Boat Propulsion.

WHILE the power used to move ships has been made the subject of many experiments, and marine engines have been brought to a high degree of efficiency, the screw by which the power has been utilized has, in a certain sense, stood still. Its position at the stern has remained unchanged ever since it was first used. It has been tried at the bow, where it worked well enough, until it proved troublesome when brought in contact with drift-wood. It has been placed at the sides, where it operated only as an imperfect paddle-wheel. More recently it has been tried in an entirely new position. The vessel to which the new method of placing the screw has been applied is a lighter, designed for carrying heavy freight upon a crooked and shallow river. The hull, which is of wood, is about 28.35 meters (ninety feet) long, and 10.08 meters (thirty-two feet) wide, and draws about one meter, when loaded with one hundred tons of freight. In general appearance the boat does not differ from the ordinary steam-lighters used in American waters. The hull is of the usual shape, except at the stern. Here the after-body turns abruptly inward at the water-line, making a double curve toward the stern-post. Below the water-line, the hull carries a lip or projection that follows the ordinary lines of a ship's stern. In the concave recess on each side of the stern is placed a single screw facing outward. That is, the shaft carrying a screw at each end extends directly across the hull. This shaft is just at the water-line, and carries each screw half-submerged. The deck above each screw overhangs the hull, as in American river-boats. The engine (which for certain reasons is quite small for the boat) is placed between the two screws and directly connected with the shaft. On turning the two screws placed in this position, it would appear that they would act as paddle-wheels. They do so, but the amount of work performed in moving the boat is thought to be very small. Experiments seem to prove that the movement of the boat is caused by the streams of water turned by the screws against the wedge-shaped hull. The water thrown into the concave part of the stern cannot easily escape, and the result is the hull is thrust forward by the action of the water against it. The actual trials of the boat show that she can be moved with a full load, in rather rough water, at a speed of from four to five knots an hour. This is considered a good speed for such a boat, with an engine of such power. On the second trial trip, careful measurements were made of the power utilized by the screws. The boat was towed at her usual speed, and the amount of strain on the tow-line found by the aid of a dynamometer. The power needed to move the boat, compared with the actual working power of the engine, was found to be over fifty per cent. In other words, one-half the actual power of the engine appears to be realized in moving the boat. This is regarded as a very favorable showing for the position of the screws. The trial trips of the new boat are regarded as interesting contributions to the question of screw-propulsion. The positions of the screws gives a good economy of the power employed, and in the new and faster boats, that are to be built upon the same pattern, even more interesting results may be expected.

The Waterphone.

THIS is the name applied to a new mechanical device for observing, by means of sound, the flow of liquids in pipes. It consists of a metallic diaphragm inclosed in an ear-trumpet resembling a telephone. The diaphragm is connected and supported at the center by a slender steel rod that extends through the trumpet, while it is free on all sides and does not touch the trumpet in which it is inclosed. The object sought is to amplify any sonorous vibrations that may travel through the rod, so that, on placing the trumpet to the ear, the sounds may be heard. So far, the only use to which the apparatus has been put has been the detection of waste in city service-pipes. The apparatus is applied directly to the valve or stop-cock controlling the supply of water delivered at dwellings. The stop-cock is uncovered by opening the trap in the sidewalk, and the key is turned till the water is shut off. The steel rod of the instrument, which is threaded at the end, is then screwed into the top of the key. If any water is escaping past the stop-cock, or if the pipe leaks at this point, the sound of the moving water is heard in the waterphone. On letting the water flow freely into the house, any leaks or waste within may be detected in the same way. Any stream, however small, makes a sound, and by the aid of the apparatus it may be amplified or increased sufficiently in volume to enable the observer to tell how much water is running past the stop-cock. These observations are made at midnight, when the streets are quiet and when the water is supposed to be shut off within the house. The chief merit of the invention lies in the simple and convenient manner in which the sonorous vibrations caused by flowing liquids may be conveyed to the ear. While the apparatus has, so far, only been applied to the detection of leaks in water-pipes, it will, no doubt, find many other uses. It could be used to observe sounds caused by mechanical movements in places not easily accessible. It is practically an enlarged stethoscope for detecting obscure sounds. In some cities the stop-cock placed under the sidewalk is turned by a long rod let down into a small well in the walk. This rod has, in such places, been used to detect waste. It is simply held to the ear (and it might better be held in the teeth with the ears closed), when the sound of the water may be heard, the sonorous vibrations traveling along the rod to the ear, or, if held in the teeth, thence through the bones of the head to the ear. The diaphragm for amplifying the sounds is clearly an improvement on this.

