THE WORLD'S WORK.

Street-Car Motor.

THE problem of cheap transportation in cities is receiving constantly increased attention in all parts of the world, and the street railroad is everywhere the most popular method. But the fact that horses must be used as a motive power, limits the capacity of such roads, and attention has been turned of late to various steam and other motors, in the hope of finding something faster and more reliable than horse power. A great variety of steam motors have been tried with more or less success. The fireless locomotive, already described in this department, a motor using the steam that may be stored in a tank till consumed, has also been tried with good results. A more recent invention employs compressed air as a source of power, and, as it has now been in daily practical use for several months, may be worthy of brief description. The main idea of this motor is to store compressed air in a tank attached to a street car, and to use the air in an engine in driving the car. The car is intended to be of the usual "house" pattern, with platforms at each end and with seats on either side. In laying out the system of tanks, in which the air is stored, reference is had to the shape of the car, and the tanks are placed under the seats and behind and before the wheels and under the floor of the car,—the space between the wheels being left for the engine. The tanks resemble cylindrical boilers, and are made of steel plates securely riveted. The two larger tanks under the seats extend the whole length of the covered part of the car. The smaller tanks are hung under the car and reach from the axles of the wheels to the ends of the car. This gives six tanks capable of holding air enough for a trip of ten or twelve miles; all the tanks are joined together by short pipes so that the pressure is the same throughout. The entire system of tanks and the engine are securely fastened to a strong plate-iron frame, supported by the wheels, and serving as a base on which to rest the car. The motor is a double cylinder engine, connected directly with cranks on one of the axles, the two pair of wheels being connected on the outside. The levers used to control the engine are brought to one end of the car, the handles being conveniently arranged on the forward platform. As a piece of mechanism the motor deserves attention for its ingenious adaptation to its peculiar work. A street-car motor must be obedient, quick to stop and start, go forward or backward, and it must be clean, free from bad odors, and as nearly noiseless as possible. It must have reserved power for mounting grades, and sufficient brake power to allow it to descend steep inclines in safety. It must submit to the peculiar rocking motion of long cars balanced on a short wheel base, and it must be able to stand the ill usage of rough and cheap roads. This motor appears to be happily designed to meet these requirements, and to meet the demands of a power that practically perishes in the using. On preparing the motor for a trip, it is brought up to a compressing engine and charged with air up to a pressure of 660 kilos per 6¼ square centimeters (300 lbs. per square inch), the levers are then placed so as to cut off quite early in the stroke of the engine, and the car is started ahead. As the car proceeds the cut-off is increased at intervals to the end of the trip; by this arrangement the power when high is used sparingly, and as the pressure is reduced by the exhaustion of the tanks more and more air is given to the engine. Starting with a pressure of 660 kilos, the engine will run till the pressure is reduced to about eighty kilos, when the tanks must be recharged. One charge is, however, sufficient for a run of ten or twelve miles. On reversing the engine to run backward, the point of the cut-off may remain unchanged, or can be altered at will, and without changing the direction of the car. On stopping for passengers the action of the engine may be checked instantly, and at the same time the cylinders may be changed into pumps. The momentum of the car urging it forward then causes the engine to pump air back into the tanks, and thus the engine becomes a brake, stopping the car within its own length and without jar, as the momentum of the car is cushioned against the compressed air in the tanks. An ingenious arrangement is applied to the axles of the driving wheel for adjusting the engine to the rocking motion of the car, so that the engine runs smoothly when traveling at a high speed or over rough roads. The movement of a car fitted with this motor is easy and pleasant. There is no heat or disagreeable odor, and the noise of the exhaust is not in any way troublesome. The engine may be easily managed by one man, and so simple is the mechanism that skilled labor is not required. Any driver able to manage a car and pair of horses in a crowded street, can, after a few hours' instruction, run the motor in safety. The car used to cover the motor is of the common pattern, except that it is slightly longer and is not quite so wide as the usual New York car. It has now been running regularly for several months doing the same duty performed by the horse cars and over a very poor road, and has given sufficient satisfaction to lead the company to order more motors of the same pattern. The cost of a motor is said to be less than a common car and its necessary teams of horses. The cost of the pumping plant must also be included in equipping a road with these motors, but as one car can be charged in about five minutes, one plant is sufficient for a great number of cars. In addition to this is the fact that cars fitted with the motor carry more, can run faster and perform a much heavier duty than the ordinary horse car.

New Electric Lamp.

IN addition to the various electric lamps described in the last number of the Magazine may be

mentioned a new and smaller style of lamp intended for domestic use. In place of two pencils or plates of carbon, a pencil and a wheel are used to form the wicks, or burners of the lamp. A stick of carbon of the usual shape is placed in an upright frame, or support, so that it will hang point down. The lower end rests on the edge of a carbon wheel, fixed on an axle so that it can freely revolve. The support for the wheel and axle is formed by a lever pivoted at one end and arranged to "give" or sink slightly under the weight of the carbon pencil resting on the edge of the wheel. The lever carries a brake that rests on another wheel that is turned, by means of a rack and pinion, by the weight of the iron rod that holds the pencil. By this arrangement the weight of the pencil, that continually tends to make the wheel revolve, is compensated by the action of the brake on the second wheel, the movement of one exactly balancing the other. The carbons in electric lamps waste while burning, and in this style of lamp the loss of weight in the pencil is compensated by the movement of the two wheels. The weight of the pencil pressing on the carbon wheel tends to move it forward as fast as the brake permits, and as it burns away the point is continually pressed on the carbon wheel. It will be seen that by this arrangement the two carbons, stick and wheel, are always in contact whatever the changes in the current, and a fixed and steady light is maintained. It is claimed that this lamp exhibits none of the extinguishings and relightings noticeable in some forms of electric lamps, and from all that can be learned, the lamp gives excellent results in practice. This style of lamp is designed to be used with a small battery; four bunsen elements being sufficient for a single lamp of moderate power.

Improved Ironing-Machine.

THE rapid increase of the laundry business has led to the invention of a number of appliances for ironing and polishing starched clothing. Among these is a new power ironing and pressing machine, that has already been introduced into a number of laundries. It consists of a frame holding a table and having a rigid curved arm standing behind and above the table, the whole apparatus somewhat resembling a milling-machine. At the end of the arm is hung an upright shaft that may be moved up and down by a lever moved by the foot, and carrying at the lower end a hollow polishing iron. The polishing iron may be connected with a gas main and may be heated by a jet burning inside, or iron slugs may be heated in a stove and put in the iron, either method giving a safe and moderate heat. The table on which the work is placed is supported on double brackets hinged in two directions, and thus the table has a universal lateral motion. The work is laid on the table and fed to the iron by hand and in any direction, while the pressure of the iron is controlled by the foot lever. In using the machine power is applied, and, by means of a belt taken over guide pulleys, the pressing iron is made to revolve at any desired speed. The machine is very simple in its operation, and can be used by comparatively unskilled labor.

Improvement in making Artificial Stone.

ARTIFICIAL stone is extensively manufactured, both in this and other countries, and is used with more or less success in all kinds of constructions. The basis of these stones is sand and cement, the quality of the materials often making a great difference in the character of the product. An improved process in this work consists in making a mortar of sand and cement, and casting it in wooden and iron molds. The next, and new step, in the work is to submit the window-sills, caps, and other articles thus made to the action of carbonic acid gas in an air-tight chamber. The gas is easily obtained by burning charcoal and passing the products of combustion through water to reduce the temperature, the gas being turned into the chamber for two or three days without intermission. The gas is absorbed by the damp mortar, and in time it becomes as hard as the natural stone. The articles are plunged in water for a short time and are then ready for use.

Automatic Device for Reproducing Music.

A NOVEL invention designed to be applied to reed organs may be worthy of examination as illustrating a new departure in the manufacture of self-acting musical instruments. Reed organs of the American type are all constructed on the principle of an exhausted receiver. The bellows, when operated by the hands or feet, produce a partial vacuum in the wind-chest of the instrument. The free reeds used in these organs are placed, either flat or upright, at the entrance of the wind-ways or openings leading to the wind-chest. Valves moved by the keys close the entrance to each reed, and on depressing a key the valve is opened and the air, rushing in to fill the vacuum, causes the reed to sound. Organs constructed on the reverse, or pressure plan, are only made in Europe, and there has been much discussion as to the relative value of the two systems. The exhaust system produces a good tone and it is universal in this country, and the new invention is only applicable to organs made on this plan. An organ with a single set of reeds (about three octaves) is erected without keys or action. The bellows, wind-chest and reeds are put in the usual positions, the reeds standing upright, and the top of the wind-chest is made slightly rounded, all the holes leading to the reeds being entirely open. A shaft is then set in the frame of the instrument just behind the reeds, and on this is placed a small fly-wheel and a set of friction gearing. By means of proper connections, this shaft and its gears may be kept in motion by moving the pedals that operate the bellows of the organ. If a sheet of stout paper is now laid over the openings leading to the reeds and the bellows are operated, a vacuum is set up and the paper is pressed firmly down over the holes by the pressure of the atmosphere. The result is, every reed is stopped and the instrument is silent.

