disposed to concede that the agamis are susceptible of a certain education, for we know that a few years ago, at the Garden of Plants, a Numidian crane, that is to say a bird belonging to a family very closely allied to the agamis, conceived a very strong affection for its keeper and obeyed him like a dog. One day, even, when the keeper had taken sick, the bird, uneasy at not seeing him, went to his house, to which it knew the way on account of having gone thither several times in his company.—*La Nature.*

Arrowroot Manufacture in Queensland.

The manufacture of arrowroot is carried on extensively in the south of Queensland. In the districts of Coomera and Pimpana there are from 250 to 300 acres under cultivation, the chief plot—that known as "Rockholm"—being the property of Mr. Samuel Grimes. I recently visited this representative plantation, a description of which will serve to convey an idea of the whole.

The arrowroot grown in this district is the purple variety—the *Canna edulis.* It sometimes grows to a height of 8 feet, bears a pretty scarlet flower, and a dark purple seed pod follows, which is generally sterile. The best variety of arrowroot, the *Maranta arundinacia,* which is grown so extensively in the Bermudas, thrives well in this district, but its cultivation has been almost abandoned, owing to the difficulty of manufacture. This kind attains a height of 2 feet, and bears at maturity a small white flower somewhat resembling potato blossom. The mode of cultivation is as follows:

The ground is plowed in ridges of about 46 feet wide, and thoroughly harrowed and scarified. Nine rows are placed in this, 5 feet apart, leaving six for the row in which the by-furrow comes. Shallow furrows, 5 inches deep, are run with the plow, after which the smaller bulbs—about the size of a small apple, which are found growing at the bottom of the stems—are placed 4 feet 6 inches apart in the drill, and covered by turning a furrow from each side on to the top of the bulbs. Cultivation is then carried on by keeping it clear of weeds by means of horse hoes or "scuffiers." When it reaches the height of about 3 feet the space between the rows is turned up with a one-horse plow, the soil thrown toward the plant, and a furrow left in the middle. No further attention is required till the arrowroot is dug up for the mill. When the tubers have come to maturity, which is generally in ten months or a year's time, the crop is ready. The stalks of the plant are then cut off as close as possible to the tubers with a cane knife or strong reaping hook. The tubers are afterward raised with a grubbing hoe or mattock. They are placed with all speed in carts and conveyed to the mill, for the color is seriously affected by being exposed to the sun or weather before grinding. Sometimes as much as 50 pounds weight of tubers is obtained from the plant.

The machinery consisted in this case of a 6 horse power engine made by Messrs. Manlove, Alliott & Co., Nottingham, a root washer, grinding mill, cylinder, sieves for separating the farina from the fiber and pulp, and a centrifugal drying machine. The roots are washed in a trough 10 feet long, 3 feet deep, and 2 feet in diameter. This has a half-circular bottom, through which a stream of water is constantly running. A spindle having pegs about 4 inches apart, and of a sufficient length to reach within an inch of the bottom and sides, revolves in the trough. The pegs cleanse the bulbs of all dirt, and the latter gradually work down to one end of the trough. A wooden rake pushes the bulbs out upon a belt elevator, whence they are conveyed to the hopper of the mill. This is a wooden drum, 2 feet 6 inches wide and 2 feet in diameter. It is covered with a galvanized iron sheet punched and placed with the "burr" on the outside. The drum revolves at a high speed, and a stream of water falls upon it from tanks fixed above.

Thus the bulbs are grated up, the bulbs and the water passing through the sieve No. 1, which is a cylinder 8 feet long, with the bottom half perforated with holes about the size of a No. 7 wire nail. Within this a beater revolves, forcing the water and farina through the holes, and being placed on the screw the pulp and fiber are forced out at the end. The farina and water pass into sieve No. 2, which is similar to No. 1, except that the holes are about the size of a large pin-head in the bottom of the copper. After this it runs along a trough, where the farina is deposited and the water passes off. The farina is now dug out, and passed through sundry more sieves, and washings by hand and in tubs, then finally left to subside. When fairly firm it is taken out and passed through a centrifugal machine. It is now placed on the drying frames, about 6 feet long, with marsupial netting and calico stretched upon them. They are placed away from any dust or smoke, and the wind passing underneath, as well as the sun above, aids the drying process. But the sun and air are not alone depended upon for drying, Mr. Grimes having erected a drying house capable of accommodating 180 frames. This is heated by means of steam pipes to 140° Fah.—*Industries.*

United States and Europe in 1893.

