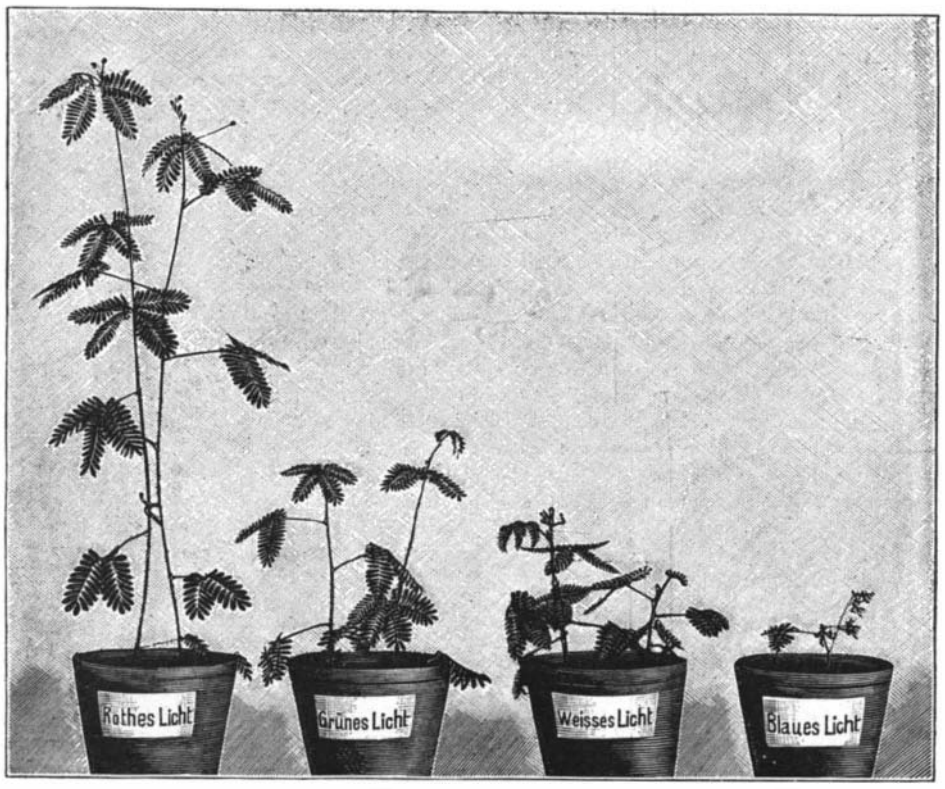
THE PHILOSOPHY OF PLANTS.

It is well known that most animal organisms need the direct influence of sunlight for their proper development, and in the same way plants and, in fact, all life on earth, depend on the action of this wonderful agent. The beautiful structure of plant cells, the study of which constitutes the most interesting part of plant biology, has never been properly understood until now; but men like Liebig and others have determined the peculiar use of the cells in the life of plants and have also included in their investigations, as of equal importance, the processes of nutrition. Present knowledge shows that plants take from the atmosphere what is needed for the formation of the cells, and also throw off useless material through the leaves. Thus carbon is taken up by the leaves, which transform, under the influence of sunlight, the carbonic acid taken from the air and through the roots into carbon and oxygen. Water and salts are also taken up by the roots of the plants.



EFFECT OF DIFFERENT COLORED LIGHT RAYS UPON PLANT LIFE.

The various ways in which the sunlight affects the leaves and blossoms, and consequently the whole development of a plant, must be considered in the study of plant physiology.

It is well known that sunlight has a decided influence on the coloring of the leaves, which look sickly and pale when the plant has only a little sunlight, whereas strong sunlight increases the amount of chlorophyl, thereby giving the leaves a richer color. Referring to the influence of sunlight, we may with propriety speak of the rays that work chemically, others which act simply as dispensers of heat, while still others are simply light rays, even though there is not actually such a division in nature. The chemical action of the sun's rays can be best understood by the wonders of photography, and we certainly cannot go astray in assuming that certain rays of the sun's spectrum also have a special influence on the plant cells, which will, doubtless, affect the plants of the different species differently, for the conditions of light and heat impress themselves clearly on the character of the plants.

