3 inches, ¾ inch live steam pipe, 1 inch exhaust, 1½ inch suction pipe, 15 feet long; it discharges through 1½ inch pipe about 70 feet, with about 40 feet rise above the level of the pump. The friction in the discharge pipe consists of 10 ells, 4 unions, 1 T, and 2 1½ inch Globe valves. The pump does not work very satisfactorily. I think that the pump will do its work better if fed through a 1 inch steam pipe, with 1¼ exhaust. The person who put it up says it would be of no advantage to connect it differently. I am now using 20 lbs. steam. A. An increase in the size of the discharge pipe would probably be more beneficial.

(25) W. E. L. writes: We force water from a well 70 feet up to a tank by means of a Hooker pump. It discharges into the tank from the top. If the pipe had entered from the bottom about 50 feet of pipe could have been saved, but it was thought by a friend that the pressure from the water in the tank would be too great for the pump. I claimed it would be no greater from its entering the bottom, in fact not so great, unless the tank was kept full. In putting in the pump, the original suction was 2½ inches, and the discharge 2 inches, but he changed it and made the suction pipe the same as the discharge, and said it would be better if the suction was ½ inch smaller than the discharge. This I claim was wrong, and that the suction should be larger than the discharge. A. As you state the cases, we are inclined to agree with you.

(26) M. J. C. writes: Please explain the interior construction of the American steam gauge, or how the steam acts on the interior so as to indicate the pressure on the dial? A. The pressure acts in a coiled elliptical tube, tending to make it round, and the end of the tube is connected to the hand by levers or rack work.

(27) P. R. writes: 1. I have an old electric battery. I wish to use it for giving shocks, sparks, and for heating small wires. Please tell me how to connect and charge it. The battery consists of a rectangular box (of vulcanized rubber) 12 inches long and 7 inches wide by 9 inches deep; divided into four compartments, two zinc and one carbon plate (6 x 8 inches) for each division, hanging on an insulated brass rod, with knobs of the same metal on each end, resting in bearings at each end of the box. A. You can charge your battery with a solution of bichromate of potash in water acidulated with about one thirtieth of its weight of sulphuric acid. Connect the two zincs of one compartment with the carbon plate of the next compartment, so that one terminal of the battery will consist of two zinc plates and the other terminal will be a carbon plate. A wire connected with the two zinc plates is called a negative pole, and a similar wire connected with the carbon plate is called the positive pole or terminal of the battery. Now if your zincs are thoroughly clean and the connections well made, a very fine shred of platinum placed between the poles so as to be in circuit will become white hot. To give shocks you will need an induction coil (see p. 251, SCIENTIFIC AMERICAN of October 20, 1877), having its primary coil in connection with the poles of your battery. 2. What kind of cement shall I use to repair the box? There are some cracks in the bottom of it. A. Have the box thoroughly dry and clean, and fill the cracks with a mixture of rubber cement and pulverized sulphur.

(28) H. D. I. asks: What is the diameter of the disks in M. Trouvé's moist battery, described in the SCIENTIFIC AMERICAN of October 3, 1877? A. They may be made about 6 inches in diameter.

(29) C. H. B. asks for instructions in preparing paper for taking leaf photographs. A. Pass the paper first through a solution of gelatin, 1 part in 20 parts of hot water, and use a strong solution of potassium bichromate; or the gelatin and bichromate may be used