Make a hole in the paper over any reed and that reed will sound. Make other holes and other reeds may be made to sound at the same time, and thus it is easy to see that, if the holes are made in the paper in the proper places, the organ might be made to sound a chord. In playing keyed instruments, the number of notes in a chord is limited by the capacity of the hands to grasp the keys. Any number of holes might be made in the paper, and thus a wider chord, or fuller harmony, could be produced than by hand on a keyed organ. The next step is easy. Cause the paper to move over the wind-chest, make more holes or groups of holes, and the instrument may be made to reproduce a series of notes or a procession of chords which would be practically music. This is the aim of this new device. Sheets of stout paper, from ten to thirty meters long, are carefully stamped with holes of varying lengths, a hole designed to give a whole note being twice as long as one intended to give a half note, and so on throughout all the varieties of notes. Rests or silence are made by simply leaving the paper uncut. Strips of paper thus prepared and rolled on spools are placed in the instrument, one spool fitting into the friction gearing. On making the pedals move with the feet the shaft is made to turn, and, by means of a feed-roll and a guide-roll, the paper is made to pass over the top of the wind-chest. The same action of the pedals also moves the bellows and sets up the exhaust in the organ. Suitable arrangements are also provided to maintain a uniform tension in the roll of paper, and to prevent it from being torn when reaching the end of the roll. The result obtained by thus passing the perforated paper over the reeds is curious, if not artistic. The music impressed on the paper by means of the perforations is exactly reproduced on the organ without the aid of any performer. Any one who can move the pedals can reproduce a piece of music, whatever its character. On reaching the end of the roll and the end of the musical composition, the roll may be taken out and rewound (changed back from one spool to another) by a simple arrangement placed in the organ case, and without interfering with the performance of any roll that may be in use. While this apparatus does not rise above the music-box class of instruments, it may prove of some value in making a standard of reference in regard to the movement of certain pieces of music and as a possible means of instruction in harmony and melody, showing the order and arrangement of chords and the progression of successive sounds.

Experiment in Floating Apiaries.

THE fact that the floral season moves over the continent from south to north has long been familiar, and it has been proposed to move colonies of bees by road or rail from the southern to northern states, keeping pace with certain flowers, and thus supplying the hives with the needed bloom. Transporting the hives by wagon or rail has been tried, but without success, and the scheme was considered of doubtful value. This past season the experiment was renewed on a large scale by water. A number of colonies of bees were placed on barges, and by the aid of a small steamer were towed up the Mississippi River. The design was to keep pace with the blooming of the willows that line the banks of the river from Louisiana to Minnesota, and had it not been for a series of accidents to the towboat, the plan would have been fully carried out. The delays caused by the stoppage of the steamer prevented the floating apiary from keeping up with the march of the flowers. The blooming of the willow begins in Louisiana in April and moves up the river as the season advances, ending in late summer in Minnesota, and the boat being detained was left behind several times during the voyage; in spite of these drawbacks the experiment was a success. The bees gathered the honey from the willow and other flowers by day and traveled up-stream by night, the voyage ending with a fair crop and only a small loss in the stock of bees. The honey-raising business is a large and growing interest, the demand for export being in excess of the supply, and the result of this experimental floating apiary may be regarded as opening a new branch in the business.

Memoranda.

A NEW white pigment has been obtained by precipitating chloride or sulphide of zinc by means of a soluble sulphide. The precipitate when dried is submitted to a cherry red heat, in a furnace freely supplied with air. It is drawn from the furnace while hot and plunged into cold water, well stirred in the water and then taken out and dried. The result thus obtained is said to give a pigment of a pure white color, though slightly variable in shade according to the time of exposure in the furnace, and of superior qualities as a paint.

Very many attempts have been made to make a practical self-inking pen. One of the latest of the inventions employs a hollow hard rubber handle closed at the top as a reservoir for the ink. Within this reservoir is a small tube extending from the top of the handle, where it is open to the air, to within a short distance of the point of the handle or pen. A minute hole is made in this tube at the lower end and a slender hair-like wire supported on a spring is fastened to the bottom; a pointed cap, with a minute hole at the end, fits over the handle to form the point of the pen. On filling the reservoir with ink and screwing on the point, the ink flows down to the point and would escape were it not for the atmospheric pressure. On using the pen the wire projects beyond the point of the pen and touches the paper, the contact with the paper and the slight lateral movement of the wire as the pen is moved serving to draw the ink to the point, the pen then leaving a fine unshaded line on the paper till all the ink is exhausted. At the same time the hollow tube inside the handle admits a little air, and relieves the pressure and permits the ink to flow continuously. When not in use the pen is dry and no ink escapes, and by means of a cap the point can be covered when the pen is in the pocket. A single filling is said to be enough for two or three days steady writing.

THE WORLD'S WORK.

Machine for Measuring Plane Surfaces.

AMONG the new appliances shown at the exhibition recently given by the Mechanics' Association in Boston, the most striking invention was an apparatus for measuring the area of plane surfaces. As the machine performs this work automatically, instantly and with absolute precision, careful personal examination was given to it, and in describing so entirely novel an apparatus, care will be taken to make its plan of action clear. The apparatus consists essentially of a wooden table, a weighing device resembling a platform scale and a platen or carrier supporting a great number of iron pins or bolts. It is practically a weighing machine; but with the unit of weight representing a unit of superficial area. The table is of wood supported on four iron legs, of a convenient height, and the entire surface of the table is perforated with holes placed at equal distances and in parallel lines in two directions. Above the table is a platen of the same size and supported by a system of compensated levers whereby it may be easily raised and lowered a short distance. The platen is also perforated with an equal number of holes, each one exactly corresponding with a hole on the table; each of these holes is bound with brass, and in each is placed an iron flat-headed bolt. The head prevents them from falling through, and yet leaves them free to play up and down in the hole. Beneath the table.is a platform scale having a platform equal to the whole size of the table. Behind the table is a dial having a hand or pointer connected with the weighing apparatus and recording the weights placed on the scale; when the platen is brought down on the table all the bolts pass through the holes in the table and rest on the platform of the scales below. Thus the weight of all the bolts is supported by the scale, independently of the table or the platen. The total weight of the bolts is then recorded on the dial and the apparatus becomes actually a device for weighing the bolts, and, at first sight, this is its only use. It is really all the machine can do; but by a most ingenious transformation, the measuring of weight is practically the measurement of surface. To understand this we may suppose the total weight of the bolts is twenty kilos, and that the dial records this weight. We may then lift the platen and place on the perforated table a sheet of paper that will cover just half of its surface. Draw the platen down upon the table and half of the bolts will strike the sheet of paper and be prevented from reaching the scale. The weight will then rest half on the table and half on the scale, and the hand on the dial will record only ten kilos.

It is now easy to understand that if the dial had been marked in meters instead of kilos, and that the highest figure had been four meters, the dial would now record not ten kilos, but two square meters. In this way the weighing of the bolts becomes a device for measuring the superficial area of the sheet of paper. In the apparatus inspected, the bolts are arranged in close lines so that sixty-four bolts cover one square foot of surface. This number is selected because it may be divided into four groups of sixteen each, or four parts equal to one quarter of a square foot. On placing a sheet of paper one foot square on the table, and bringing down the platen, sixty-four of the bolts are stopped by the paper and prevented from reaching the scale, and the dial gives the weight of all the bolts less sixty-four. This is the actual operation; but the hand rests over the mark "one square foot." Cut the square sheet of paper into four equal parts and lay them on any part of the table, and on drawing down the platen the dial still records one square foot. Cut a hole in the paper or tear it into a dozen ragged pieces and scatter the fragments over the table, and the dial will again record one square foot. Each piece supports more or less of the bolts, and the sixty-four are still stopped from bearing on the scale, the dial reports the weight of all the bolts, less sixty-four, or one square foot of surface. Throw a goat-skin, a dress pattern, or any other irregular piece of cloth or fabric on the table, and the dial will at once record the total area in square feet and quarters. There can be no mistake, whatever the shape of the fabric. If there are holes in the skin, the area of the holes will be left out and the machine will give only the actual surface. Place a number of skins on the table and the dial will give their combined area. Place all the patterns of a dress or cloak on the table and the machine will give the exact number of square feet of cloth needed to make the garment.