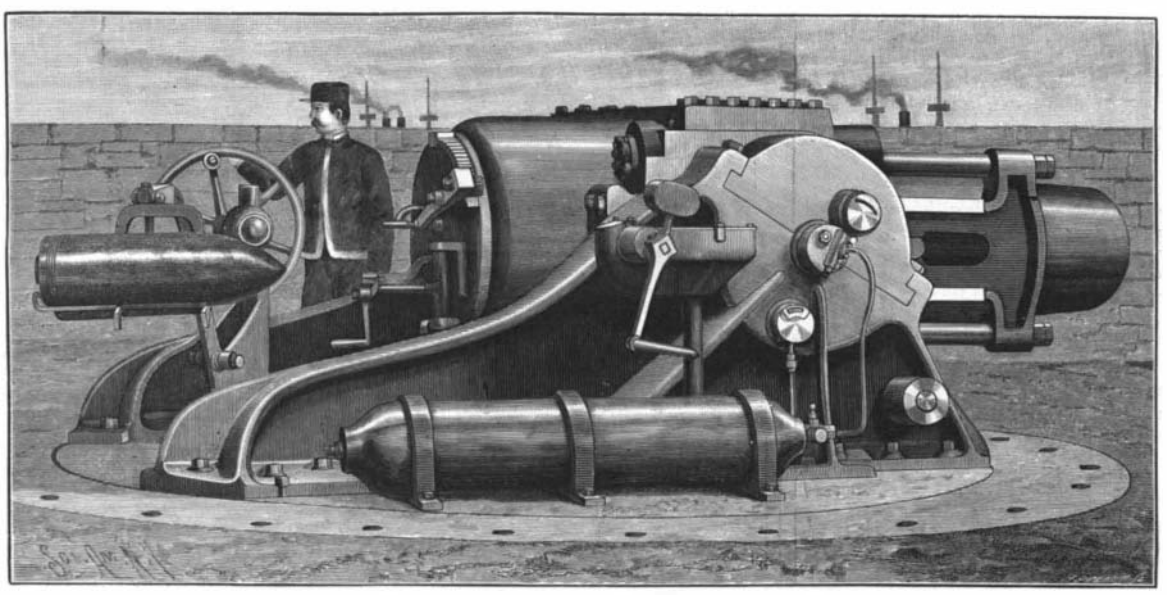
Former observations have already proved that certain rays of the sun's spectrum have a harmful effect on plant organisms, while, on the other hand, others accelerate the circulation of the sap and the assimilation of nourishment, thus promoting the growth of the plant. A recent experiment made by the well known French physicist, Camillo Flammarion, at the Agricultural and Climatological Experiment Station, at Juvisy, indicates plainly the effect of different colored light upon plants, and the result is of special value, practically and theoretically, to plant physiologists and climatologists. It has been clearly shown by the various experiments that ordinary "colorless" light is represented by natural sunlight, because, when exposed only to it, health and natural growth reign. Colored light, according to the particular color used, causes either one sided acceleration or retardation of the development of the plant. In his most interesting experiment, Flammarion adopted the plan of exposing sensitive plants (Mimosa sensitiva), which he raised from seed, to different colored light. These plants are specially sensitive to the effect of light and to touch, and were, therefore, well adapted for Flammarion's experiment.

He planted a number of seeds, and the seedlings, after they reached a height of about one inch, were planted in pots, in pairs, and placed in a hothouse, where each pot received the same quantity of light and an even temperature prevailed, so that the plants were subjected to the same conditions. But the experimenter placed over some of the plants bells of green, red or blue glass, while others received the sunlight through the plain glass of the hothouse window. The effect of the colored light was soon perceptible in the development of the plants, and the more they developed the plainer this difference became, until, at the end of two months, the plants under the red glass were 16 inches high, those under the green glass measured only 5 inches, and those under the blue glass were only 1 inch high, while the plants that had been left in the "colorless" light were 4 inches high. The accompanying engraving is a reproduction of a photograph of these plants.

