RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE BOILER FURNACE.—John Milton, Alexandria, Va. This is an improvement in other boiler furnaces of the same inventor, in which air is introduced into the fire box through perforated pipes in an inclined partition above the fire, protected by water beds or refractory jackets. According to this invention, water pipes are arranged in the fire box above the fire and have communication at both ends with the water space of the boiler, the pipes supporting two layers of detachable fire brick having cavities in their adjacent faces and perforated air pipes being arranged between the layers.

Railway Appliances.

CAR TRUCK.—George F. Fischer, Rochester, N. Y. This truck consists of saddles connected with standards connected by a spring truss, a bracket connecting the saddles being supported by the truss, while also connected with the truck is a center bearing and friction rollers, the latter being received by a platform provided with slideways. The truck will support any car body, or may be used in pairs or in any desired number, or may be used without a floor as a support for a tank body, or as a flat or logging car. A special form of coupling is provided, and the trucks automatically return to the center of the body which they support when passing from a curved to a straight line of track.

COAL CHUTE.—John F. Schmadeke, Brooklyn, N. Y. For use where coal is liable to be broken by being dropped from cars on a high dump this invention provides a novel form of chute for connection with the hoppers. The chute is open at its top and has one side open, but adapted to be closed by a series of vertically sliding doors, which may be successively raised, beginning with the lowest door, so that the chute may be opened for a little distance from the bottom or for its entire height, according to the quantity of coal to be discharged.

Electrical.

BATTERY.—Charles H. Brown, Portland, Oregon. This battery has positive plates formed of an alloy of zinc and aluminum, preferably equal parts, the aluminum being first melted in the crucible and the zinc added, when the whole is agitated until the mixture is complete. Great economy is thus designed to be insured in the protection of the current, and by employing a number of positive plates, placed near each other but not in contact, the electrolyte is economized. The battery may be used for either open or closed circuit work for motors, electric lighting, etc.

Mining.

ORE SEPARATOR.—Robert Dilworth, El Paso, Texas. To rapidly separate gold and silver from sand and other tailings is the especial object for which this machine has been designed. A box-shaped table held in inclined position and supported on links carries pans separated from each other by transverse riffles, the lowermost riffle discharging into a trough through which pass the finer tailings, and there being mechanism for giving longitudinal and lateral oscillation to the table and a screen secured on it over the riffles. The heavier tailings do not pass into the riffle pans, but may be returned or delivered to a stamp for further treatment.

Agricultural.

HARROW.—Augustus Neal and Robert B. Suhr, Ashland, Neb. This is a sulky harrow in which provision is made for the use of parallel rows of teeth, to be laterally reciprocated in opposite directions when used upon an unplanted field. Means are also provided whereby certain of the teeth may be removed and a shield attached to the beams carrying the teeth in such a manner as to cause the shield to cover and protect young plants while the ground is being cultivated around them. By means of a simple and easily operated device the teeth may be made to enter the ground more or less deeply.

AUXILIARY MOULDBOARD FOR PLOWS.—Charles E. Fox, Natchez, Miss. This is an attachment to enable an ordinary plow to be used successfully in cultivating small plants, the auxiliary mouldboard facilitating the placing of the earth around such plants without injuring or covering them. The auxiliary mouldboard is shallow as to width and has a graduated overhanging upper edge curved upwardand outward from the body, the forward end of the overhanging section meeting the front edge of its body portion, while the rear section is arched over the rear upper edge of the body. By the use of this device the storage and cost of an extra implement may be avoided.

ROTARY PLOW AND PULVERIZER.—George F. Whitmore, West Union, Iowa. The rotatable digger frame has colter disks connected near their outer edges by radial blades forming buckets in which operate followers automatically discharging the dirt after it has been elevated. A pulverizing platform receives the dirt forced out of the buckets and drops it to the rear of the colter frame.

Miscellaneous.

PRODUCING CHLORINE AND PURIFYING LEAD.—Farnham M. and Cecil H. M. Lyte, London, England. This invention covers a process whereby chlorine is produced conjointly with the purification of lead and recovery of silver therefrom, the process being based upon the decomposition of a soluble chloride by nitrate of lead. The operations are carried on in a cycle, fresh quantities of lead and of calcic chloride being added for each cycle, the same nitric acid being used over and over again indefinitely, while silver is recovered as rich silver from impure lead, and pure lead is recovered, the calcic chloride liquors being decomposed into chlorine and lime.