If it is desired to know the superficial contents of a farm, garden, house-lot or room, place a pattern of the farm, lot, etc., drawn to scale, on the table and the dial will give the area of the pattern and a little mental arithmetic will give the area of the lot or farm, however irregular its shape. Even the superficial area of a lake or bay can be given in miles, by testing a pattern or plan of the outline of the water drawn to scale. So far, the only use made of this singular invention has been found in the manufacture of shoes and shoe materials. In measuring the pattern used in making shoes and in measuring skins it has proved of great value,—one man assisted by two boys being able to measure ten skins a minute. The apparatus will doubtless prove of still greater value to the dress-making trade in giving the exact number of square inches in the patterns of a dress, and thus preventing the wasteful guess-work and allowance for mistakes now so common in this line of work. It may also prove of value in other arts and trades requiring quick and accurate measurements of superficial areas.

New Electric Lamp.

THE interest in the electric light tends steadily to increase and several new lamps are soon to be manufactured upon a commercial scale. One of these departs radically from the carbon pencil form of lamp and employs a large saucer-shaped mass of carbon combined with a very small and slender pencil. The lamp has a hollow stand supporting a bracket on one side and at the end of this bracket is suspended, with the rounded side down, the disk of carbon. A metal ring is bound round the disk and from this the connection with the line is made. In the hollow stand is placed a rod of carbon about one meter long and three millimeters thick. A spring collar clasps this rod just at the top of the stand and serves to raise it till the sharpened point just touches the bottom of the disk. Below and inside the stand is a cord running over a pulley and attached to a rest or support for the foot of the carbon and having at the other end a weight. This tends to keep the rod pressed up against the disk as fast as it is burned away. The connection with the line is made through the collar that clasps the rod, and on sending a current over the line the electricity passes over the few centimeters of the rod between the collar and disk and bringing this small section to a white heat. There is also a small voltaic arc just at the junction of the rod and disk and from these comes the light. This simple and inexpensive lamp is reported to give a perfectly steady light of moderate power. It is also claimed that the resistance offered by the lamp is low, thus making it practical to put, at least, sixty lamps on one circuit. Other new lamps will be reported upon as soon as they can be examined.

Hydraulic Fire-Escape.

THE familiar hydraulic elevator, using a nest or group of pipes telescoping one within the other, has been recently applied to fire-escapes. The apparatus belongs to the self-erecting ladder type of fire-escape, and consists essentially of a hydraulic elevator mounted on wheels. Two hydraulic cylinders are fitted upright on the frame of a four-wheeled carriage. The pistons of these cylinders support, by means of universal joints, the larger of the four pipes of the elevator. When not in use, all the tubes are pushed one within another, and the nest of pipes rests horizontally on the carriage. In addition to the elevator tubes are six shorter telescopic tubes, designed to serve as legs or struts to hold the elevator in position when erect. On bringing the apparatus to the fire and releasing the horses, it is connected with the street mains or with an engine or hydraulic pump and water is forced into it. The first action of the water is to extend all the telescopic legs till they touch the ground and lift the apparatus clear of the carriage. The legs may then be clamped firmly together, and the elevator is then secure on a wide and solid base. The next operation is to fill the cylinders, and as the pistons rise they lift the elevator tubes, and the lower end being weighted, the telescope rises and stands erect, and by means of clamps it may be secured in this position. Water is then forced into the elevator and it rises to its full height, and carrying a platform with a load of men and materials at the top. This platform is railed in, except on one side, where a short ladder is hung on hinges. By means of a windlass on the platform, this ladder may be placed at any desired angle to reach the roof or windows of the buildings above or below the level of the platform. The height of the elevator can also be regulated from the platform, and it may be raised or lowered by the men at the top at will. It will be observed that the apparatus gives a firm support at any desired point of its length, that the elevator may be raised or lowered even while heavily loaded, and that, as it is wholly of iron and filled with water, it will stand great exposure to heat without danger. An iron telescopic hose-pipe is fitted to the elevator, so that a stream may be turned on the fire from the platform, or an extra line of hose may be hung on the outside of the elevator. A fire-escape of this description can be extended to a height of 17.08 meters (56 feet), and lifting a load of 500 kilos in about nineteen seconds, and can be lowered in safety in seventeen seconds. When laid down on its carriage, the elevator is about 2.13 meters (7 feet) high, and perhaps twice as long, and may be drawn by two horses.

New Insulated Telegraph Wire.

THE objections raised against the unsightly telegraph poles used in our streets has called out a new telegraph wire, so perfectly insulated that it may be laid in the ground with safety and economy. Copper telegraph wire is cut into lengths of 3.05 meters (ten feet), and inserted in glass tubes of a slightly larger diameter, or just enough to fit loosely. The glass tube is then pushed into an iron pipe of the same length, and two pipes and inclosed wire are brought to a red heat in a furnace, and while hot are then drawn through rolls. This operation binds iron, glass and copper into a solid mass, and making an iron rod with a glass core inclosing the copper wire. The glass flows easily under the rolling, and when cold, makes a perfect insulation for the wire, while the iron skin gives strength and a durable covering. The ends of each length are then ground to a convex surface, so that when the pieces are coupled together with ordinary gas-pipe coupling, the copper core comes in contact first, thus securing a good electrical connection. The exterior pipe is designed to be enameled, and is then ready for laying in the ground.

Observing Underground Temperatures.

A SIMPLE thermo-electric apparatus for testing the temperatures of waters in deep bore-holes has recently been introduced. It consists of a copper and iron wire, each insulated and joined together at one end, where, for a short distance, the insulation is removed. To find the temperature of the water in a boring, the two wires are lowered into the bore-hole till the uncovered end rests in the water. The upper ends of the wires are then connected with a

galvometer, and placed loosely in a basin of water. Now, so long as there is a difference in the temperature of the water in the basin and the water in the ground, the galvometer will be affected, and by raising or lowering the temperature of the water in the basin till the galvometer comes to rest the temperature of the lower water can be found. A thermometer placed in the basin of water will give the temperature below, because the two temperatures are alike.

Burning Wet Peat.

THE extensive beds of peat found in the New England states have often been made the subject of experiment in the search for cheap fuel. Nearly all the efforts that have been made to utilize peat have proved abortive; the cost of cutting and drying being too great to enable peat to compete with coal. More recently. it has been found that a system of boiler setting already freely used in the Eastern states is capable of solving the peat fuel question in a satisfactory manner. This system is applied to horizontal tubular boilers, and consists essentially of a system of air ducts or pipes designed to convey the air needed for combustion, in a highly heated condition, to the rear of the fire. The boiler is set in brick in the usual manner, except that the fire-box is much deeper than the ordinary fire-box, the boiler being about 76 centimeters above the grate bars. In the brick walls on either side are open flues extending backward and forward several times the length of the boiler and next the fire. The entrances of these flues are placed in front beside the furnace doors, and the outlets are at the sides above the fire and across the furnace behind the fire. These outlets into the furnace are covered with cast-iron plates perforated with a great number of small holes. On starting a fire, these long air ducts are heated, and the air, that soon begins to flow through them, becomes intensely heated and enters the fire under considerable pressure. The result is a complete combustion of the gases from the fuel. By the ordinary method of making the fire-places, the air needed for combustion is supplied under the grate bars. A part of the gas is supplied with oxygen and is consumed, but a large part escapes up the chimney as unburnt fuel. By supplying hot air behind and above the fire, these fugitive gases are caught and burned. On looking into the furnace from the sides or rear the gases may be seen taking fire and burning in long streaming flames at every hole in the plates over the air ducts. Raw peat contains a large percentage of gas, and the experiment has been made of burning it in this furnace with entire success. Peat freshly dug from a marsh is mixed with one-fourth its bulk of small bituminous coal and thrown on the fire, and within a few minutes the gas flames begin to form on the flue openings, and presently the entire furnace is filled with flame, showing a practical gasification of the peat and a perfect combustion of the gases. No blower is needed, as the streams of hot air thrown on the fire create a good draught and effectively consume the peat and with good results in steam power. This system of boiler setting is already in extensive use, and in making it possible to burn peat with economy, will do much to utilize our vast stores of peaty fuel, and tend to cheapen the cost of steam power. A battery of boilers burning peat every day was exhibited at the recent exhibition in Boston, and this description was made from examination there.

Memoranda.

A CONVENIENT method of finding the temperature of pieces of hot metal has been introduced in several German rolling-mills. Dark-blue eye-glasses are tested by the foreman till he finds a glass of the proper degree of transparency to allow the light from hot rails to disappear from sight at a known temperature. Having secured the right glass he may look at red-hot rails and decide, by seeing the light fade out when the metal has cooled down to the desired temperature, when to cut the rails. By this method all the cutting will be performed at the same temperature, and the finished rails and other pieces of metal will be of the same length when cold. In using colored glasses for this purpose it will be essential that the same man uses the glasses, as any difference in vision would easily throw the observations out of proportion.

Plastilina.—This new material, designed to take the place of modeling clay, is described as consisting of 51.2 per cent. of fatty acids and fat, 5.2 per cent. of oxide of zinc, 30.2 per cent. of sulphur, and 13.4 per cent. of clay. To make a quantity, 300 parts of fatty acid (from olive oil) may be boiled in 43 parts of the oxide, and 130 parts of olive oil, and 60 parts of wax, and added, and the whole melted together. While still hot, 280 parts of sulphur and 118 parts of clay are stirred in till well mixed. The material is said to have a somewhat disagreeable odor, but to serve a good purpose in modeling, as it requires no moistening.