The United States is not in the least dangerous to us in connection with military affairs. But from an economic point of view it constitutes an immediate and pressing menace. The debt contracted by the United States during the war of the secession will be completely extinguished before the end of the century, whereas the total debt of European countries is estimated at the enormous sum of 126,000,000,000 francs. The United States has an army of only 27,000 men, that is, scarcely as many as we have in one of our nineteen corps. In comparison with these 27,000 men, place the 3,500,000 soldiers kept by the European countries in time of peace, and it is easy to see how much of their productive force the European powers annually sacrifice.

It must be taken into consideration that the men thus taken from the peaceful employments are all in the height of their activity and at an age when the character is forming. The loss of revenue which results from such a state of affairs is frightful when it is looked upon as a factor in the industrial war with the United States. One must be blind not to see, in these conditions of rapid and progressive development of the United States, that Europe is threatened with such a competition that there will come a time when the balance of industrial power and political influence must be placed to the profit of the New World. That movement threatens France more than any other European nation, because France carries the heaviest load and has the largest debt. Everywhere in Europe, even among the smallest states, nothing is spoken of at present but armies, the increase of war materials, and, of course, new taxes.—*Figaro.*

Sawdust Building Bricks.

The sawdust is dried and screened, to remove the coarser particles, and is then mixed with cement, lime, and sand in the following proportions: One part cement, two parts lime, five parts sharp sand, and two parts sawdust. The sawdust is first mixed dry with the cement and sand. The final mixture is pressed into blocks, which are said to be cheap and useful. There is as much lime and more than twice as much sand as sawdust in them.

RECENTLY PATENTED INVENTIONS.

Engineering.

BALANCED SLIDE VALVE.—Daniel Kiley, Brooklyn, N. Y. This is an improvement on a formerly patented invention of the same inventor, relating to slide valves having their top surfaces protected from direct contact with the live steam that enters the steam chest from the boiler, and provides a simple relief valve attachment for the valve, to cause it to operate more reliably and prevent accident.

DREDGING APPARATUS.—James B. Quinn, New Orleans, La. A swinging frame hinged to a support carries an excavating wheel having buckets and discharging cells, the wheel being connected with a driving drum and cable, the latter being controlled by an adjustable tension device, while there are mechanisms for raising and lowering the frame to give the wheel any desired angle to the support. There are no joints or bearings subject to abrasion by the grit stirred up by dredging, the buckets are built to be very durable and automatically discharge their loads at the right time, and the apparatus is designed to be operated with comparatively little power for the work it can do.

FLOATING SUPPORT FOR DRILLING DEVICES.—Adoniram Fairchild, New York City, deceased (Benjamin D. Fairchild, administrator). Upon a hollow float is a truss frame supporting a second float, there being a derrick frame on the upper float, which supports ballast weights, while there are flexible connections between the weights and floats, and devices on the top float drawing on these connections. The invention affords a simple and practical means to neutralize the lifting force of wave action on a floating support for the drilling apparatus used to perforate the rock bottom of a harbor or other body of water.

Railway Appliances.

SWITCH OPERATING DEVICE.—Benjamin Bartelmes, Brooklyn, N. Y. This is an improvement especially adapted for use on cars of cable railways with intersecting lines on which cars are drawn by horses, the latter being switched onto and off the cable road, and liable to leave open switches from the cable road to the divergent side track. The switch adjuster consists of a vibratable presser bar carrying on its outer end a rotable presser wheel, operated by an upright shaft on the platform, by means of which the gripman of a cable car will be able to close an open switch in advance of the car.

STREET RAILWAY SWITCH.—Daniel F. Doody, Brooklyn, N. Y. This is an improvement in that class of switches adapted to be thrown by means of an actuating bar or like attachment on the car. Combined with two sleeves mounted to partially rotate and fitted one within the other, and located in a box-like structure beneath the track near the switch, is a switch lever connected with the inner one of the sleeves and with the switch point, arms adapted to be tripped by the trip arm carried on the car being made in separable sections and extending radially from the outer one of the sleeves.

Agricultural.