VACUUM PUMP.—William S. Moore, New York City. This is a portable apparatus with a vacuum chamber, into which leads a pipe from a retort, in which ammonia may be subjected to heat, producing gas, which expels the air from the chamber. The exit pipe being closed, the gas is condensed by the admission of a few drops of water from a sealed cap, when, by opening a valve in an inlet pipe, the vacuum chamber may be filled with any fluid desired by placing the inlet pipe in communication therewith.

PIPE FITTING.—John McIntyre, Jersey City, N. J. This fitting is provided with an annular recess, from which extend branch openings to the pipe sections, a nut screwing in the recess to press the packing material through the branch openings into the pipe sections. A metallic packing is also provided, formed by concentric rings connected with each other by branch arms, the fitting very securely connecting the pipes with each other without danger of leakage at the joints or through sand holes or other defects in the castings.

A further patent of the same inventor provides a fitting more especially designed for pipes carrying corrosive fluid, to prevent leakage by the destruction of the threads in the couplings or other pipe fittings. The fitting has nuts having differential screw threads, and screwing one in the other, and both on the adjacent ends of the pipes, there being a packing between the nuts and pressed in contact with the joint of the pipes when the nuts are screwed up one on the other.

BRACE FOR TRENCHES, ETC.—George M. Pilcher, Logansport, Ind. A bearing block is connected with a plug in one end of an open-ended tube by a universal joint, while a head screwed on the other end of the tube has a removable outer annular section, through which a screw rod extends into the tube, a bearing block being pivotally connected with the screw rod at its outer end. The device is especially adapted for use in bracing the banks of excavations, being of simple and durable construction, easily applied and adjusted, and not liable to have any of its parts accidentally detached.

BATTENS AND PADDING IN HOUSE BUILDING.—George Knower, Greenwood, Wis. Thin, flexible lumber for making arched wooden ceilings by being bent into form, and too thin for tonguing and grooving, is liable to shrink and expose the joints—a defect which this improvement is designed to obviate. For this purpose battens of peculiar construction are provided, with padding of a paper material, so that on the shrinking of the lumber the padding and battens keep the joints closed and water and air tight. This padding and battens may be readily applied and made to serve as an ornamental finish for the woodwork.

WAGON SEAT.—Charles C. Field, New York City. This invention provides a simple and strong seat support, useful particularly on city trucks, to permit the driver to conveniently swing the seat over when not in use. Sockets are secured to supporting posts on the truck floor, and each of the sockets is formed with a rest, which is engaged by a bar hinged on the socket and fastened to the seat proper. The seat is readily swung forward and folded against the front sides of its supporting posts when not in use.

OILCLOTH CUTTER.—James W. Lewis, Ganister, Pa. Dealers who cut oilcloth from the web are provided by this inventor with a cheap and simple device by which the cloth may be conveniently measured, squared, and cut off. It comprises a guide, consisting of parallel and slightly separated strips, having longitudinal grooves in their inner edges, and a knife adapted to slide between the strips, with a guide plate at its lower end sliding between the grooves. A tape measure is hung at one end of the guide.

CABINET.—William S. Stanley, Washington, D. C. A chiffonier or chest of drawers, washstand, etc., is afforded by this improvement, the construction being such that when the cabinet is not used as a washstand or dresser, its upper portion will be closed and conceal all contained therein. The front panel may be occupied by a mirror, and brought into the best position for use without interfering with the furniture of the washstand, and the sides may be used as splashboards, with or without mirrors.

SPRAYING DEVICE.—John J. Dugan, Salem, Oregon. For spraying plants by hand, the hollow handle of this device is adapted to support any desired form of nozzle in such way that it will by gravity assume a position to direct the sprays upward, so that the water may be directed to the under sides of the leaves. The device is particularly adapted for sprinkling solutions to kill insects on the plants.