Test for Cotton.—To test linen fabrics mixed with cotton, it is recommended to dip the material in an alcoholic solution of aurine or yellow coral, and to then wash in a concentrated aqueous solution of carbonate of soda, when the linen threads will take a rose-red color, the cotton remaining unchanged.

Coloring Zinc Articles.—The free use of zinc for making vessels and utensils of all kinds has created a demand for coloring materials for decorating the zinc. Some of these processes give excellent results, both in white and mixed colors. In a new process for coloring zinc, the articles are first scoured till bright with sharp quartz sand moistened with dilute muriatic acid, dipped quickly in water and then dried with white blotting paper. The articles are then placed in a solution of alkaline tartrate of copper at a temperature of 50° Fahr. This bath is made by dissolving three parts of air-dried tartrate of copper in caustic soda-lye, containing four parts of hydrate of soda to forty-eight parts of water. In placing the zinc articles in the bath they rapidly change color from violet to dark brown, then to green, to golden yellow and finally to purple. By

watching the process till any one of these stages is reached and the desired color obtained, and then immediately removing the articles from the bath, and rinsing in water, the color may be made permanent. The metal must be at once dried carefully, and may then be varnished. The change from color to color in the bath is said to take place in less than eight minutes, and, unless the process is stopped inside of this time, the colors become confused and valueless for decoration.

New Use for the Sand-blast.—The sand-blast has been recently applied to the sharpening of files and edge-tools. In cutting the teeth of files a burr is formed on the top of the teeth, and by an ingenious application of the sand-blast it has been found possible to reduce this burr, thus making the teeth sharp and clean. A double blast is used, and the file is held between them, and given a slight motion from side to side, and is drawn backward through the united blasts at the same time. Worn-out files are also resharpened and cleaned in the same manner. In sharpening edge-tools a blast using water with a little fine sand is employed with the steam or air. The process is reported to give excellent results, and is now being applied in a number of file shops and cutlery works.

BRIC-À-BRAC.

BORROWED SKATES.

Mythological.

THE mindful gods once gave to men
A bird of plain but soaring wing,
Endowed with song so sweet, that when
The warbler did his best to sing,

All human sounds in wonder died,
All other birds were mute and still,
While the melodious vocal tide
O'erspread the list'ning vale and hill.

But, ah, vain thoughts this singer nursed;
He envied birds of brighter hue,
And grieved that he could not be first
In beauty's shining circle too.

So when the gods discerned this thing,
They gave the bird his heart's desire,—
Bright golden plumes and gorgeous wing,
All glowing like celestial fire.

Oh union rare of gifts divine!
What richer boon could gods devise?
The fairest bird on earth to shine,
The sweetest song below the skies?

Alas for pride and vain desire!
On joyful wing he grandly shone;
But lo, his wondrous notes expire,
His voice is changed, its music gone!

A humbled bird, of song bereft,
He sought a quiet dwelling-place
In forests dark; and, dying, left
His beauty to a songless race.

And ne'er could fallen man's device
The sylvan mutes to music wake;
Now these poor birds of paradise
Are hunted for their beauty's sake.

STEPHEN SMITH.

The Lazy Lover.

O BROOK, I suppose I ought to address you,
Since I'm in a sentimental mood.
I'm hardly up to it, really; but—bless you!—
I'd do the appropriate thing if I could.

But at least I can try. The adorable lady
Who reigns o'er my heart, dwells—no, *that's* wrong!—she boards
On your flowery marge, where it isn't so shady
As one would expect from the terms she affords.

O brooklet, carry her this little message
(Since you're going that way, you can save me the walk):
That I love her as much as I did at a less age,
But that cash isn't plenty—— Pshaw! That's not the talk!

I mean, please inform her (I'm short of ideas)—
That I'll try to call when it isn't so hot;
And if *I* had as large an income as she has,
I'd—well, it don't matter much—I forget what.

The fact is—but, brooklet, hold on! You're not going
The right way to find her; she lives up-stream,
And you in the opposite quarter are flowing.
So perhaps you'll do this: Since the heat is extreme,

And in summer I always favor "protection"—
Just oblige me by turning and going up hill!
It would emphasize neatly my strong predilection,
And I shall be greatly obliged, if you will.

GEORGE P. LATHROP.

THE WORLD'S WORK.

Wire Rolling Mill.

AN improved form of rolling mill for stretching round, square, and oval wire of very small diameter has recently been patented. In place of the two rolls placed one over the other, as in the present mills, three rolls having conical faces are set up with the face of each touching the others at an angle of 120 degrees. By making a fine groove in the center of each face an opening is made between the three rolls, and through this the wire is passed. The power to move the rolls is applied to the upper roll, and this moves the other by means of gearing. Screws are provided for regulating the distance between the rolls, and in front is a guide, designed to direct the wire into the mill, while at the back is a plate resembling an ordinary "draw-plate," for smoothing down the wire after it has passed the rolls. By this use of three rolls the wire is acted upon from three sides, and it is claimed that this form of mill produces a wire of better quality and finer diameter than by the usual methods of stretching wire.

New Cement.

A NEW cement, insoluble in hot or cold water or steam, and that will resist acids and alkalies, is reported. It is designed to be used in two portions, neither being of any value till moistened and joined to the other. One portion is composed of a preparation of chromium, and is made by dissolving crystallized chromic acid in water, in proportion of 2.5 grams of acid to 15 grams of water. Fifteen grams of ammonia are added to this, and then about ten drops of sulphuric acid are added, with finally thirty grams of sulphate of ammonia and four grams of fine white paper. The second preparation is made by dissolving isinglass in dilute acetic acid (one part acid to seven parts water). This cement is designed chiefly for envelopes, and in using it the chromium preparation is applied to the back of the envelope, and the isinglass to the flap. On wetting the flap and pressing it down the two preparations meet and instantly form a firm and insoluble cement, binding the paper against every effort to open it. The materials may be applied in the same manner to other uses.

New Alloy for Art Metal-work.

AN alloy resembling red gold has recently been reported, and the following formula shows its character and composition. Put 800 parts pure copper, 25 parts platinum and 10 parts tungstic acid in a crucible, and when melted and well stirred together, run the metal out into a bath composed of 500 grams of slaked lime and 500 grams of carbonate of potash for each cubic meter of water. This granulates and purifies the metal, when it may be dried and placed in a crucible for remelting. When melted the second time, 170 parts of fine gold may be added, and when the whole is finally run into ingots an alloy of a fine gold color is obtained, the shade of gold depending on the proportions of the materials. For a flux, equal portions of boric acid, nitrate of soda, and chloride of sodium are recommended in the proportion of 25 grams for each kilogram of the alloy.

Electric Spark Pen.

A NEW invention in the art of engraving, probably suggested by the familiar electric pen, has been brought out in Paris. A copper plate is prepared as for engraving, and over this is secured, in some convenient manner, a thin sheet of paper. The plate is then connected with one pole of a Ruhmkorff coil. The pen (presumably a simple insulated metallic rod or pencil with a fine point) is also connected by means of an insulated wire with the coil. Then, if the point of the pen (which is bare) is touched to the paper, a minute hole is burned in it by the spark that leaps from the point of the pen to the plate. By using the pen as a pencil, a drawing may be made on the paper in a series of fine holes precisely after the manner of the electric pen, except that in one case the holes are mechanically punched out and in the other case are burned out. When the drawing is finished the paper may be used as a stencil. A printer's roller carrying an oily ink is passed over the paper, and the ink penetrating the paper through the holes reproduces the drawing in ink on the copper plate. The paper may then be removed and the plate submitted to an acid bath when the surface will be cut away, except where the ink resists the acid, and those parts will be in relief and thus making an engraved plate ready for the printing-press. By this ingenious device, the artist, drawing upon the paper with the spark-giving pen, performs two operations at once, drawing the picture and engraving the plate at the same time.

Improved Style of Portable Motor.

STEAM-ENGINES for farms are usually made with horizontal boilers, for the simple reason that when thus laid down on four wheels the apparatus is less liable to tip over in traveling over rough roads. At the same time, the vertical type of motor has a number of advantages over the horizontal form, and in a new farm engine, a compromise has been effected by making an upright boiler and engine with a large and solid base so that when ready for work it rests on a firm foundation. On each side of the boiler, just above the fire, are secured strong iron brackets, and at the end of each are bearings for carriage wheels. Near the top of the boiler is another bracket designed to rest on the truck of a second and smaller pair of wheels. The boiler with its engine attached is accurately balanced on the larger wheels, and when it is desired to move the machine, the forward pair of wheels are brought up and the boiler is tipped over till it rests horizontally on the four wheels. The smoke-stack may

then be turned back on its hinge and laid down on top of the boiler. A pole may be put in, and the apparatus is ready for the road. To use it again, the boiler is simply tipped up till it rests on its base, when all the parts are re-adjusted again for immediate work.