CULTIVATOR.—Henry Eastman, Racine, Wis. This is an implement adapted for use in working listed corn, and is supplied with runners to protect the corn, shovels to tear down the ridges, and cutters to remove weeds from the rows and direct the loosened earth toward the runners and the rows of plants. The runners may be readily adjusted to and from each other, and the shovels arranged either laterally or vertically, while adjacent to the shovels are balance rollers adapted to travel upon the ridge acted upon by the shovels, these rollers serving as guides to the machine and to preserve its equilibrium.

Miscellaneous.

BOAT STOPPING DEVICE.—Pedro Samohod, Lima, Peru. On the bow of the vessel is a post carrying a vertically sliding frame having on its sides pivoted wings adapted to extend transversely to present a large resistance surface to the water, as the frame is immersed, its normal position being raised, with the wings closed forwardly. The frame is raised and lowered by means of chains connected with a winch, and is let down when the vessel is moving into a dangerous place, or is liable to collide with another vessel or iceberg, etc.

STONE PLANER.—Charles Biganess, Quincy, Mass. This is an improvement in that class of stone-dressing machines having cutters which reciprocate and revolve simultaneously. The reciprocating and revolving shaft carrying the cutting plates has on its end rounded heads fitted by sockets in oscillating levers connected with an eccentric to oscillate the levers simultaneously. The planer shaft is revolved at a high speed, and a worm and gear mechanism makes the reciprocating movement very slow, whereby the cutting plates will be brought in contact with the entire surface of the stone, to plane it perfectly.

PRESSURE REGULATING VALVE.—August Heithecker, Brooklyn, N. Y. This valve is especially designed for reducing and regulating the pressure of gas or other fluids. Its casing is made up in two separable parts held together by screws, the construction is very simple, and there is nothing about it liable to get out of repair. The tension of the valve-closing diaphragm is regulated by a spring and screw arranged to be very nicely adjusted.

LIFE PRESERVER.—Michael O'Hara, Pittsburg, Pa. The body of this device has upper and lower series of vertical metallic tubes and intermediate horizontal semicircular tubes, with fastenings, and boxes on the breast portion, the whole adapted to be made in the form of a garment, and be light and comfortable to the wearer, while affording receptacles for food and drink.

BURGLAR AND FIRE ALARM.—William C. Dillman, Brooklyn, N. Y., and George A. Seib, New York City. This is a positive working apparatus which operates as an ordinary messenger call, and may be operated by the opening of a window or door to ring an alarm at the central station. It has automatic mechanism for shifting the device from a burglar alarm to a messenger call after the burglar alarm has been operated, and it may also be connected with any thermostatic or thermometric circuit breakers or closers to ring in an alarm in case of fire. The apparatus may be manually operated when desired without interfering with its electric mechanism.

TROUSERS HANGER.—Joseph A. Jourdan, Paris, France. This device has two integral main sections, each bent from a wire rod into two spring limbs that normally diverge, there being clasping devices on the ends of the limbs and a connecting sleeve having opposite flanges bearing on hanger loops on the main sections. A hanger hook engages the bowed ends of the loops, and sliding rings on the main limbs are adapted to press the fingers together. The device holds the garments stretched to permit its suspension in an unwrinkled condition in a wardrobe or show room.

PARALLEL RULER.—Alexis F. Gillet, Kearney, Neb. This instrument has a base support or rule along which is movable an angle holder having a transversely movable clamp section by which to secure the angle, and a step-by-step feeding mechanism for advancing the holder along the rule. The improvement is designed to enable an amateur to space section and similar lines with as great accuracy as a skilled draughtsman, while it will be useful to the latter in facilitating the rapid drawing of the lines, as the spacing may be accomplished automatically.

WAGON AXLE.—The same inventor has also obtained another patent for an axle to be used on farm implements and wheeled vehicles generally. A spindle sleeve is provided for squared or other non-circular axles, the sleeve having its inner end slitted and having at such end a tapered threaded portion on which is turned a tapered nut. The sleeve, which may be made of any suitable metal or composition, is designed to receive all the wear of the wheel, and it may be cheaply replaced when worn.

SPONGE MOISTENER.—James S. McClung, Pueblo, Col. This is a device especially adapted for use in a school room, enabling one person to properly moisten a number of sponges in a convenient and expeditious manner without bringing the hands in contact with the water or with the sponges. The device has a partitioned compartment in which is held a table and a pivoted presser plate, and may be readily carried from desk to desk by a child, to moisten and return the sponges used at each desk, the sponges being handled with pliers.