CIGAR-TIP CUTTER.—Ira C. C. Rinehart, Kansas City, Mo. This is a portable device, to be set on a counter, and it has a coil spring mechanism with revolving cutter, and an escapement with gears and trigger tripped by the entrance of the cigar tip, thus allowing the cutter to rotate and cut off the cigar tip.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

HOME WARMING AND VENTILATION AND HERENDEN MANUFACTURING COMPANY'S SOUVENIR EDITION OF CATALOGUE OF FAULTLESS FURMAN HEATERS. Geneva, N. Y. 1893. 16mo. Pp. 64+288, illustrated.

Both the hot water and steam heating systems are described. The souvenir catalogue is chiefly filled with half tone cuts of houses in which the heating apparatus of the Herenden Company has been installed. The pamphlet on home warming and ventilation is composed of a collection of articles by persons who are thoroughly familiar with the subject but who are not connected with any business firm, so that their judgment in regard to various systems is not biased by mercenary motives.

ELECTRICITY UP TO DATE. By J. B. Verity. London and New York: Frederick Warne & Co. 1893. 16mo. Pp. 163. Illustrated. Price 75 cents.

This little work has now reached its third edition. We learn from the preface that the author finished his work in January, 1893. The book is intended for non-professional readers and does not go into details. It probably answers a useful purpose among this class of readers.

Notes and Queries

HINTS TO CORRESPONDENTS.

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.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5320) The Harrodsburg Water Company write: Is there any phone attachment by which you can detect leaks in water pipes, such as dropping wire in service box or attaching same to pipe? Also, I have a pressure gauge at pump station graduated in pounds and feet, by which I determine when stand pipe is full. When same is at rest I have no trouble, as the hand is still and steady, but, while pump is working, the hand vibrates 15 or 20 pounds, and cannot tell when pipe is full only by stopping the pump. Is there any attachment to steady same? I take pipe to gauge out of discharge of pump. A. There has been a number of devices invented for detecting water leaks and waste from neglect during the night, by attachments to the street service pipe; some by phonograph and others by differential pressure by nearly closing the street cock. There are practical difficulties in their adaptation, mostly in the expense of maintaining a uniform system. It was tried in New York some years since, and found to cost more than the lost water. By putting a cock in the pressure gauge pipe and almost closing it, the gauge hand will not vibrate to any extent, and the mean of the small vibration will show the pressure or height of water in the stand pipe. By simply holding a rod of wood against the pipe, a current of water passing through it can be detected. If the cocks are supposed to be closed, such current would indicate a leak.

(5321) W. F. S., Jr., Sandusky, O., says: I send you a specimen of worm found in a yard adjoining our premises. It was found lying on the sidewalk under a crab apple tree. As nobody around here ever saw one like it, any information you may give in the columns of your valuble paper concerning it will be of interest. A. Reply by Professor Riley: The specimen is the larva of the Turnus swallowtail (*Papilio turnus, Linn.*), a large and handsome lemon yellow butterfly, the wings of which are banded and bordered with black. It is not uncommonly seen flitting about orchards and over meadowlands, and is one of our handsomest and most striking species. It is widely distributed, being found in nearly all parts of the United States and Canada, and its larva feeds on a great variety of trees and plants and affects particularly apple, cherry, and allied trees and also basswood. The larvæ occur singly and are rarely abundant enough to be of any economic importance, and have a purely æsthetic and scientific interest. The very young larvæ are black in color, roughened with brownish black tubercles. When full grown the body is smooth and greenish, thickening toward the reddish brown head. On the dorsal edge of the first segment is a raised yellow fold from which the larva protrudes, when disturbed, a fleshy, yellow, forked organ giving off a very disagreeable odor, which is the means of defense of this otherwise helpless larva against its vertebrate or other enemies. Other markings peculiar to the larva are a raised yellow fold on the hinder portion of the fourth segment, bordered with black, and an eye-like spot inclosed with black on either side of the third segment. The larva transforms to a chrysalis in the early part of August, fastening itself for support to fence posts or other objects by the help of a silken band around the middle of the body. This chrysalis changes to a dull brown color, and in this state the insect hibernates until the following spring, when the butterfly is disclosed. The first specimens of the butterflies appear during May and become more abundant during June and July, depositing their nearly round dark green eggs singly on the leaves of the food plants.