Improved Method of Packing Butter.

By a new system of packing butter for market, much of the trouble, loss and inconvenience of the usual method of packing in tubs is avoided. The butter is first spread in a wooden tray having edges of a fixed height on three sides. It is then rolled down by means of a common wooden roller to a uniform level marked by the wooden edges. Strips of thin wood, sewed at the ends into rings of uniform size, with circular disks or covers, are prepared by soaking in brine, and by slipping one of the rings into a steel die, or form, and pressing the die down on the latter a circular block of butter is cut out of the mass. The ring and inclosed butter may be then slipped out of the die and the covers may be put on above and below, thus forming a neat package for a quantity of butter reckoned at one pound weight. A pile of these circular boxes may then be tied together with twine and packed in salt in cases for transportation. The advantages claimed for this method of putting up butter are found in the neat and ready system of weighing and packing the butter, and in the convenience of the package for retailing.

Memoranda.

Among the novelties shown at the recent International Paper Exhibition at Berlin, were samples of white paper made by submitting common paper stock to the action of a mixture of sodium sulphate and water glass. The stock is placed in a cold bath of these solutions, and under ordinary pressure and after soaking for some time, the dissolved vegetable fats, tannic acid, resinous matters, etc., may be easily washed out without injury to the vegetable fiber. The product obtained in this manner is said to be much larger than by the ordinary method of boiling in alkali, besides having greater strength and more readily yielding to bleaching. White rags first steeped in the water glass and then boiled in sulphide of sodium and water glass become brilliantly white, and paper made from jute refuse and straw by the same treatment gives a white paper of fair quality.

Among the many attempts that have been made to devise an apparatus for heating the feed-water for boilers of locomotives and other non-condensing engines, one of the latest and most promising throws the water after it has passed the pump into a fine spray in direct contact with a portion of the exhaust steam. The details of the plan are not given, but the idea is one that may be applied in a variety of ways, as the ingenuity of the engineer may suggest.

Black Venetian Glass.—The black glass of Venice has been made the subject of recent experiment, and M. Kazses, of Nuremberg, reports that in a mixture of sand and sulphur, he placed fifteen per cent. of peroxide of manganese, and obtained a deep black glass, showing, when broken, somber shades of violet, and exactly imitating the Venetian black glass.

BRIC-À-BRAC.

Kosciuzko's Will.

In the second year of the Revolutionary War, Thaddeus Kosciuzko, a young Polish noble of distinguished family and large estate, having not very long before been graduated from the French military school at Versailles, appeared in America, and offered his services to Washington in the cause of American freedom. A love affair at home, whose sequel was disappointment, had impelled the young Pole to leave his native country; and his philanthropic spirit and innate love of liberty pointed to the conflict then raging in the New World as the fittest place to seek forgetfulness of self in working out the good of others. In order that he might battle for freedom in America with a clearer conscience, one of his earliest acts had been to liberate the serfs upon his ancestral estates. On reaching America, he was cordially received by the colonial commanders, and assigned by Washington to a position as his aide-de-camp. That he fought courageously throughout the conflict; that he was the warm personal friend of Washington and of Jefferson; that he was commander-in-chief of the Polish army in the famous uprising of Poland in 1794, and that he was defeated and thrown into prison by the event of the disastrous battle of Macieowice, are all matters of history.

But there are, perhaps, few now living who are aware of the fact of his having left behind him in America a testimonial of his fervent love of liberty, so enthusiastic that it takes the colors of poetic beauty, and as eminently characteristic of the man as was his famous reply to the Emperor Paul, who, on his release from prison, wished to restore him his sword:

"I have now no need of a sword, since I have no longer a country."

In the Clerk's office of the Circuit Court of Albemarle County, Virginia, hidden away among dust-covered records, lies a budget of time-stained documents which bears the inscription, "Wills: 1819." In this packet has slept, buried and almost forgotten for more than fifty years, the will and testament of Thaddeus Kosciuzko. It is a holograph, and genuine beyond doubt, as attested by Mr. Jefferson himself. The chirography is clear and bold, and the paper whereon it is inscribed is still well preserved, although bearing unmistakably the marks of its

same results in another connection, I wrote another brief and sent it to the examiner. I will not give the argument that I used before him. There was no sense or reason in it in the world."

Senator Chaffee: "Then you were not very scrupulous?"

Mr. Raymond: "No, I am bound not to be, in securing and protecting all the rights the law may give my client. But I will pay my respects to that idea in a moment."

Senator Chaffee: "Is that the case with all the rest of the patent lawyers?"

Mr. Raymond: "Yes, sir; with every one of them, without a single exception, in my opinion. But I sent my brief on and got a patent on the railroad-switch. Now as to the suggestion of Senator Chaffee: I came, two years ago, to the conclusion that there was no logical sequence following through the patent law from the commencement, nor yet was there a great deal of conscience in it. Of course there is conscience in the practice of patent law. A man came into my office the other day who had no claim in the world in law. He had in fact and morally a claim. He had been swindled out of a monopoly of a very valuable invention which we wanted to use. I gave him a hundred dollars, simply because he did not have money enough to get out of town. In another case, a man comes in with a case against us which he ought to maintain, but which some technicality of the Patent Office gives us a right to use. I know of no other basis, and there is no other basis, than that the law said thus and so. My conscience in patent matters is the patent statute enacted by Congress, and I cannot substitute anything else. If a man has a legal claim against us (as in one instance that comes to my mind, where there was not the first shadow of a moral right), if the law gives it to him, I say, 'You have a claim'; and in the case to which I refer I paid $34,000 where, morally, the man had no claim at all. Another man comes in to whom I ought to pay $40,000 on conscientious grounds, but I say, 'The law does not give it to you, and I cannot give it to you."

In my observation a man who avows so complete a want of moral principle and attributes the same to all his associates, is never worthy of confidence.

If the eighty-one railroad corporations which Mr. Raymond claims (page 116) to represent have no more soul or conscience than their representative, can there be any doubt that they are ready to assault the barriers of justice, and crush with their combined power every interest they may regard as standing in their way? Respectfully yours,

GARCELON.

THE WORLD'S WORK.

New Forms of Electric Lamp.

AMONG the many new appliances for creating the electric arc between the ends of carbon rods may be observed one or two of some interest. One of these employs two carbons standing erect in hinged brackets, or holders, so arranged that when unsupported the carbons fall together and rest one against the other in the form of an inverted V. In the center, between the carbons, is an upright rod made of some refractory material like kaolin. This is supported at the base by a horizontal lever, the shorter arm of which makes the armature of an electro-magnet. When the apparatus is at rest the weight of the upright rod causes it to fall, lifting the armature from the magnet and permitting the carbon rods to touch each other. On passing a current through the lamp the magnet is excited and the armature is pulled down and thus pushing the rod upward between the carbons and thrusting them apart. This separates them sufficiently to cause the electric arc to spring up between them. The kaolin rod melts away in the heat as fast as the carbons are consumed and the light is maintained somewhat on the principle of the familiar electric candle. If the current decreases in strength the armature of the magnet is released and the rod falls, permitting the carbons to come together again and re-establish the light. Another form of lamp employs two carbons, one standing upright and the second supported by a lever leaning against it. One arm of the lever forms the armature of an electro-magnet, and in action the second carbon is alternately permitted to fall against the upright carbon and then pulled away by the action of a spring somewhat after the manner of a "chattering" electric bell. This vibration of the carbons is so rapid that, to the eye, the quivering light is practically continuous, and appears to be steady. Another form of vibrating lamp has two carbons placed one over the other in a vertical line, the lower carbon resting on a lever that forms the armature of a magnet. Still another form of lamp, and one said to be much more successful in general practice than either of these, employs four carbons, two placed in the form of the letter A and two inverted like V, the four making the figure X. The light is maintained at the junction of the four carbons. The rods are held in cups connected by cords with weights that keep them adjusted to each other and in the best position for maintaining the light. An electro-magnet is also used with this lamp. The advantages found in this lamp are steadiness in the light and ease of adjustment, as a carbon can be replaced when burned out without extinguishing the lamp.