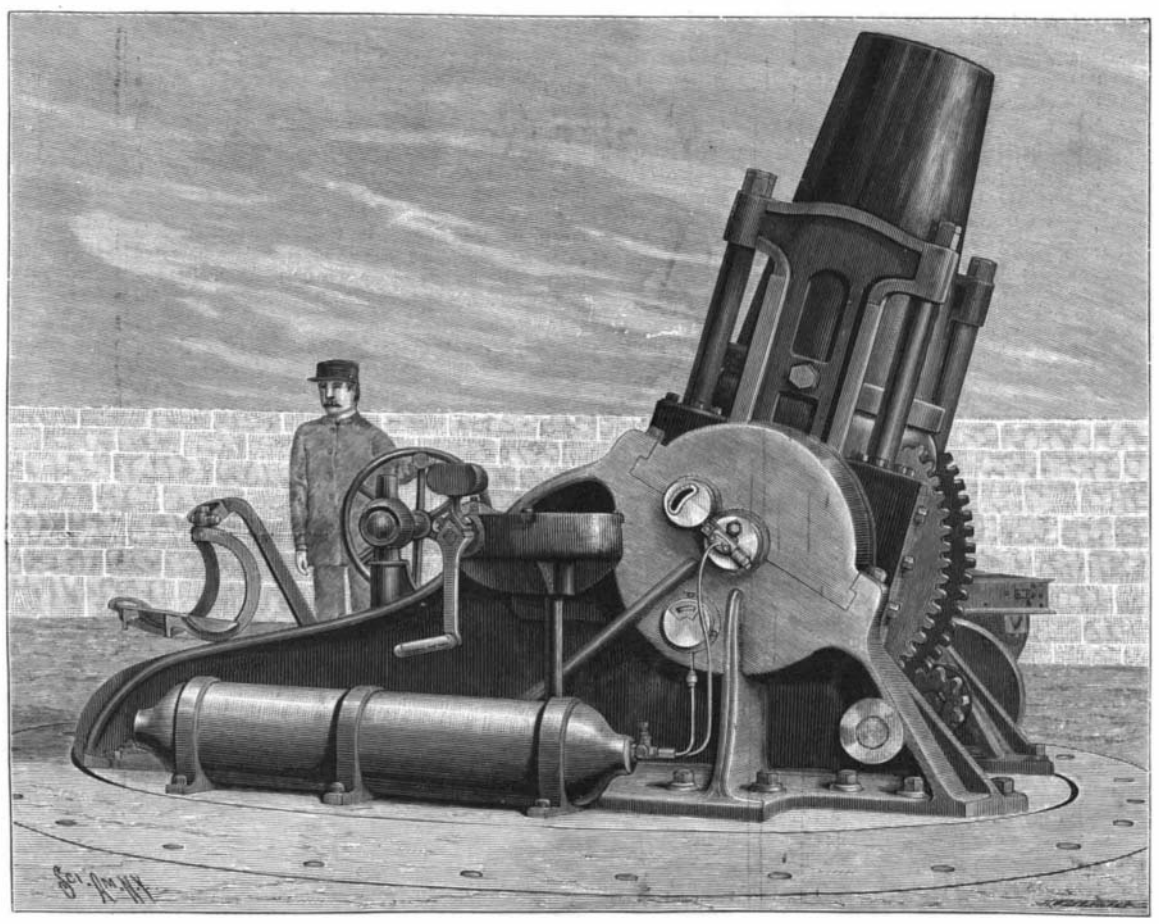
The red light forced the plants most, for those subjected to it blossomed five weeks after the seeds were planted, and the stems were much longer than the stems of the other plants. The difference between them and those exposed to the blue light was most marked. The leaves of the latter were, indeed, dark green, while the leaves of those subjected to the red light were pale, poor in chlorophyl, but the plants themselves seemed unhealthy and stunted; they had gained nothing in height since they were placed under the blue glass. Therefore, it was proved that the blue light was not only an impediment, but an actual injury to vegetation. The effect of the red light was noticeable, not only in the growth of the plants, but also in their sensitiveness, for even the slightest touch, a breath, was sufficient to cause the leaves to close and the little stems to droop. The plants exposed only to white light were not so easily affected, and those raised under blue glass were not at all sensitive. Those raised under white light must be considered normal. They were more stocky and showed a greater tendency to bud, but the buds did not open.