(5322) C. E. D. asks: 1. Is there any process, chemical or other, by which illustrations, half tones or even woodcuts, may be transferred onto white paper? A. We do not think there is any very satisfactory way of accomplishing this. You might, however, try saturating the print with naphtha, and applying it to the plain paper under very heavy pressure, leaving it for some hours to dry. 2. Would like to know the best method of repairing a flute of grenadilla wood that has become cracked sufficiently to slightly injure the tone. A. Probably the best method of repairing the flute will be to fill the crack with a cement composed of gutta percha, pitch and shellac, equal parts. 3. Please to give directions for making leaf photographs. A. If you refer to photographs which lie flat without mounting, we think you will succeed by stretching the paper in a suitable frame while wet, and allowing it to dry under tension. 4. At what height above sea level will eggs cease to boil, and why? What would be the temperature of boiling water at 15,000 feet above sea level? A. The height varies with the pressure of the barometer. At high altitudes water may boil at a temperature below that required for cooking eggs.

(5323) R. S. C. writes: 1. The wheel on my wagon is 3 feet 11 inches diameter. How many revolutions will it make in a mile? A. Your query is one of simple arithmetic. A wheel 3 feet 11 inches in diameter will be 12·34 feet in circumference. A mile is 5280 feet; 12·34 (the circumference of the wheel) will go in 5280, 427·7 times, which is the number of revolutions made by the wheel in the distance given, provided there are no slips. 2. Also please tell me where I can get the directions for making the telephone used by the Bell Telephone Company. A. For directions for making telephones consult SUPPLEMENT, No. 142.

(5324) J. T. D. says: I wish to build a reservoir for holding water. I want it to cover about two acres for cutting ice from. The ground upon which I wish to construct pond is partly clay and partly black loam. Can you tell me what is necessary in order to make it hold water, as I expect to get my water supply from wells outside to pond? A. In excavating for an ice pond in a mixed soil of clay and loam, the loam should be carried to the banks and the clay saved for a clay and sand or clay and loam puddle over all parts of the ground where there is no clay bottom found, and up the sides of the bank to above the water line. The clay puddle should be made as thick as the clay found in the excavation will permit, and not less than 6 inches for shallow pond for ice purposes, say of 3 feet in depth. On the surface should be spread a layer of as clean sharp sand as can be found, 3 inches or more in depth, extending to the top of the bank. This will keep the water clear and free from clay and will make clear ice.

(5325) J. A. W.—Answer by Professor Riley: The plant sent is a species known to botanists as *Exochorda grandiflora*, a species which only occurs in cultivated gardens in this country, but which is native in northern China. There are only two or three species of the genus to which this plant belongs, and all of them come from the same region in China. They are flowering plants belonging to the family Rosaceæ, and the one in question is not uncommonly met with in botanical gardens or in ornamental cultivation.

(5326) A. H. S. writes: I have a cellar walled and arched with brick, cemented inside with Portland cement, top, sides and bottom. I have it thoroughly drained. When the atmosphere is dry the walls of cellar are dry, but when the atmosphere is moist (as for instance 2 or 3 days before a storm) the walls begin to sweat, which will gather in large drops and run down to floor, making a great puddle of water. What can I apply to the walls to stop this condensation? A. The best remedy for condensation on a cellar wall is to fir off, lath, and plaster, on all parts exposed to earth backing. Only a non-conducting material between the wall and the moist air will prevent the condensation. A covering of felting would do, but should be made of asbestos or mineral wool to avoid any unpleasant odor.

(5327) G. B. writes: I would like to put up a bell in my house and use an earth connection. Now if I connect the wire with the gas pipe on second floor, and then connect the street side of meter with the house side, would I get a good earth? If not, could you tell me how to get a better one without running a wire all the way down to the cellar. A. Your proposed plan for making the ground connection is very good. We think it will be unnecessary to make a connection around the meter.

(5328) L. E. Y.—We see no fault with your diagram. Your difficulty probably arises from too much resistance in your circuit or too little battery power. Try 2 or 3 additional cells of battery.

(5329) F. W. B. asks: What is the origin of the word penny as applied to nails? A. Nails are called 6, 8, and 10 penny according as 1,000 of a particular kind weigh 6, 8, or 10 pounds; "penny" being the old term used for pound.