In the search for an electric lamp of moderate power, attention has already been drawn to the fact that a strip of metal or carbon inclosed in a glass jar charged with nitrogen and brought to incandescence by an electric current will give a good electric light. Hitherto, experiments in this direction have not been wholly satisfactory. More recently this field has been investigated with better results, and a new electric lamp and an improved system of electric switches have been brought out that present some features of interest. The lamp is designed for domestic use, and gives a light varying from a faint cherry red to sun-like whiteness, and developing at its brightest a light equal to 27 candles. In shape and size it resembles the chimney of an argand burner. The lamp is divided into two parts, the electrical apparatus and a hermetically sealed cylinder charged with nitrogen. This cylinder is a heavy glass tube closed at the top, and having a thick glass base accurately fitted to the bottom, and having two openings for the electrical connections. Within the cylinder are two long

convoluted ribbons of copper (silver plated) extending nearly to the top of the cylinder. At the top is secured a disk of soap-stone nearly filling the cylinder and designed to prevent downward radiation from the incandescent carbon. At the top these conductors are joined by a slender bow or arch of carbon. In constructing the lamp great ingenuity has been shown in overcoming the difficulty of removing all traces of oxygen from the cylinder and charging it with nitrogen. Brass tubes, each containing a stop-cock, are fitted to the glass base of the lamp, passing quite through the base, and joining the copper conductors within. Connection is made through these tubes with a supply of nitrogen, and a current is passed through the lamp till the air is displaced. The stop-cocks are then closed and the tubes are filled with a soft fusible metal. Brass caps, filled with hot liquid gum, are screwed over the tubes to secure both insulation and a perfectly air-tight joint. A ring on the base of the cylinder serves to hold a brass ring or cap that may be pressed by screws tight to the glass base, and heavily coated with insulating material. Within the lamp is placed, as an extra precaution, a small quantity of sodium, to absorb any remaining traces of oxygen. In connecting the lamp with a dynamo-electric machine, one wire may be brought through an ordinary gas fixture, and the return wire may be connected with the fixture and thus to earth. In this case the electric lamp stands on the gas bracket in a convenient position for use. This lamp in practice gives a pure, white, steady light by the incandescence of the carbon, and varying from a dull glow to intense white. When the lamp is to be used the current is gradually sent through it, the light growing in brightness gradually. Early experiments in this direction often resulted in a fusing or rupture of the carbon by a too sudden increase in the current, and to prevent this an ingenious form of switch has been devised that deserves attention. This apparatus is based on the fact that an electrical current will readily divide among conductors of equal resistance, or will divide in proportion to the resistance the conductors offer. If one has a resistance of one-fourth of an ohm, and the other of three-fourths, the current will split in these proportions. The new switch consists of a series of pins arranged in pairs, and a sliding bar that may be made to move from pin to pin, connecting them in pairs, and making new circuits of varying resistance each time. When at rest the whole current passes in one direction. On moving the bar to the first pair of pins, a certain proportion of the current is diverted to the lamp. At the next pair, more is turned aside, and so on till the whole current passes to the lamp; in each case the resistance is exactly balanced, and the current flowing from the main line divides with perfect precision. If two lamps are placed on a circuit, each will get half the current. On putting out one lamp the resistance, by means of the switch, is maintained the same, one lamp being unaffected by the action of the other. In like manner the change in intensity in any one lamp does not affect other lamps; nor is it possible to turn on the full power of the current at once, as the switch passes through a series of changes in resistance as the current is turned on or off. This involves time, but it is only a matter of seconds and not, therefore, of consequence. This system of electric lighting is soon to be tried on a large scale, and new data will be presented as soon as obtained.

Illuminating Watch Dials.

THE attempt to make clocks self-luminous by covering the dials with some chemical preparations has led to the invention of other methods of obtaining the same result. A Geisler tube containing a gas giving a good light is placed on or near the dial and a minute battery and induction coil are connected with it. To illuminate the dial a spring is touched and a current is passed through the coil and to the Geisler tube and lighting up the dial for a moment. It is said the whole apparatus can be easily carried in the vest pocket and will keep in order for a year without attention. The same idea has been applied to clock dials of every size.

Paper Friction Pulleys.

A CHEAP form of friction pulley is now made by cutting pieces of pasteboard into disks of the size of the required pulley, pasting them heavily with hot glue and laying one over the other till the proper thickness is obtained. The hole for the shaft is cut in each piece before they are glued together, and when the wheel has been formed it may be pressed till the glue is cold. The face of the pulley may then be turned down smooth in a lathe and, to make a firm edge, iron rings or clamps may be fastened to the sides. Such paper pulleys are said to run with good usage for a long time.

Plating with Tin.

A NEW method of coating metals with tin by electro-deposition is reported. A zinc and carbon battery is employed, the inner cell, containing the carbon, is half filled with chromic acid, and the outer cell, containing the zinc, is filled with dilute sulphuric acid. The articles to be coated with tin are first "pickled" and then suspended in a bath containing eight parts of protochloride of tin, and sixteen parts of cream of tartar dissolved in twenty-two liters (about 100 gallons) of distilled water. The articles suspended in the bath are connected with the positive pole of the battery, while the negative pole is connected with a piece of tin hung in the bath. After plating, the articles are held over a fire to give the tin a bright surface.

New Tools for Amateurs.

THE demand for light wood-working tools for the use of young mechanics and amateurs has led to the manufacture of a great number of novel and ingenious tools of more or less merit. Some of these have already been described in this department. Among the more recent is a new foot-power lathe having a circular saw, scroll saw and bracket

molding attachments. The chief novelty in this combined tool is a cylindrical bed for the lathe. This bed is supported on two iron frames that also carry the balance wheel and the foot treadle. The balance wheel is supported by a shaft that rests on bearings on each frame, and is connected with the treadle at both ends. By this arrangement the power is transferred from the treadle to the wheel without unequal strains, and the machine can be driven at high speeds smoothly and steadily. The head-stock, tail and tool stocks of the lathe are made to clasp the cylindrical bed, the head-stock being permanently fastened in place, the other stocks being free to move upon the bed. The tool-stock is cut open below the bed, so that it may be moved round the bed and set at any angle by means of a set-screw. The tail-stock is kept in a true position by a groove cut in the bed, and may be held at any point by a set-screw. The scroll saw, the bracket molding device and the circular saw may be attached to the lathe easily and quickly, and the whole apparatus appears to be admirably adapted to the wants of the young student in wood-working.

Painting Stairs Crossing Windows.

IT sometimes happens that in designing houses, or rather in erecting houses without a design, that a stair-way will be made to cross a window. The only way to correct this mistake is to paint the stairs in some suitable color, but often the error is only made the more glaring by the choice of the wrong color. Slats placed inside warehouse windows to protect an elevator are open to the same objection, and it may be worth while to consider what color they should be painted. In daylight, out-of-doors, the observer stands as it were before the source of the light, and in looking at a house he is practically behind the light. It is moving away from him into the windows, and as a natural result they appear black, as black is the absence of light. Unless the interior walls or some object within reflects the light he can see nothing, and the window opening appears black. Rooms of the ordinary size are too large to reflect enough light to counteract the bright light outside, and they have a cave-like darkness. Slats inside a window or a crossing stair-way catch and reflect the light and become visible, and it is evident that they should be painted black. Paints with a shining surface would be useless, as every point and edge would be outlined by the specular reflection, and all such exposed wood-work must be painted a deep, dull black.

Memoranda.

AN improved letter envelope has been introduced that reproduces upon the inclosed letter the post-marks stamped on the outside of the envelope. The inside of the envelope is covered, presumably with some preparation of carbon black, and any blow or pressure on the outside repeats on the letter within the words or design of the stamp, very much after the manner of carbon paper as used in copying manuscripts.

A new machine for cutting stone paving blocks has recently been reported. It consists of a strong table having near one edge a prismatic steel cutter, or knife edge, rising slightly above the level of the table. Above this, and in line with it, is another prismatic cutter set in a heavy steam hammer. The block of stone to be cut is brought to the table on rollers till a certain portion of the stone rests on the lower cutter. A series of short, quick blows are then given with the steam hammer, followed by one heavy blow. This last blow cleaves off a slice or layer of the stone having clean, sharp edges. The block is then moved forward the thickness of the intended paving blocks and another slice is split off. These thin slabs of stone are then laid flat on a second table. This table has also a prismatic cutter and corresponding hammer. The top of the table is set with springs, the stone slab being laid upon them, its weight compressing them sufficiently to allow it to touch the cutter. A few blows from a sharp-edged hammer over the cutter serves to break off blocks of the required size, when the slab may be moved over the springs and another row of blocks may be split off.

Unslacked lime, loose or packed in cartridges, has been recommended as a substitute for powder in firing mines. The cartridges are designed to be dropped into the drill holes and then to be soaked with water till they expand and split the coal. This suggestion has certainly the advantage of being safe from explosion and smoke or gas.

Among the appliances recently offered as a covering for boiler and steam pipes, none has greater merits for cheapness than a paste made of sawdust and flour paste. The paste is made with rough flour without starch and is applied with a trowel. It has been found that several successive layers of about five millimeters each, say twenty-five millimeters (one inch) in all are quite equal to double this thickness of the materials commonly used. For copper tubes two light coats of a hot solution of clay must first be applied, and for exposed situations an outside coating of coal tar is recommended.