Flammarion extended his experiments to other kinds of plants, such as geraniums, strawberries, etc., but in all cases blue light proved injurious to vegetation, and plants that were exposed to its influence for months showed no development. All the functions of the plant organism seemed to be suspended. The fruit of strawberry plants developed under bells of different colors, but varied considerably in size and quality, as in some cases the leaves were developed at the expense of the fruit, and in other cases, as when the plants were exposed to blue light, growth was impeded in every way.

By making these investigations Flammarion has given an impulse to the study of the subject, and new results will be obtained which will be of practical use in gardening and the propagation of plants.—Der Stein der Weisen.



MORTAR IN THE LOADING POSITION.



MORTAR ELEVATED FOR FIRING.

COMPRESSED AIR RECOIL CYLINDERS FOR HEAVY MORTARS.

Despite the theoretical drawbacks attendant upon the use of compressed air, it has features which

render its use desirable for certain special classes of work. We present in this issue cuts of a heavy mortar, whose recoil cylinders are designed to be operated by compressed air. The design was worked out by Mr. H. A. Spiller, of Boston, Mass., to whom we are indebted for the particulars.

The carriage consists of a lower and upper racer bed, the upper circular bed supporting the two cheeks of the carriage, which are secured in position by a cross key 3 inch by 1 inch and eighteen 1·5 inch bolts in each cheek. These cheeks are provided with trunnion bearings with caps 30 inches in diameter and 6·5 inch face, for the reception of the trunnions formed on plates connecting in pairs the recoil cylinders.

The four recoil cylinders, 8·5 inches in diameter, are arranged in pairs on each side. They are connected by plates 2·5 inches thick and are provided with horizontal ways 7 inches wide on the sliding face between the cylinders and frames, having crossheads in which the outer ends of the hollow piston rods are secured, and they also carry trunnion bearings for the reception of the trunnions of the mortar. At each end of the lower recoil cylinders is a 1·5 inch pipe connected to same for equalizing the pressure. The hollow piston rods, four in number, 4·5 inches in diameter, extend rearward from lugs on the sliding frame through especially prepared packed glands in the heads of the recoil cylinders, and they are provided with conical valve rods, 2 inches in diameter at the large end, whereby a portion of the air below the piston is admitted to the space above the chambered heads. When the gun is fired, the recoil is taken up by means of the cushion of compressed air, and the arrangement allows a sufficient amount to pass to the forward ends of the cylinders to nearly form an equilibrium of pressure on both sides of the pistons, thereby taking up the counter recoil and forming a positive elastic cushion by which the dead weight of the gun is supported. On these recoil cylinders cast in pairs, and on the opposite side of the 2·5 inch plate from the recoil cylinders, is cast a trunnion 30 inches in diameter which supports the plates and the two cylinders. This trunnion fits into the side cheeks mentioned above, which the mortar and recoil mechanism swings on. At the right hand side, and in the center of this trunnion, there is a gage connection and a charging pipe which may connect with a portable or fixed receiver, charged with a suitable pressure to give 750 pounds initial pressure in the recoil cylinders; as the area of the four hollow piston rods must be depended upon to lift the mortar into battery at its highest elevation, this said pressure must not be lower than 650 pounds.

During its recent test by the government the carriage showed itself to be certain and regular in its action, and its service was attended by no accident or drawback of any description. A knowledge of its merits for practical use in our sea coast fortifications can, however, only be obtained by comparing it with similar carriages which have been tested by the government. These are the carriages already adopted for service, a large number of which are now mounted in their batteries, and the Gordon mortar carriage. Either of the latter, so far as its practical manipulation for loading, elevating and traversing is concerned, differs in no essential particular from the pneumatic carriage which is the subject of this report; the comparison is therefore reduced to a consideration of the relative merits of oil and compressed air in controlling the recoil. An extended experience during many years in firing hundreds of rounds in all possible conditions of temperature and weather has shown that the former method involves the simplest possible appliances, which are easily kept in order and ready for action without strain on any part of the system except at the instant of firing. The care of the carriage and its manipulation in service require no skilled labor and involve operations easily understood by the average artillery soldier. At a test of the rapidity of fire it may be mentioned that ten rounds were fired in 22 minutes 20 seconds.