(5330) W. T. D.—Reply by Professor Riley: The spider sent is one of the orb-weaving species known as *Epeira domiciliorum*, Hentz. It is not

an uncommon spider and is widely distributed throughout the United States. Its beautiful regular orb webs are to be found in woods and fields, and very frequently also about dwellings and outhouses, from which latter habit it doubtless received its specific name. It establishes itself in sheltered angles of barns or porches, and if the presence of the web is no objection to the housekeeper, this spider will be of considerable service in reducing thenumber of house flies, for which it has a special fondness.

(5331) J. L. says: I have a twenty-five foot hull. Would you kindly recommend to me through your query column the safest and cheapest motor (no steam) that can be used for same? A. A gasoline or petroleum explosive engine is probably the cheapest and as safe as proper care and attention can make a motive power for a boat. Electric power is no doubt the safest, but has not yet arrived at a practical condition for general use. The storage electrical system is in use, but charging is not always convenient. The combined live battery and storage system is under improvement, but as yet rather a burden in a boat, from its bulk.

(5332) C. B. writes: I have found upon my tomato vines during August a green worm, about 1½ or 2 inches long and ¼ to ⅛ inch in diameter. All over the body of this worm are little white substances, apparently eggs, sticking out straight, each one about ⅛ inch long, and as thick as a hairpin wire or a trifle thicker. Each worm carries about thirty or forty of these. Will your entomologist kindly inform as to this phenomenon? Of course the worm doesn't stick these foreign bodies all over himself. What insect does it, and why? Reply by Professor Riley.—Your correspondent has observed a rather common phenomenon at this season of the year. The large green worm which he describes is one of the Sphingid caterpillars, and the minute white egg-like bodies projecting from it are the cocoons of a small black four-winged parasite (*Microgaster* sp.) A single parent fly deposits in the partially grown Sphingid larva a very great number of eggs, usually extending into the hundreds, which ultimately hatch into minute grub-like larvæ and which subsist on the fatty matter of the host larva, avoiding the vitalorgans. On reaching full growth, or having attained a length of about ¼ inch or less, they pierce the skin of the host larva and, remaining attached in the puncture at the posterior extremity, construct a beautiful silken cocoon which, on account of the immense numbers and close regular disposition over the back and sides of the larva, always excites the greatest curiosity when observed for the first time. Each of these cocoons, in a week or so, will disclose a small black fly, exactly similar to the one which was the author of the original parasitism. The females of these, after mating, will seek other larvæ, in accordance with their parasitic instincts. There may be several broods of these parasites in a single season, the later ones wintering over.

(5333) J. N. writes: I am making two carbon batteries, using ¾ inch carbons. I would like to know if I bored holes in the top of these carbons and filled them with hot lead, if that would make a perfect contact, so that I could solder or put set screws into it? Also the strongest carbon battery, in volts and amperes. A. You will do better if you cast your lead in a collar or cap shape around the top of the carbons. If the carbons are copper plated, tin the upper part of the copper with solder to insure contact. A battery can have any amperage. It depends on its size, nature of solution, etc. Practically 1·5 to 2 volts is the limit of E. M. F. for primray carbon batteries.

(5334) A. B. R. asks: Which of the following metals will be the most durable and have the least frictional resistance when used together, *i. e.*, one metal used in a bearing and the other in a revolving shaft: mild steel, wrought, cast and malleable cast iron, copper, brass? A. Mild steel journals running in brass boxes are considered the most durable in service and run with least friction. Wrought and malleablecast iron and cast iron, running in brass boxes, are next in order, as enumerated. Copper is not desirable as a journal box, from the difficulty of casting and fitting, although it is a good anti-friction metal.

(5335) R. H. asks: 1. Describe method of making a small electric furnace for heating soldering iron, using the Edison current. A. Use a heavy platinum coil within a chamber of non-conducing material. The coil should surround the iron. 2. Of what material is the magnet in a Thompson reflecting galvanometer made of? Would a piece of watch spring do, or would it be better to have two astatic needles? How should the needle be magnetized? A. Watch spring is excellent. For details, see our SUPPLEMENT, No. 628. 3. Is the arc light introduced into the Edison current without any resistance? A. Resistance is generally used. 4. Is the arc light used on other systems the same as the Edison, and can they be transposed? A. No.