CHALK RAIL FOR BLACKBOARDS.—Willard S. Terry, Hilo, Hawaii. This rail is made in the form of a hopper-shaped receptacle having in its bottom an opening connected with an exit tube, the top of the receptacle having an apertured covering. The device supports crayons or chalk, but useless particles and dust pass to the receptacle below and are thus prevented from settling on articles in the room or being inhaled by persons in the room.

FRAME.—Heinrich Schuessler, College Point, N. Y. A simple and durable frame to hold and lock a picture, looking glass, cards or other articles, is provided by this invention. An open casing held on the back of the frame is adapted to receive the article, and a spring plate fitting in the casing presses the article on its entire back surface, a locking device fastening the plate to the casing, and effectively preventing shifting or displacement.

GUITAR.—John F. Stratton, Brooklyn, N. Y. The performer may, with this improvement, quickly change the stringing of the instrument by using either gut or metallic strings, at the same time increasing the volume and purity of the tone when metallic strings are used. An auxiliary bar or lever is secured to the bridge and engages the strings at the top in the rear of the bridge fret. By using a tail piece in connection with the bar, the strain on the resonating top of the instrument is transferred to the side, so that the top is not liable to warp.

CLASP.—Joseph F. Chatellier, New York City. This is a device for conveniently suspending hose and other wearing apparel and other articles. It has a fixed and a hinged swinging member, and the clasp is opened by moving a button out of a slot, to permit of swinging the hinged member away from the fixed member. The device is very simple, and will conveniently engage or disengage articles without tearing or injuring them.

FRUIT PITTER.—James L. Hall, Kingston, Mass., and Frank H. Chase, Grand Rivers, Ky. This is a device for conveniently removing the stones or seeds from small fruits, especially raisins. It has a wooden handle from which extend a series of elastic prongs or fingers having enlarged heads, and preferably made of round or flat steel wires or rods, a thin perforated plate or seed discharger sliding on the fingers. The fingers are forced through the skin and pulp, and are thus designed to engage the seeds, which are removed from the implement by the sliding perforated plate.

COVER FOR POTS, PANS, ETC.—David D. Davies, Wilkesbarre, Pa. This cover has a central steam escape opening, with an adjustable valve or cap to vary the size of the opening or close it altogether, a spring automatically holding the valve in adjusted position. Applied to a frying pan, this cover enables cooking to be done without greasing the stove or stewing the food, and as a ventilating pot cover it diminishes the escape of steam and tends to prevent the boiling over of water.

WIRE STRETCHER AND HOLDER.—Adolf Westmeyer, Pacific, Mo. Upon the handle of this implement are dogs adapted to clamp the wire, while upon its shank is a pivoted, bent fulcrum block on which a hook bar is movably arranged. The device forms a simple tool for stretching fence wire and holding it taut while being made fast to a post.

RIDING SADDLE.—Ferdinand E. Du Moulin, Joliet, Ill. This invention consists of an attachment comprising a fork, a knee horn detachably and adjustably secured to the fork and provided with an arm, and a leaping horn detachably secured to the arm of the knee horn. By means of the improvement the saddle may be quickly converted for use as a lady's riding or side saddle, the knee joint and leaping horn being located either at the right or left of the tree, or it may be readily changed for use by a man. When used as a

side saddle the seat may be lengthened or shortened to accommodate the rider.

TRACE CARRIER.—William A. Mayhall, Gloster, Miss. This invention relates to buckles such as are used to connect the back band of a farm harness with the traces. The construction is simple and durable, and the buckle is very efficient in service, securely locking the traces in place and firmly holding the back band.

RUNNING GEAR.—Axel Warenskjold and John G. Burgess, San Diego, Cal. This is an improvement upon a formerly patented invention of the same inventors, for a simple and durable gear so arranged as to permit of turning the vehicle in very short curves without binding the king bolt or other working parts. The improvement embraces a fifth wheel having two fulcrums. A fifth wheel is pivoted to one of the axles, and a second fifth wheel is connected by two pivots with the other axle, while reaches crossing each other connect the axles with each other.

TROUSERS HANGER.—Arthur C. Nash, Cambridge, Mass. This device consists of a looped cord furnished at opposite ends with hooks, and provided with a button cleat and rings for tightening the cord upon the legs of the trousers. By this means trousers may be suspended in the best position for retaining their shape, and so that they will take up but little room.