AN explosion occurred on Saturday afternoon, December 12, in the Moabit quarter of Berlin, in the house of the scientist George Isaac, who was experimenting with the manufacture of acetylene gas. Isaac and three assistants were killed. It is stated that Emperor William had intended to visit Herr Isaac's laboratory, as his experiments had attracted ths emperor's attention.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Lewis M. Barlow, Donaldsonville, La. To prevent the formation of scale in the shell, and to facilitate the discharge of impurities accumulating in the mud drum, this inventor has devised a boiler in which a stand pipe leads from the bottom of the boiler shell to the mud drum, near one end of the shell, while a feed pipe discharges into the other end of the shell, near its bottom, in a direction toward the stand pipe. In the drum are nipples leading from near its bottom to a transverse pipe extending through one end of the drum to the outside, by means of which, on the opening of a valve, the impurities in the drum are discharged.

Railway Appliances.

CAR FENDER.—Mariano Sparmo and Louis Russo, New York City. This is a fender which may be readily moved from one end of the car to the other, and is light, strong and durable. It is made in sections, and may be folded upon itself when not needed, but when brought in contact with a person or object while in folded position, the sections are released, and forward spring-controlled sections move automatically into position to pick up a person or object in the way of a moving car, transferring such obstacles from a point close to the ground to the fender, which is of basket form. The forward part of the fender on receiving a weight, has rolling connection with the ground, and, in striking a slight projection, rises sufficiently to pass over it without injury.

STREET CAR GONGS.—Thomas Kelly, New Orleans, La. This invention is for an improved device for automatically actuating car gongs while the car is in motion, the motorman sounding the gong as desired when the car is at a standstill. A lever is vibrated by a projection on the car axle, the lever being connected with a striker and the latter being also connected with a foot piece under the control of the motorman, while a spring yieldingly connects the several parts.

Electrical.

ELECTRIC RAILWAY.—Andrew C. O'Connor, Lynn, Mass. According to this improvement, positive and negative conductors are carried overhead on insulated supports, whereby the current is conveyed from the power station to and from the car motor without employing the ground as a conductor. Poles on opposite sides of the track support cross bars carrying the conductors, and insulated swinging arms having rollers at their lower ends are connected at their upper ends with the conductors. Supports on the top of the car carry two conducting bars adapted to engage the rollers carried by the hanging arms, the bars being insulated from each other and connected with the motor of the car. As the car moves along the bars make contact with the rollers in advance before dropping the pair already engaged at the rear

Mechanical.

COUNTERSHAFT AND BELT TIGHTENER.—Eugene C. Weston, Gallatin, Mo. According to this improvement, an independent shaft mounted in hanger bearings has rigidly connected hanger arms which support a countershaft on which are two fixed pulleys, the first shaft also carrying a rigidly connected arm on which is a segmental gear engaged by a worm on a vertical shaft supported by one of the prime hangers, there being a hand wheel on the lower end of the vertical shaft. Belt guides are arranged in connection with the pulleys on the countershaft, and the countershaft and its parts are carried upward or downward, to tighten the belts or throw the countershaft out of action, by turning the hand wheel on the vertical shaft carrying the worm. The improvement dispenses with loose pulleys and is designed to effect great saving in the wear and tear of belts.

Miscellaneous.

CLEANING SHIPS' BOTTOMS.—Charles P. Turner, New York City. A scouring brush designed to facilitate doing this work rapidly and effectively has been devised by this inventor. It comprises a casing made in sections, designed to adapt itself to the shape of the hull, and containing a flexible shaft carrying at its outer end a revolvable brush, the outermost section of the casing being connected with a rope passed around the hull on the opposite side, by means of which the brush can be drawn down along the outside of the hull and held in contact with it. The shaft is revolved by a crank or other power transmitting device provided with casters adapted to travel on the deck of the vessel.