(5336) E. L. S. asks: 1. How is a galvanic battery made, using sodium as one pole? What is the other pole composed of, that is, the bath? The electromotive force? Is it an open circuit battery? A. A sodium battery is provided with a porous cell filled with sodium amalgam. In one form the amalgam is a paste composed of 1 part of sodium and 50 of mercury. In two otherformsitis a liquidcomposed respectively of sodium 1 part, mercury 100 parts; sodium 1 part, mercury 200 parts. The electro-motive force of the sodium battery is about2½ volts. The other elements of the battery consist of carbon, and the electrolyte is dilute sulphuric acid. There are other combinations also. 2. How can I remove scars by electricity? A. In regard to removing scars by electricity, you should consult a competent surgeon.

(5337) J. E. B. asks for: 1. The U. S. government rule for safety valves. A. For boilers having flat or stayed surfaces, 30 square inches for every 500 feet of effective heating surface; for cylindrical boilers orcylindrical flued, 24 square inches. 2. In designing a field magnet, which is proper to use, ampere turns or ampere feet? A. Alwaysworkby ampere turns. 3. I have about 4 pounds of No. 31 cotton-covered copper wire. I wish to make a volt meter with a reading as high as 110 volts E. M. F. Would it be possible to use this wire to make a good spark coil? A. Your wire is rather too large for a volt meter, and rather fine for a spark coil. Bottone's "Electrical Instrument Making for Amateurs," 50 cents by mail, describes various electrical instruments. 4. Which is proper, ampere or amphere? A. Ampere. 5. For other definitions asked for consult the "Century Dictionary."

(5338) F. W. A. asks: 1. What horse power is one of the Edison motors, such as used in the phonograph, motor to run at about 1,500 revolutions per minute, and using a large plunge battery, such as described on page 401, "Experimental Science"? A. The power is very low, perhaps one one-hundredth horse power. 2. What is the length of time the above battery will run, giving full power, before being exhausted? A. One or two days. 3. If two of the Edison phonograph motors were coupled together, would the plunge battery above furnish power enough to run one of the Barnes 13 inch by 69 inch lathes and do work within the capacity of what a man could do on same lathe? A. No.

(5339) J. H. M. A. G. writes: I wish to light a three candle power lamp, requiring six volts, about. Will you please tell me: 1. Will three cells of storage battery be enough? A. Yes. 2. How many square inches of plate surface, including both + and −, should each cell have? A. Allow one square foot of positive plate. 3. The cells are to be made as nearly alike as can be. Will charging each cell separately for the same time with the same battery make them nearly enough alike to use together in series? It is far better to charge in series. You can, however, charge separately. 4. Will it be best to use resistance box and volt meter, so as to always obtain the same voltage through the lamp? A. This is not necessary. The batteries will be near enough. 5. With eight hours charge, how long will the storage cells run lamp? A. Fully charged, the batteries should give ten hours' current.

(5340) C. D. asks: 1. Why could not the armature and field magnets in the simple electric motor described in the SCIENTIFIC AMERICAN of March 17, 1888, be wound with No. 28 wire? A. Any sized wire could be used. The size is a matter of calculation, and depends on the E. M. F. and current to be employed. 2. Would it not increase the resistance so as to need more battery? A. It would, if wound singly, increase the resistance, and would require higher E. M. F. or more cells of battery; but such cells could be much smaller in such case.

(5341) G. D. C. writes: 1. If thirty dry batteries were put on a circuit with a simpleelectric motor as described in "Experimental Science," on page 498, the motor being about double the size of the one described, would it run it to its full power? If not, how many would it take? I want them to run it about three-fourths of an hour ata time. No other battery can be substituted in this case. A. Probably 200 dry cells would be required, and it is doubtful if they would run it for the time mentioned. 2. In making this motor twice the size of the other one, must I use the same size wire for the fields and armature? If not, what size must I use? A. This is all a matter of calculation. See preceding answer.

(5342) W. H. asks how to prevent barrels containing indigo extract from exploding. A. To prevent fermentation, salicylic acid or mercuric chloride might be used. By barreling the extract at a boiling temperature and closing the barrel while hot, fermentation should be prevented.