The Music Electrograph.

THE suggestion was made in "The World's Work" for June (page 318, vol. xxiv.) that the common chemical telegraph systems, of which the American Rapid is an example, might easily be made to record music played upon an organ or piano. It now appears that this idea has been made the subject of experiment, and that a practical apparatus has recently been constructed to carry out this suggestion. The inventions were quite independent, and appear to have been made at about the same time. In the new apparatus the recording mechanism is quite independent of the instrument to which it is to be electrically connected. The aim is to cause the depression of a key of the piano to close a circuit, and to accomplish this a wooden bar is placed over the keys and resting at each end on the blocks at the sides of the key-board. From this bar are suspended, by wire rods, pellets, that rest one on each key, for about four octaves in the center of the key-board. Each of these pellets has a slight vertical play, and serves to make and break an electric circuit. While the key is untouched, the pellet is supported and the circuit is open. On depressing the key the pellet falls and the circuit is closed, and remains closed as long as the key is kept down. Wires connect each pellet with a small battery, and with a recording apparatus resembling the ordinary Morse recorder, the wires being insulated and twisted together into a cable. The recording apparatus consists of a clock train for moving a system of rollers, through which a ribbon of paper is caused to move. The first set of rollers moisten the paper with the chemical solution, this solution being the same as used in any chemical telegraph. The next system of rollers is both printing and recording, one roller making the lines in ink upon the paper that represent the musical staff, and the other being placed in the circuit from the battery. A style kept in position by a spring rests upon the ribbon, as it passes over this roller, there being a style for every circuit and for every note of the four octaves. The depressing of any key closes that circuit, and causes the current to flow through the style and through the moving paper, and, so long as the current passes, a blue stain is left on the paper. These stains represent the notes touched on the key-board. Another circuit, with a circuit-closing device in the form of a foot-pedal, is added to mark the bars or the beginning of each measure. From an examination of a portion of one of the stained ribbons, it appears the music staff is printed in narrow, black lines, there being four ledger lines above the treble staff and three below the bars, these being dotted lines to distinguish them from the others. The music is recorded in long and short stains, and in choral style of music can be read and played without serious difficulty. In the copy seen, the markings of the time was very indistinct, but, aside from this, it was clear enough to be played at sight, as from the common musical notation, and there appears to be no reason why any music could not be recorded in the apparatus, and with a little practice easily transcribed into the ordinary characters. So far as can be learned, the apparatus is a practical success.

New Motors.

TWO motors, both designed to be independent of steam, have been recently carried through the experimental stage, and now appear to be ready for the severer test of actual work in business. Of the examples examined, one is a five horse-power engine, using crude petroleum as a fuel, and the other is a ten horse-power air-engine. Of the many experiments that have been made to use petroleum as a source of power, by far the larger part have been based upon the idea of using the oil as a fuel in making steam. In the new motor the oil is burned in or near the cylinder, very much as gas is burned in a gas-engine. In the engine examined, the cylinder is horizontal, and rests upon a stand or frame containing a tank for compressed air. The piston and the two piston-rods are hollow, the rods being connected by means of flexible tubes with the street-main, so that a constant circulation of cold water is kept up through one rod and the piston, and out through the other rod. There is also a water-jacket on the cylinder, the object being to keep all parts as cool as possible. At the end of the engine, and connected with the crank-shaft, is a small air-pump for keeping the air-tank filled with compressed air. The crude oil is kept in a tank near the engine, and is drawn from the tank as required in the engine, through a small pipe, by a small pump connected with the engine. The oil is delivered by the pump to a burner placed at the rear end of the cylinder. This burner has an annular wick, the oil being thrown upon the rear end of the wick, while the air needed for combustion is supplied from the compressed-air tank. To prevent the flame from passing into the cylinder, the end of the cylinder next the burner is covered with fine wire-netting. In the center of the burner is the inlet for the compressed air, the opening being controlled by a valve moved by the engine. There is also a governor for regulating the supply of air, the design being to cut off the air at any point of the stroke required. The engine is single-acting, and its operation may be easily understood. When it is desired to start the engine, the burner is lighted through an opening at the top, and the engine is given a few turns by hand to obtain a supply of compressed air. The piston being drawn back near the burner, the compressed air is allowed to enter. The immediate effect is a greatly increased combustion of the oil, and the air is heated and expanded. The expansion of the air is the immediate source of power, and under its influence the piston is driven backward, thus making the effective stroke. At the right point the supply of air is cut off, the stroke being finished by the expansion already obtained. At the end of the stroke the exhaust port, which is the same as the inlet at the end of the cylinder, is opened, and the spent air is allowed to escape while the piston is moved back by the momentum of the engine. The engine examined was not at work at the time, it having just been stopped for the purpose of painting; but, from reliable reports, it is said to work cheaply and easily, and with very little attention. It is believed to be the first motor of its class using a cut-off controlled by a governor, and having both the air and oil supply regulated by the speed and the amount of work put upon the motor.