PRODUCING ORNAMENTAL SURFACES.—Rafael J. Chavez and Charles C. Herman, Pana, Ill. For ornamenting in a selected color glass, wood, paper, metal, etc., these inventors have devised an apparatus comprising a number of furnaces, each having a burner, above which is a wire netting supporting a pigment, a hydrocarbon supply pipe discharging into the furnace above the netting. Pipes connect the furnaces with a mixing chamber above, and a receptacle connected with a mixing chamber is provided with means for supporting the material to be ornamented. When the apparatus is in operation a colored heated gas is produced in each furnace, by the burning pigments, in connection with oils and turpentine supplied from a tank, the gases passing into a chamber and settling on articles where not covered by a stencil or pattern.

LEVEL.—Thomas F. Deck, Swanton, Ohio. This level indicates horizontal and vertical positions, and the angle of deviation when placed out of horizontal position. It comprises a stock having a transverse bore and opposite concentric recesses, bearing plates seated in the bore, one of which has an annular rim engaging with the other plate, and dial plates secured in the recesses. Rollers have journal bearings in the dials and plates, and a weighted shaft having pointers on its ends is journaled on the rollers. There are transparent covers for the dials.

KILN FOR BURNING BRICKS, ETC.—Andrew Thaison, Laredo, Texas. This is an improved kiln designed to enable the operator to control the heat to insure a uniform and equal heating of the articles set in the kiln, and at the same time requiring only a small amount of fuel. It comprises an arched chamber to receive the articles to be burned, opposite furnaces in the sides of the chamber with draught flues above their inner ends, each having branch flues opening at an angle into the arched roof, whereby the products of combustion pass upwardly and sidewise through the material to be burned, there being dampers in each branch flue and a draught flue from the arched roof of the chamber at each end, as well as a draught flue for each corner of the chamber. All draught is upward, and the water smoke readily escapes without injuring the green brick.

SHUTTER OPERATING DEVICE.—Robert H. Ireland, New York City. To facilitate opening and closing doors, shutters, gratings, etc., particularly fire shutters, according to this improvement, a bar is extended across the space closed, two sleeves sliding on the bar, and links of different lengths are each connected at one end to one of the sleeves, both links being coupled at their other ends to the same shutter, there being means for holding the sleeves against movement on the bar. The device also acts as a lock to hold the shutters in closed and open positions.

SLEIGH KNEE.—Herman and Henry Wesle, Medford, Wis. In order that the body of the sleigh may have lateral play on the knee to a limited extent, these inventors have devised a simple and inexpensive construction, applicable to any sleigh runner. The knee comprises an upper or body portion and side flanges, with a lug at each side of the center and a clamp adapted for attachment to the body of the sleigh and located on the upper central portion of the knee to have lateral movement between the lugs. The clamp has side flanges to engage the side flanges of the knee, and guide devices connected with the flanges of the clamp are controlled by stop devices on the flanges of the knee.

PENCIL SHARPENER.—Constant E. Consy, New York City. This is a device designed to remain permanently on the pencil, which, as it becomes dull, is fed toward the knife of the sharpener to renew its point, the knife being so located on the sharpener that the knife and its support form a rest for the fingers of the hand grasping the pencil. It consists of a conically tipped tube around which is a spiral slot, a sleeve traveling on the tube, while a set screw enters an opening in the sleeve and slot and projects into the pencil. The tube is also designed to protect any portion of the lead that is exposed and not actually used, thus preventing breakage.

AUXILIARY BROOM HANDLE.—Loy B. Young, Newport, Ark. To facilitate the advantageous use of a broom in cleaning ceilings, walls, etc., this inventor has devised a ready means of attaching an auxiliary handle to the ordinary handle to lengthen the latter. It consists of a clamp having semicircular bearings adapted to engage the broom handle and opposite bearings to engage a stick forming the extension handle, a thumb screw tightening the parts to firmly draw the handle and stick together.

ASH SIFTER.—John W. Fee, Chicago, Ill. This sifter has a suitable casing, in the bottom of which is a receptacle to receive the ashes, and the top being closed by a cover, while near the top is a removable cylindrical receptacle, which may be taken to the stove to receive the ashes, and which also constitutes a sifter when in place in the casing, being revolved by a crank handle extending out at one side. The cinders remain in the cylinder after the ashes are sifted out, which is effected without any escape of dust.