SURGICAL INSTRUMENT.—Frederick C. Thompson, East Tawas, Mich. This invention comprises a novel form of forceps, attached to the jaws or blades of which near their forward ends is a soft elastic ring for use in connection with a flexible medicine cup.

MEDICINAL COMPOSITION.—Otto L. Mulot, Long Island City, N. Y. This is a composition to be used for the blood, to increase the healthy tone and natural action of the body. It comprises an electrolyzed distillate from a mixture of oil of turpentine, juniper berries, white oil of amber, aloes, gum myrrh, gum mastic, flowers of sulphur, gum olibanum, and various other ingredients, combined and prepared in a specified manner.

DESIGN FOR BOTTLE.—Daniel O'Reardon, Jersey City, N. J. This design provides a peculiarly shaped bottle, designed to have an antique appearance, and somewhat resembling the vessels made of skins used in Oriental countries.

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.

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Notes & Queries

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

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(5014) W. T. asks: With a stream of water 6 inches in diameter, having a head of 10 feet, and using the best turbine wheel, what would be the available horse power? Also, what would be the best water wheel to use? A. You will have an available 5 horse power. Address James Leffel & Co., Springfield, Ohio, for a good and economical turbine.

(5015) C. H. S. asks: Is there any means by which small red ants can be exterminated from a lawn without injuring the grass? If so, I should appreciate any information thereof. Reply by Prof. C. V. Riley.—It is difficult to accomplish this result without any injury to the grass, but the use of bisulphide of carbon, which I have frequently recommended, only temporarily destroys the verdure of the grass plots immediately above the nests. It turns them yellow for a few days, but does not impair the vitality of the plant. The nests of the small red ant are very small, and it will probably suffice to pour a half teaspoonful or so of the bisulphide into the principal hole of the nest and destroy and cover up the sand-like mound. With the more extensive nests of larger ants, however, it will be desirable to pour a teaspoonful of liquid down each of the principal holes of the nests and cover them ten or fifteen minutes with a wet blanket, afterward exploding the vapor at the mouth of the holes with a torch of lighted kerosened rag at the end of a long pole.

(5016) M. A. C. asks how to grind and set razors. A. Razors that have been in use so long that the edge is rounded by strapping can be brought to a flat bevel on the edge by placing them on a perfectly flat hone or other fine grained stone, with a little thin oil, as lard oil or fine machine oil, letting the back always rest upon the stone, and with small circular motions of the hand, without pressure, grinding down the bevel until the stone marks meet on both sides in a thin feather edge.

(5017) C. W. G. asks how to make potato starch. A. Convert the potatoes into a pulp by means of a scraping knife or an instrument similar to a nutmeg grater; throw the pulp upon a fine linen cloth in a large funnel, and allow pure cold water to run through the mass slowly for several hours. By this means all the minute starch granules may be washed through the cloth; and on allowing the water to stand for some time, these will settle to the bottom, and may be removed by decanting the water and straining.

(5018) R. H. P. says: Can you give me a formula for perfumed carbolic acid? A. Carbolic acid, 4 oz.; rectified spirit, 6 oz.; oil of bergamot, 28 min.; oil of citronella, 10 min.; water, to make 1 pint. Dissolve the oils and acid in the spirit and add the water, shaking well.

(5019) G. C. G. S. says: Will you please give a table showing the contraction of castings in different metals? A. Table by Bowen & Co., brass founders, London:

	Inch.	Inches of length.
In thin brass castings	1/16	in 9
In thick " "	1/8	in 10
In zinc castings	5/128	in 12
In lead, according to purity	3/128 to 5/128	in 12
In copper, " "	5/128 to 7/128	in 12
In tin, " "	3 1/2 to 1/16	in 12
In silver, " "	1/8	in 12
In cast iron, according to purity, small castings	1/16	in 12
In cast steel, according to purity, pipes	1/8	in 12

The above values fluctuate with the form of pattern, amount of ramming, and temperature of metal when poured. Green sand castings contract less than loam or dry sand castings.