The second motor is described as a differential high-pressure air-engine. By this is meant that heated air is employed as the source of power, the same body of air being continuously heated and cooled alternately, the difference between the pressure of the cold and the hot air being used to move the pistons in the cylinders. To accomplish this, four cylinders are used and arranged in pairs for the purpose of balancing one against the other. In each pair is a working-cylinder with a piston having a single action, or one effective stroke, and a larger cylinder in which the air is heated preparatory to its use in the working-cylinder. The four cylinders are upright and are grouped together, the larger ones of each pair being placed over the furnaces. The pistons in each of the larger cylinders are connected by means of their rods and link, and a rocking beam, thus balancing one against the other. The pistons in the two working-cylinders are also connected in the same way. Above each of the larger cylinders is placed a great number of small air-pipes and surrounded by a casing. Cold water is designed to circulate around these pipes precisely as in a condenser. There is also an air-pump and a water circulating pump connected with the engine. While these are the main features of the motor, the arrangement of the various parts is too complicated for explanation without the aid of intricate diagrams. It is sufficient to observe the principle upon which the engine works and to note the results. The air used in the engine is confined and is employed over and over, alternately heated in the larger cylinder immediately over the fire, and then displaced by the movement of the piston and allowed to expand and thus spend its force in the working-cylinder. After the stroke is made, this same body of air, by the descent of the working piston (by the movement of the opposite piston), is passed to the condenser and goes through the small pipes back into the larger cylinder. On its passage through the small pipes it parts with a portion of its heat and is reduced in pressure. The power is thus obtained by the difference in pressure between the heated and the cooled air. The air above the pistons in the working-cylinders is not used as a source of power, as it is merely transferred through pipes from one cylinder to the other, and each stroke thus making the pressure above the pistons the same in each cylinder at all times. The motor examined was at work and appeared to run with great steadiness. It was silent, and moving at a speed of over eighty revolutions a minute. The engine has been at work for over a year, and has been put to a number of practical tests, the most severe being the running of a series of electric lights, and with entire success. It is reported, on good authority, to be very economical in fuel and oil; it certainly is easily managed, and is safe from all danger of fire and explosion. Engines of one or more hundred horse-power are soon to be built upon the same plan.

BRIC-À-BRAC.

Narcissus in Camden.

A CLASSICAL DIALOGUE OF THE YEAR 1882.

(*"In the course of his lecture Mr. ——— remarked that the most impressive room he had yet entered in America was the one in Camden town where he met ——— ———. It contained plenty of fresh air and sunlight. * * * On the table was a simple cruse of water."* * * *)

PAUMANOKIDES. NARCISSUS.

PAUMANOKIDES.

Who may this be?
This young man clad unusually, with loose locks, languorous, glidingly toward me advancing,
Toward the ceiling of my chamber his orbic and expressive eye-balls uprolling,
As I have seen the green-necked wild-fowl the mallard in the thundering of the storm,
By the weedy shore of Paumanok my fish-shaped island.
Sit down, young man!
I do not know you, but I love you with burning intensity,
I am he that loves the young men, whosoever and wheresoever they are or may be hereafter, or may have been any time in the past,
Loves the eye-glassed literat, loves also and probably more the vender of clams, raucous-throated, monotonous-chanting,
Loves the Elevated Railroad employee of Mannahatta my city;
I suppress the rest of the list of the persons I love, solely because I love you,
Sit down *élève*, I receive you!