ATTACHING HARNESS TO VEHICLE SHAFTS.—Frederick Dickerboom, Windom, Minn. A device designed by this inventor is particularly for attaching light tracing harness to the vehicle shafts, whereby the harness need comprise only the bridle and driving reins and the saddle, the attachment being connected with the saddle straps, and a portion of the device being a fixture to the straps, while another portion is made a fixture on the shafts. Attached to the thill is a body with a slot intersected by a bore, while a slotted slide is inwardly spring pressed, a spring pressed bolt stud being movable in the slot of the slide, and a buckle with a stud movable in the slot is engaged by the bolt to prevent the disengagement of the stud with the body.

EVAPORATING PAN.—Leon F. Haubtman, New Orleans, La. This patent is for one of a number of similar inventions by the same inventor, for quickly evaporating moisture from a liquor, and comprises a casing within which is an inclined evaporating plate, on the underside of which is secured a plate forming chamber to receive steam pipes, a wave-like plate being arranged over the evaporating plate, over which a blower forces heated air, while a liquor tank has communication with the upper end of the evaporating plate.

VEHICLE BRAKE.—Vardiman T. Sweeney, Springfield, Ky. This is an improvement on two formerly patented inventions of the same inventor, to simplify brakes adapted to be applied by the team in backing, and providing means for their application by hand as readily as by the team. The mechanism is such that when the vehicle is on an incline and the tongue is free to act, the brakes will be automatically applied, owing to the inclination of the tongue, due to the team in holding back. The invention also provides improved means of suspending the brake beam to take up lost motion, and for the taking up of lost motion in the chains or cables.

VEHICLE WHEEL.—Paris Richardson, Deshler, Neb. This wheel has a divisible hub, and the spokes and sectional fellies are made to press outwardly on the tire and hold it tightly bound on the felly sections. The hub is composed of two sections, one slidable on the other, the sections having parallel flanges receiving between them the inner ends of the spokes, there being a divided ring in the hub whereon the inner ends of the spokes are seated, radial bolts engaging the ring and projecting between the spokes, while clamping plates on the outer ends of the bolts rest on the hub flanges.

CHRISTMAS TREE STAND.—Henry W. Kurtz, New York City. This is a stand in which the body of the tree will be received and held in position on the base of the stand by braces pronged around the tree trunk, effectually preventing the tree from toppling over, while the attachment of the stand to the tree may be readily and quickly effected. The stand consists of base members detachably secured together in cruciform shape, and braces pivotally attached to opposite sides of the members are adapted at their free ends to be secured to the trunk of a tree by means of nails or screws. When the stand is not needed, its parts may be folded and packed in a small space.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Notes & 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.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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.

(7070) H. S. P. asks: What is the smallest in weight and size and economy of a plunge battery or batteries that will develop two actual horse power for 10 or 12 hours, and also the solution and metals and proportion, etc.? A. This cannot be done except by using an extravagantly large battery, because a plunge battery runs down very rapidly, the chromic acid attacking the zinc. A battery just sufficient to give 1,500 watts when fresh would at the end of 10 hours run down to perhaps 150 watts. A practical rule is to allow 12 square inches of zinc to 4 watts. The number of cells the battery should contain depends on the voltage. Then in use the battery may consume one-half of the power. The rule given will do for one or two hours probably. If for a long run, make the battery five or ten times as large. A powerful plunge battery is described and illustrated in our SUPPLEMENT, No. 792.

(7071) M. W. C. says: Salts are of two kinds, acid and neutral. The acid salts are those in which only part of the hydrogen in an acid has been replaced by a metal and reacts on acid. Why then is $NaHCO_3$ basic in quality? Is it called an acid salt as $KHSO_4$? A. Your first definition is correct and full. The fact that a salt affects test paper does not always show that it is not neutral. The general statement about such a salt as sodium carbonate would be that sodium is of so strong an alkaline reaction that its effect on litmus solution or test paper can only be masked by a strong acid. In other words, the neutrality of a salt is a question of constitution, not of reaction on test paper. $NaHCO_3$ is an acid salt.