The "Pharmacist" offers the following recipe for an ink that resists acids: "To good gall-nut ink add a solution of Prussian blue dissolved in distilled water. The ink is greenish blue on using, and turns black when dry.

twenty years. As a fine reprint of an American classic, which for its loving appreciation of nature and its pure English everybody ought to read, the present volume, though unwieldy, is to be recommended; but as an addition to the ornithological literature of the United States, it simply represents an opportunity thrown away.

Colonel Waring's "Typhoid and its Causes."*

A CONCISE *résumé* of the facts so ably discussed in this little pamphlet may prove of such vital importance to fever-haunted districts that no apology need be offered for submitting them. As with meningitis, scarlet fever and diphtheria, a disregard of the laws of health in regard to sewage, etc., conduces alike to the spread of the deadly typhoid poison and supplies the conditions for its reception. The air we breathe and the water we drink, if tainted, not only carry with them the living germ of the disease, but they at the same time so lower the tone of the system that that deadly seed shall take root, develop and bear its fruit of suffering and death. Typhoid is a disease of the alimentary canal, and that presents the only surface susceptible of attack. Each case is derived (almost if not quite always) from a previous one, and the poison by which it is transmitted exists in the dejecta of a typhoid patient, but only becomes active when it undergoes decomposition without sufficient oxygen. Too great care cannot be taken in the disposition of that poisonous matter.

The water which lies in the waste-pipe traps of a hundred dwellings may become poisoned from the common cess-pool, and the *contagium* contributed by a single typhoid patient exhale poison through a hundred families. This poison possesses exceeding vitality; it may be carried miles by a running stream, it can be absorbed and exhaled by standing water, it is retained for a great while by clothes saturated with it, and then develops in the most virulent manner upon exposure. Perfect cleanliness, good drainage with sewage pipes closed by mechanical contrivances and not merely by traps, pure air, and water safe against possible contamination, together with strict adherence to hygiene in the persons exposed, will almost certainly and immediately stamp out the disease where it appears, and usually when constantly practiced prevent its appearance.

* Fiske Fund Prize Essay. The Causation of Typhoid Fever. By George E. Waring, Jr. Cambridge: Riverside Press.

Lewis Sargeant's "New Greece."*

AMONG the books hastily called forth by the Eastern Question is Mr. Sargeant's "New Greece." The author is a strong Philhellene. He justly arraigns the policy of England in regard to Greece, and points to the flattering hopes she held out and the promises she broke; he justly attacks Lord Beaconsfield and England for their breach of faith in the Berlin Congress. He proves beyond a doubt that Greece, against her own interests, was induced by England to hold aloof from attacking Turkey and then left out in the cold. But his argument that it would be for England's advantage to raise Greece to the position of a first-class power in the East is by no means conclusive. On the contrary, it is questionable whether it would not be more advantageous that Russia should occupy Constantinople than that Greece should hold all the coast of the Ægean, for Russia is not a naval power, while Greece would soon threaten England's supremacy as Queen of the Seas.

The first part of "New Greece" consists of a summary of the present condition of education, literature, commerce, finance, manufactories and agriculture in Greece, but unfortunately Mr. Sargeant has drawn his information largely from the beautifully printed but untrustworthy book by Moraitinis, and the statistics must therefore be received with caution. In spite of the bright picture painted by our author, it is doubtful if Greece is at present much better off than she was a century ago under the Turks. The second part is a brief history of the country since the Revolution of 1821, and being founded on the faithful works of Finlay and Gervinus, it can be accepted without question. The book is furnished with an incomplete index and two large but poor maps.

"Under the Empire." †

"UNDER the Empire" is no more than its preface claims: "A trifle, confusedly sensational in name and structure." The plot is simple and natural, the style dramatic, the sentiment though not pointing a moral is healthy, and it has the merit of being interesting. A half-hour spent upon it would not be lost.

* New Greece. By Lewis Sargeant. Cassell, Petter & Galpin. London, Paris, and New York.

† Under the Empire: or, The Story of Madelon. By J. B. H. Norfolk, Va.: James Barron Hope & Co.

THE WORLD'S WORK.

Lighted Buoys.

BUOYS having whistles or horns that sound continuously as they float are already in use, and it is now proposed to light such floating beacons at night so that they may serve as miniature light-houses. From the experiments that have been made, it appears that gas can be successfully employed for this purpose. The buoy itself is designed to be filled with compressed gas, and at the top, above the water, is placed a suitable lantern containing a single fish-tail burner that once lighted burns steadily for several weeks, or till the gas is exhausted. To accomplish this a rich, fatty gas, distilled from shale oil or fatty material, is compressed in the buoy to a pressure of from five to six atmospheres. A suitable regulator for reducing the

pressure of the gas before it passes to the lamp is provided, and above this is the lantern. Such a buoy of the ordinary shape and size has been put to a severe trial on an exposed coast for several weeks, and has maintained its light day and night through all weathers. Such buoys once charged and lighted are estimated to give a light visible in clear nights for a distance of four miles for about ninety days without attention or renewal. Other experiments in this field, though in another direction, have been recently tried. A Ruhmkorff coil and vacuum tube or globe are placed in a lantern on top of the buoy, and below, suspended in the sea water, is a battery made by fastening together a large zinc and carbon plate. Wires from this battery pass up to the primary circuit of the induction coil and the secondary current becomes visible in the vacuum tube. The light is comparatively faint, and is only visible at night, yet is sufficient to warn passing vessels and prevent them from running the buoys down, as sometimes happens on dark nights. The light is said to remain constant till the battery is consumed, and from the experiments already made it is thought good practical results may soon be obtained.

Preservation of Wood.

Two new processes in the preservation of wood are reported. In one a boiler is prepared, and in this are placed iron gratings on which the pieces of wood may be placed, care being taken in loading up the boiler to keep each piece of timber separate from the others. Water is then placed in a second boiler and raised to a temperature of 113° Fahr. when the following chemicals are added in these proportions: sulphate of zinc, 55 kilograms; American potash, 22 kilos; American alum, 44 kilos; oxide of manganese, 22 to each 55 kilos of water. When these have dissolved, sulphuric acid of 60°, in the proportion of 22 kilos, may be slowly added till the mass is well saturated. This mixture is then placed in the boiler containing the wood till the wood is covered, when the whole is boiled for three hours. The wood is then taken out and laid on wooden gratings to dry and harden. Wood treated by this process is said to become partially petrified and able to resist fire successfully, only charring slowly under intense heat. The second process is cheaper and much more simple. Timber is placed in pits and covered with quicklime, and the lime is then slowly slaked with water. The timber is then left undisturbed for eight days. Wooden sleepers thus treated are reported to become very hard, tough and durable while retaining all their strength and elasticity.

Economy of Fuel.

VERY many appliances designed to heat the water intended for steam boilers by means of the waste heat of the fires, or waste steam, are in use through the country. These feed-water heaters vary greatly both in construction and economy, but the least valuable is better than none at all. Among the latest and cheapest of these heaters is one designed to save the heat that usually escapes up the chimney, and thus to carry the economy of the fuel to a still greater refinement. In erecting the stack a long and narrow chamber of brick-work is placed beside the stack, and resting on iron beams at a convenient height above the ground, and between the furnaces and the stack. This chamber opens into the chimney at one end, and is connected with the flues from the fires at the other end, the outlet to the stack being somewhat higher than the other entrance or inlet. Within this chamber are placed a number of upright wrought iron pipes connected at top and bottom by a series of horizontal pipes, the entire system of pipes resting on brackets on the sides of the chamber, and extending through the roof to allow for expansion when heated. Iron scrapers arranged in groups are suspended by chains among the vertical pipes, and by means of a windlass on the roof of the chamber all the scrapers can be raised and lowered at once for the purpose of cleaning the pipes from soot and dust. The cold water for the boilers is admitted at the bottom of this system of pipes on the side furthest removed from the fires. The outlet is placed at the top next the fire, where a safety valve is provided to permit the escape of steam, should it form in the pipes, or to relieve the pressure caused by the expansion of the water. Below the chamber is a pit for collecting the dust brushed off by the scrapers, and by means of outlets the contents may be shot into carts below as often as may be desired. It will be seen that this simple appliance saves the heat usually quite thrown away into the air through the chimney. The spaces about the pipes are sufficient to keep up the draft, and as the pipes are kept clean without opening the chambers, it will continue its work without repair or attention for a long time. This form of feed-water heater has been tried with success in a large sugar refinery, and is reported to supply feed water ready for the boiler at a temperature of 300° Fahr., at an estimated economy of twenty per cent. in the fuel, and as this is obtained from heat otherwise wasted it represents a clear gain.

Butter Package for Export.

THE rapidly growing demand for butter for export has led to the invention of a number of packing devices for preserving the butter in warm climates. One of the best of these was described here recently. Another form of package reported to give good results consists of a strong wooden box, a pail with a double wooden cover and handle. Within this is placed a stone-ware "crock," or jar, in which the butter is placed. The box is somewhat larger than the crock, so that there is an air-space on every side. The crock is fastened into the box, no filling being required to prevent injury from breakage.