NARCISSUS.

O clarion, from whose brazen throat
Strange sounds across the seas are blown,
Where England, girt as with a moat,
A strong sea-lion, sits alone!

A pilgrim from that white-cliffed shore,
What joy, large flower of Western land!
To seek thy democratic door,
With eager hand to clasp thy hand!

PAUMANOKIDES.

Right you are!
Take then the electric pressure of these fingers, O my Comrade!

house and church, and a post-office, which they were instrumental in erecting, have become the focus of civilization for that mountain country.

R. H. D.

Sunlight on all Sides of the House.

THERE is one subject of great importance, from a sanitary point of view, that, so far as my knowledge goes, has received little attention. Why is it that, in placing a house or plotting a Western town, village, or city, so much pains is taken, such sacrifices of local characteristics, often made, to have the street lines conform to the cardinal points of the compass? A moment's reflection would show that every building intended for a residence, if it is rectangular, should never be placed, as it almost uniformly is, so that the rooms on the southern aspect are sweltering with mid-day heat while those on the north are molding for the want of the sun's rays, but should be placed diagonally with reference to the cardinal points, or with one corner to the east to receive the sun on two sides in the forenoon, and the diagonally opposite corner to the west, that the other two sides may get the benefit of the afternoon sun. So situated, there would be no disagreeable north side to the house, and at noon, the hottest part of the day, the sun's rays would not be beating directly upon the walls of the building. It would be excellent to plot a new town according to the same plan, since in the heat of the day there would always be a shady side to every street; also the glare toward sunset on an east and west avenue would be avoided. Perhaps tradition has something to do with the fact that nearly all new towns are laid out as they are, because, forsooth, King Solomon erected a house "north and south"; but his temple was so placed that "the sun at its meridian height could dart no rays of light into the north part thereof," as the north was considered "a place of darkness."

The advantages of sunlight in a hygienic view are very great, and the disadvantages of living on the north side are fully appreciated.

I. H. Stearns.

THE WORLD'S WORK.

New Form of Hydrometer.

A SMALL and convenient apparatus has been recently devised for measuring the amount of moisture in the air, and finding the point or degree of temperature at which dew is formed. The hydrometer consists of a small metallic tube closed at one end with a piece of ground glass, and having a small lens at the other end. The interior of the tube is nickel-plated and highly polished. On looking through the lens, with the opposite end of the tube directed toward a bright light, the ground glass appears as a brightly lighted disc, surrounded by a bright ring. Openings are made at each end for passing the current of air to be tested through the tube. The apparatus is surrounded by a jacket for holding a cooling liquid. In using the apparatus, the current of air to be examined is drawn through it and cooled by the surrounding liquid. Dew is formed on the inside of the tube, and appears on the annular space surrounding the illuminated disc as dark colored spots. A thermometer is placed in the cooling liquid to indicate the temperature at which the dew is formed in the tube. By raising the temperature the dew is caused to disappear, and the point at which it disappears is indicated by the thermometer.

Improved Hand-Drill.

THE general use of power rock-drills has naturally led to efforts to produce a machine-drill that could be worked by hand. Of the new tools designed for this purpose, the latest and most promising employs a steel or rubber spring to make the manual labor available. The machine consists essentially of a drill supported by guides, a hammer designed to strike a blow upon the head of the drill, and a cam system that, under the movement of hand levers, causes the tension of a steel or rubber spring to be applied to the handle of the hammer. The apparatus is supported by a tripod having telescopic legs, and may be set up before the rock to be drilled in any position, high or low, horizontal or vertical, at any angle that may be required. In every position the two hand levers are in convenient reach, and they are operated by simply drawing them forward and backward. Drawing the levers backward or pushing them forward moves one of the two cams in such a way that the hammer is drawn back and the spring is brought into tension. On reaching the limit of the tension of the spring it is suddenly released, bringing the whole force upon the hammer and causing it to strike a heavy blow upon the drill. The same movement, by means of a simple ratchet mechanism, causes the drill to turn on its axis a part of one revolution between each blow. The drill being supported between guides is fed up to its work by each blow, and to prevent its recoil after the blow of the hammer, set screws are provided to bind it to the guides. These set screws are intended to be fastened very lightly, so that the hammer overcomes the resistance of the screws, and yet they are tight enough to keep the drill always in place. In the machines for light quarry-work, the operator sits upon the drill, resting his feet in stirrups on the tripod, and employing his weight to keep the machine steady. In the machines examined, drill-holes were being made in micaceous granite at the rate of an inch a minute, by one man, and apparently with little labor. The holes made by the machine were remarkably smooth, even, and straight. For rapid and heavy work, where two men are employed, two springs are used and the weight of the blows struck on the drill greatly increased. Each machine may be easily moved about, or placed in position by one man, and can be folded up compactly for transportation.