(5020) R. W. C. says: Will you please tell how to preserve the natural colors of plants? A. A recent improved receipt for preserving plants with their natural colors is to dissolve 1 pt. salicylic acid in 600 parts of alcohol (parts by weight), heat the solution up to boiling point in an evaporating vessel and draw the plants slowly through it. Shake them to get rid of any superfluous moisture and then dry between sheets of blotting paper under pressure in the ordinary manner. Too prolonged immersion discolors violet colored flowers, and in all cases the blotting paper must be frequently renewed. The novelty appears to be the salicylic acid.—*Art Amateur.*

(5021) A. R. C. asks how to test air for sewer gas. A. Saturate unglazed paper with a solution of 1 ounce of pure lead acetate in half a pint of rain water; let it partially dry, then expose in the room suspected of containing sewer gas. The presence of the latter in any considerable quantity soon darkens or blackens the test paper.

(5022) B. J. M. wants to know how carton pierre ornaments are made. A. The following is a formula for such a composition: Glue, previously dissolved in water, 13 parts; pulverized litharge, 4 parts; white lead, 8 parts; plaster of Paris, 1 part; very fine sawdust, 10 parts. Oil the moulds to prevent adhesion.

(5023) G. F. F. asks for a remedy for buffalo moths. A. Take strips of red or blue flannel (as these colors are particularly attractive to them), dip in solution of arsenic and lay around the edges of carpets, or wherever the pests are troublesome. Said by those who have tried it to be sure death to the insects.

(5024) E. A. J. asks for the United States government formula for whitewash. A. The following coating for rough brick walls is said to be used by the United States government for painting lighthouses, and it effectually prevents moisture from striking through: Take of fresh Rosendale cement, 3 parts, and of clean, fine sand, 1 part; mix with fresh water thoroughly. This gives a gray or granite color, dark or light, according to the color of the cement. If brick color is desired, add enough Venetian red to the mixture to produce the color. If a very light color is desired, lime may be used with the cement and sand. Care must be taken to have all the ingedients well mixed together. In applying the wash, the wall must be wet with clean, fresh water; then follow immediately with the cement wash. This prevents the bricks from absorbing the water from the wash too rapidly, and gives time for the cement to set. The wash must be well stirred during the application. The mixture is to be made as thick as can be applied conveniently with a whitewash brush. It is admirably suited for brickwork, fences, etc., but it cannot be used to advantage over paint or whitewash.

(5025) N. K. K. asks: Is the incandescent lamp used as a "Geissler tube," useless without first admitting air into it (as the description given by E. M. La Briteaux)? A. The vacuum is too high to permit of using a lamp as a Geissler tube. The vacuum of an incandescent lamp is more like that of Crooke's tubes.

(5026) G. R. C. asks: In what ratio does the amount of steam (expressed by weight of water) generated under different pressures by a fixed unit of carbon vary? A. The total heat from 32° of one pound of steam at 0 pressure is 1,146 heat units and at 100 pounds pressure is 1,184 heat units. One pound of best coal, with perfect combustion, gives out from 14,000 to 15,000 heat units, and will make from 11 to 12½ pounds of steam at 100 pounds pressure if no heat is lost.

(5027) D. W. says: 1. I want to build the simple electric motor described in "Experimental Science." It does not state whether the magnet wire used is single or double wound. Which is it? A. You can use either a single or double covered wire. There is less danger of crosses when double-covered wire is used. 2. Will the same size machine, with cast fields and wound as described for dynamo, furnish current sufficient for the motor to run two or three sewing machines? A. When the machine is used as a dynamo in the manner suggested it will not furnish current enough for running two sewing machines.

(5028) H. A. F. asks: Will you kindly give me advice on the following: I have a 16 foot boat, galvanized iron No. 18, in compartments of 3 feet, without any ribs, but well braced. As I intend to put a 1 horse power gasoline motor in it, will I need to put in any ribs, and, if so, will 1/8 + 1 angle iron do? And will I need any papers of pilot or engineer to run the same? A. You should strengthen the shell of your boat near the engine. The 1 inch angle iron ribs will do. You will need a pilot's license if you run on waters having commercial traffic.

(5029) J. H. W.—The sawmill dogs you describe are, no doubt, steel castings, which are made by melting and pouring cast steel, and can be forged and tempered like bar steel. Steel castings are far better than malleable iron castings.

(5030) A. C. asks: Are not malleable iron tube fittings preferable to cast iron ones for steam and hot water heating purposes, and also for piping steam under ordinary pressures, provided the interior shape is the same? A. The malleable fittings are preferable when made with taper threads for steam use, wherever there is liability of accidental breakage of the fittings and danger from leakage. For ordinary steam piping, cast iron fittings are in almost universal use and considered safe.