(5343) F. S. asks for a good zinc solution for plating on copper, and also the necessary acids for dipping. A. A "Watt's" solution is made by dissolving pure metallic zinc powder, by the aid of a strong current, in a strong solution of cyanide of potassium, with ammonia added. The proportions given are as follows: 200 ounces cyanide of potassium, 20 gallons of water, and 80 ounces, by measure, of strong aqua ammonia. A good dipping acid is formed of sulphuric acid 4 pounds, nitric acid 2 pounds, water 4 pounds. The fumes from the solution should not be inhaled. You will find further particulars in Watt's "Electro-Deposition of Metals," price by mail $3.

(5344) O. A. W. asks how to make nitrobenzene. A. Treat benzene with a mixture of 2 volumes strong sulphuric acid and 1 volume strongest nitric acid. Drop the benzene slowly into the mixture and filter through dry salt, after separation and washing.

(5345) J. S. M. asks: Can 20 to 30 tons of ice be put up in one ice house and keep satisfactory? About what would be the percentage of loss in one season? How large an ice house will be required, and how should it be constructed? A. Ice in quantities of 20 and 30 tons can be stored to advantage, and with a loss of no more than 10 per cent, when packed with ordinary care. Thirty tons will occupy a space of 10 × 10 × 10 feet, or 1,000 cubic feet, with 8 inches all around the inside and 3 feet at the top for packing, which may be hay or sawdust. A peak roof, ventilated, and, if possible, the ice house shaded from the sun. See SCI. AM. SUPPLEMENT, No. 59, for construction of ice houses and cold storage rooms; 10c., mailed.

(5346) R. A. S. says: A says that if brakes are applied to a car with force enough to cause wheels to stop turning and slide on rail, all power to stop train is absorbed. B claims that if brakes are not applied quite so strong, but as strong as possible without causing wheels to slide on rail, more force is exerted to stop train. Who is right? A. B is right. A skidding wheel does not hold to the track as well as a rolling wheel with the brake on nearly to the limit of the rolling traction.

(5347) F. W. L.—The ordinary newspaper pictures are produced by making a print from a negative of the same size which the newspaper print is to be. This print must be made on plain silvered paper; an artist then draws exactly the lines which appear in the picture, with waterproof indigo ink; the print is treated to a bath of bichloride of mercury dissolved in water or alcohol; this fades away the photograph, leaving only the black ink lines. The drawing is then touched up if necessary and photo-engraved like any other line drawing. The print must not be toned.

(5348) E. McC. writes: We have a woolen mill driven by small turbine, 50 feet head; mill was formerly driven by a 30 foot overshot, and think we did as much work then as now with the increased head. The turbine is liable to breakage, is delicate and so high speeded. Why would not a water motor made on principle of chain and buckets—something similar to elevators in a flour mill—with water thrown on top, or pitch back, answer every purpose without the objections of an overshot, as weight is the principle? Have you ever known such, and results? How does the Pelton wheel compare with other wheels in economy and efficiency? A. Probably your turbine is too small and does not use all the water that the overshot wheel used. If of proper size and kind, it should give you much more power with the same quantity of water and head. With 50 feet head you should realize 80 per cent of the gross value of the water fall. The chain and bucket system is of less value than an overshot wheel and has proved, so far, nothing better than a rattle trap. The Pelton wheel has proved itself one of the most efficient motors for high heads, and equal to 85 per cent of the gross water power. It is a marvel of simplicity and power.

(5349) J. B. asks: 1. Who was the inventor of piano; in what year? There is one in Louisville, Ky., made in 1776. A. The first instrument known by the name of "piano" was constructed in 1726, by Christofor. Instruments of the nature of pianos were made in 1668 and in 1521. 2. Last winter I was working at the car works in this town at night. I went into the engine room one night and sat down on the platform on which the dynamo was set, and magnetized my watch; is there anything that will save it from being thrown away? A. You can have your watch demagnetized by almost any jeweler, or you can demagnetize it yourself by suspending it on a twisted string, allowing the watch to revolve, approaching the dynamo closely while it is still revolving, and receding from the dynamo before it ceases to revolve.