The Pedo-Motor.

FROM the parlor or roller skate has been evolved a curious device called a pedo-motor. The appara-

tus is practically a sandal shod with wheels and is designed to assist the lame and halt in walking and the ordinary walker in making good time. The sandal is provided with four wooden wheels bound with rubber, two on each side, and when strapped to the boot gives the wearer a firm footing. From the toe projects a point, or supplementary toe, shod with rubber, and at the heel is a similar projection almost touching the ground and shod with leather. In using these wheeled sandals the ordinary walking step is taken, one foot giving the body a slight push with the pusher, or toe, while the other foot rests flat on the four wheels. The result obtained is a greatly lengthened stride as the sandal rolls forward under the influence of the push and the walker practically gets over much more ground and with less exertion than in ordinary shoes. The pedomotor is reported to give a good walker a speed of twelve miles an hour over good sidewalks, and while the apparatus may be regarded as a mechanical curiosity, it is worthy some attention on account of its promises for the future. The roller skate was the result of innumerable inventions and patents before it was perfected, and, in like manner, this wheeled sandal may lead in time to something of value.

Preservation of Iron.

THE Barff process of producing an inoxidizing film on the surface of iron has already been described in this department, and as often happens, the original process has led to the development of others. By one of these new processes good results have been obtained at a much less cost. An air-tight cylinder, presumably of iron, is placed in a furnace where it can be raised to a high temperature. The iron articles to be bronzed, or covered with the film of oxide, are placed in the cylinder and the ends are closed by means of riveted plates. Through one of these is passed the pipe for the admission of the dry steam. At the other end are three openings, into one of which is placed a thermometer to give the interior temperature, while the other openings have valves for the escape of the surplus steam and the water of condensation. In operation the cylinder is raised to a temperation of 930° Fahr., and steam under a pressure of two and a half atmospheres, or a temperate of 644° Fahr., is admitted to the heated cylinder for five hours. The iron articles are then found to be covered with a firmly adhering film, or bronzing, of a greenish-black color. Still later experiments show that hot air may be substituted for the steam in this process. A coil of pipe, open at the lower end, ascends gradually through a chamber heated to 248° Fahr. and then enters the cylinder. The escape valve is modified somewhat to permit only a slow current of air to pass and the pressure within the cylinder is kept slightly above one atmosphere. Iron articles bronzed in hot air have been exposed to the weather for a month without injury. The process is regarded as a success, and is about to be applied upon a large scale in a manufactory of gun-barrels. Another and much more simple method of protecting small iron articles is announced. The iron to be protected is painted with or dipped in a mixture of borate of lead, containing a little cuprious platinum in solution and having bright scales of precipitated platinum in suspension. The articles are then brought to red heat when the mixture fuses and covers them with a gray glassy film that will resist sewer gas, weak acids and alkalies and the heat of a range. The process is reported to be much cheaper than painting or plating.

Inlaying Wood by Compression.

A METHOD of producing inlaid wood for ornamental purposes by compression has been recently tried with success. A veneer of some soft wood is laid over a board of hard wood of a contrasting color and the two are firmly glued together and dried. The two pieces are then steamed till softened, and a sheet of zinc, cut out as a stencil in some ornamental pattern, is laid over the veneer, and while the wood is still soft, the whole is passed between heavy rollers. The pressure forces the zinc into the veneer, pressing it into the backing below. The soft veneer swells up through the openings in the zinc plate, and in this manner the pattern is reproduced in relief on the wood. The plate comes off easily and it is then only necessary to plane down the veneer till the hard wood is reached. This method of compressing one wood into another is reported to give a smooth unbroken surface with clearly defined lines between the two woods.

Stone Planing Machine.

A MACHINE for planing granite and other hard stones has been brought out that promises to prove of value in reducing the cost of preparing building stones. It consists of an oblong frame of iron, supported at the corners, and carrying a movable platten, somewhat after the manner of iron planing machines. On this is placed a strong head-piece or tool holder, and by means of a system of long pulleys and corresponding belts, power may be brought to the tool whatever its position during the work. The block of granite to be planed is placed on a hand-truck and rolled under the machine and raised by means of jack-screws to the proper level for the work. The revolution of the cutting tool planes down the stone at about the pace of the iron planers, and performs the work in a manner fully equal to hand labor. The tool is fed to the work by hand, one man being sufficient for all the work.

Paper for Roofing Domes.

To reduce the weight of an observatory dome recently erected, and thus to economize the power needed to revolve it, the experiment of roofing it with paper was tried with entire success. The frame of the dome was made of wood in the lightest manner consistent with strength. Strips of a tough paper, such as is used in boat building, were laid over the frame-work, carefully fastened down and thoroughly painted. This paper roof is about four millimeters thick, and is strong, hard and apparently able to withstand the weather for an indefinite time.

The dome is 9.84 meters (31 feet) in diameter, and weighs something less than 2,000 kilos, and may be easily moved on its rollers by hand.

Dental Drill Stop-motion.

THE use of power drills in dental surgery has been attended by one inconvenience occasioned by the continuous motion of the drill. The teeth are cut too deeply before the operator is aware or can stop the work by removing the drill, or shutting off the power at its source. To prevent this, a simple form of stop-motion has been introduced. The holder used to carry the drill and protect the hand from the motion of the flexible shaft is provided with a clutch just below the drill and inside the holder. This is kept in connection with the revolving shaft by a spring, and by means of a button projecting through the side of the holder and in reach of the forefinger it may be thrown out of gear at will. A very slight movement of the finger serves to stop or start the drill without stopping the engine. The drills may also be changed in the same manner without stopping the power.

Apparatus for Signaling by Means of a Heliotrope.

THE use of a small mirror mounted on bearings that give it two motions, vertical and horizontal, in signaling from place to place by means of reflected sunlight, is already familiar in surveying. A simple apparatus for obtaining a correct sight in this work may prove of value, not only in surveys, but in telegraphing from distant points. A strip of wood of convenient width and thickness, and from 50 to 100 centimeters long has secured to each end upright screens of wood, each having a hole about 25 millimeters in diameter bored through the center. To get these holes in line it is best to lay one screen over the other and bore both holes at once. Fine wires are then drawn across each hole at right angles (vertical and horizontal) and secured in place. A sight is then taken through the holes at the distant station where the signals are to be sent, and when the two sets of wires are in line, the apparatus is secured in that position. The heliotrope is then arranged to throw a beam of light through both holes, when it will be visible at the distant station. Such an apparatus has been used without the aid of glasses for a distance of thirty miles, and with a telescope, the "day star" has been seen a distance of 100 miles across Lake Superior, though the distant shore could not be seen by the observer. The Morse alphabet is used in telegraphing with this apparatus, but in surveying a shorter code is found to answer all requirements.

BRIC-À-BRAC.

An Interview with a Poet of the Future.

I HAD an interview not long since with a poet of the future. He kept a book-stall and peddled "The New York Weekly" to dyspeptic school-girls. But he had a soul; and he was possessed by an idea.

Meeting him and coming to know him I grew interested in his soul, and so I seek here to set forth his idea.

He was not beautiful. He was no Antinoüs. He was no Apollo. He was no operatic tenor. He was rather plain. He was short, not to say squat. He was stout, not to say fat. He was round, not to say globular. And yet he had a soul and an idea, and he was a poet of the future.

For the present he had a great contempt, and I fear the feeling was mutual, as he never by any accident succeeded in disposing of any of his poetic wares.

I went to his stall one day and fell into conversation with him. I say "fell" advisedly, for his talk was so deep I could not always touch bottom. But these more incomprehensible parts of his discourse I consequently remember but ill, and shall not attempt to set down.

I happened accidentally to make a remark about the remarkable properties of the number nine. I do not know just why I made the remark, but make it I did. And it set him off.

He coughed gently, and said:

"Nine is scarcely as queer or as weird as seven. I have begun a poem on Seven——"

I remembered that Wordsworth had done the same, but I held my peace.

He continued:

"Here is the first stanza:

> "Seven was the sacred number
> Of the ancient Greeks,
> Seven were the men whose slumber
> Lasted many weeks."

He paused for a moment, and said, with a sigh: "That is not all, but it is as far as I have got."

"You find poetry a severe task?" I asked.

"I do, I do!" he answered, with noble enthusiasm. "But I lisp in numbers, for the numbers come. A similar remark was made by one of the poets of the old school. Numbers indeed have a singular fascination for me. Number three, for instance; I have another poem on that. Here it is:

> "Number three was weird and mystic
> As you learn from this artistic
> Distich."

I did not like to tell him that a three-line poem was hardly a distich, especially when he drew my attention to the identity existing between the number of the lines and the subject of the poem.

"These two poems form part of my 'Book of Numbers,'" he said.