(5031) B. W. C. asks: Is the sun motor used in this country? Could you pump water 160 feet, and cost? A. The sun motor, so far, has been only an experiment. With the ordinary force pump, water may be easily raised the height you mention.

(5032) S. H. B. asks: Is there any appliance by which sorghum juice can be evaporated by running steam pipe through the juice and applying the heat in that way? I have a friend who is raising sorghum, and he thinks there should be some way of evaporating by steam heat through pipes. He wants to make sirup or molasses, not sugar. An answer to this will be appreciated. A. Sorghum juice can be evaporated in large flat pans with a flat coil of steam pipe in the bottom of the pan.

(5033) J. B. asks: Is hemlock suitable for studs and joists in building a frame house? If not, what are the objections to it? A. Hemlock for studding and joist is liable to warp and spring out of line and is more shaky than pine; yet it is largely used now in cottage houses, on account of cheapness.

(5034) G. C. B. asks: 1. How high are the highest masts of sailing vessels, and how much canvas do they spread? A. The tallest masts are from 160 to 180 feet high, and spread from 60,000 to 100,000 square feet of canvas. 2. What is the curvature of the earth in inches per mile? A. The curvature of the earth is 8 inches per mile.

(5035) G. W. B. asks: Will a boiler built to furnish steam at 100 pounds pressure for an 18 inch cylinder, 18 inch stroke, furnish steam for a steeple compound engine, 18 inch high pressure and 36 inch low pressure cylinders, 18 inch stroke, both having condensers? If not, why? A. For equal indicated horse powers the compound condensing engine uses, or should use, less steam than any single cylinder condensing engine. With the arrangement as stated, with both high pressure cylinders alike, the compound engine, with proper cut-off, may be twice the power of the single cylinder engine, and may, by the relation of cut-off on each engine, require more steam.

(5036) W. F. C. writes: Is there any high explosive, not easily fired by concussion, that could be safely used in bombs for ordinary cannons or mortars? What is supposed to be the original substance of volcanic ashes? Are these ashes considered evidence that the internal heat of the earth is produced by combustion? By analogy the heat of the sun is due to the same cause. Is this the reason why scientists claim that it will eventually expire? A. There is no high explosive as yet known that will stand the initial concussion of discharge from guns. Much experiment has been made in this direction, but without as yet practical results. Volcanic ashes are of much the same composition as pumice stone, or nearly the same as the primary rock formation of the earth—principally silica and feldspar, with a small admixture of metallic oxides. There is no evidence from volcanic eruption, or the material thrown out, that there is combustion going on within the earth. The heat held in the interior of the globe is assumed to have been nascent with its creation, and the interior heated mass to be inert, volcanic activity being the vent for the relief of the pressure upon the hot fluid mass of the interior, caused by the contraction of the earth's crust by loss of heat from radiation. The heat of the sun is reasonably assumed to have been derived in the same manner, only that its immense mass has made it slow to cool. The condensing theory of the progress of creation indicates that the sun and the solar system is a cycle in the events of eternal time. Its life existence had a beginning and will have an end.

(5037) J. W. writes: What is the most practicable way of storing power for future use, if any? I am owner of water power with limited storage for water and am obliged to operate wheels most of the time, in fact all the time, and could use in 18 hours all the power I could develop in the 24 with the amount of water available; how could I store the 6 hours power that goes to waste? I operate electric power and light plant 18 hours out of 24. A. In the absence of particulars as to the limit of water storage, the question of a higher dam, which alone will increase the power in the proportion that the additional height bears to the present height, or the addition of power by the storage of water, need not be discussed, as you say you have a limited storage. There is but one other way that may be made available directly in your line of operation, and that is electrical storage. With your present plant you may charge storage batteries during the 6 hours to the full extent and power of your electric plant, and also utilize any excess of power that you may have to spare from the present operation for power and light.

(5038) Enquirer, Va., writes: Please advise me of an approved plan of ventilating under a building where the joists are near the ground. In this flat country if we excavate more than 12 to 18 inches, water stands under the floor and the floor joists decay, first in the brick walls and then throughout. A. Buildings on wet ground should have at least 3 feet space between the ground and the joists, and if stone or brick foundations are used, holes 1 foot square should be made through the foundation close to the sills on each side near the corners and along the sides, and covered with galvanized wire netting fine enough to keep out mice. This will give the wind