(5350) L. M. asks: 1. Please inform me through your valuable paper if the amount of heat concentrated by a double convex lens depends on the distance of focus or its diameter. If the latter, is it directly proportional to its diameter? A. The heat-gathering capacity depends on the diameter of the lens. 2. Have you any SUPPLEMENTS treating on the Wimshurst's electric machine described in "Experimental Science," by George M. Hopkins? If so, please state the number. A. You will find a number of descriptions of modifications of the Wimshurst machine in the SUPPLEMENT. Consult Nos. 548, 648, 534, and 647.

(5351) C. K. T. writes: 1. From whom can I purchase inclosed wire in quantities of two or three pounds? Please state nearest place to me. A. Address any of our advertisers who deal in scientific and electric apparatus. 2. Does the lightning which one frequently sees on warm evenings give any audible report? If not, why? A. The subject of thunder is obscure, whether as regards its presence or absence at the time of a lightning discharge. Hot-weather lightning is often produced at distant places, too far off for the thunder to be heard. 3. Please mention number of SUPPLEMENT to SCIENTIFIC AMERICAN which contains directions for making a simple electric motor. A. No. 641.

(5352) L. W. writes: I desire to construct an electric battery for general experimenting that will give a strong and lasting current, and will not be too expensive to keep in order. How should I proceed to make a one-gallon battery of this kind? Also how many cells would be required, of one gallon each, to furnish electricity for a sixteen candle power incandescent lamp? A. We advise you not to try primary battery lighting. The bichromate batteries are the best. Many varieties have been described in our SUPPLEMENT and in the SCIENTIFIC AMERICAN. Two cells to the c. p. with a 30 ohm lamp may be allowed. Our SUPPLEMENT, No. 792, gives a powerful plunge battery. We also refer you to Nos. 157, 158, and 159 for other batteries.

(5353) P. C. asks: 1. Can I successfully light a photographic dark room by electricity, employing batteries? A. Yes; but it will be expensive and troublesome. 2. If so, what is the best battery to get? A. Use a Bunsen or Fuller bichromate mercury battery. 3. What candle power lamp would it require to produce the same amount of light as a kerosene lamp employing a B wick? A. A six c. p. lamp should suffice. 4. What would be the cost of the above plant with only one light, supposing a six c. p. lamp sufficient? A. Fifteen or twenty dollars.

(5354) R. M. P. asks: 1. What size wheel and how much power can I get from an undershot water wheel, 2 feet head, and race 14 feet wide by 3 feet deep and 1,000 feet long? A. The total gross power that can be obtained from the size race stated will probably be, with a water velocity of 4 feet per second, 168 cubic feet per second falling 2 feet, 38 horse power. Of this an undershot wheel 14 feet wide, 12 feet diameter will realize about 40 per cent, or 15 horsepower. A properly arranged Leffel turbine should realize 80 per cent, or 30 horse power. 2. Can you tell me the name of the firm or company that make a succession of undershot water wheels to develop power, that is, 2, 3, or 4 wheels working in the same flume? I was told they are made at Kansas City, Mo. A. We do not know of the firm that proposes to develop extravagant power from water wheels; 80 per cent of the total power is the largest known output with any known combination of water wheels for low heads. 3. How many pounds pressure is carried on small gas machines for house use? Gas to be made from gasoline. Also have you any papers on the manufacture of gas machine to light houses with? A. The gasoline vapor and air gas machines are used with from ½ inch to ¾ inch water pressure. Address Gilbert & Barker Manufacturing Co., Springfield, Mass., for their circular descriptive of their gas machines.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(5262) In issue of August 12 under Notes and Queries (No. 5262) J. B. asks is there any way to harden steel castings? I have a process of tempering cast steel or cast iron all the way through, and will be pleased to be placed in communication with him.—L. B. BROWN, 67 Jackson Avenue, Bradford, Pa.

(5278) F. K. J.—Replying to inquiry (5278) F. K. J., August 19, 1893, would suggest filling rusted pipes with a strong solution of caustic potash or preferably caustic soda of say 36° B. Solution should remain in pipes for several days.—S. C. STRUNZ.

INDEX OF INVENTIONS

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August 29, 1893,

AND EACH BEARING THAT DATE.

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