New Steam-Boiler.

An upright tubular boiler has been designed that presents some features of merit. It is made in two parts, a round chamber containing the grate and forming the fire-box, and a steam and water-space immediately above it. The products of combustion pass upward through this upper portion of the boiler through vertical flues that open into the smoke-stack above the boiler. This part is not essentially different from other types of upright tubular boilers. The novel feature is an annular water-space extending entirely round the ash-pit and just below the level of the grate. This water-space is connected with the boiler above by two systems of pipes placed in rings round the fire. The inner circle is next the grate, the pipes being placed close together and bent toward the center and forming a cone-shaped cage round the fire. The outer circle of pipes is upright, and placed next the outer casing of the boiler. The outer pipes, being shielded from the fire by the inner circle, are less exposed to the heat, and, consequently, the tendency of the water is downward. In the inner circle, the movement of the water is upward. By this arrangement a circulation is maintained and all sediment is deposited in the colder annular space below the fire, from which it may be easily withdrawn.

Railway Conveniences.

In some railway cars recently built in New England the pressure of the air in the automatic brakes has been made of use in fire protection and in the toilet conveniences. A water-tank is placed in the end of the car under the wash-stand, and connected with the hand-basin and with the closet on the opposite side of the car. The air reservoir used to store compressed air for the brakes is connected by means of a pipe with the top of the tank. There is also a hose long enough to reach the whole length of the car attached to the tank. When the tank is filled with water, the air from the reservoir is admitted above the water in the tank. The pressure, as may be readily seen, is therefore available to force the water into the basin and closet, and through the hose in case of fire.

New Building Material.

The demand for fire-proof construction in both private and public buildings has led to the introduction of a number of new methods of using ordinary building materials and the invention of new materials. The best of these have already been described here. The most recent invention is based on an improvement in making ordinary terra-cotta, and finds a useful field as a substitute for wood and brick in building walls, partitions, chimneys, floors, and roofs. The material, when finished, is a kind of soft, spongy brick. It is much lighter than any variety of brick, and is entirely free from all grit or sand. It can be cut or sawn by ordinary wood-working tools. It will hold nails, and can be treated in every respect like ordinary heavy lumber. The underlying idea of the invention is the production of a porous or, better, a spongy terra-cotta. To accomplish this, common "top" clay that is perfectly free from sand or grit of any kind is mixed with resinous sawdust and molded by hand or machinery into slabs or bricks. When properly dried it is placed in kilns and burned. The clay is burned hard, but the sawdust minutely incorporated with it is carbonized and reduced to a fine ash. Each particle of sawdust thus leaves in the burnt clay a cell or hollow space, and the hardened terra-cotta resembles well-baked bread or a solidified sponge. The sawdust being, in bulk, equal or nearly so to the wet clay, the terra-cotta has only one-half the weight of a brick or piece of terra-cotta of the same size. The spongy texture reduces the strength, but for all purposes, except the actual laying up of lofty exterior walls, the material is strong enough. The process of making the new terra-cotta may be briefly described from an inspection of the works. The raw clay is brought directly from the clay bank and mixed by the aid of machinery with fine sawdust. Just enough fresh water is added to make the mixture work well, and it is then formed in an ordinary steam-press into slabs or pipes. The slabs are then placed in sheds, exposed to sun and wind, till dry. The peculiar texture of the material seems to prevent its warping, and in a few days it is ready for firing. The kilns are of the common "beehive" form, and as soon as the water is driven out the fires are urged till the sawdust, mixed with the clay, takes fire and is destroyed. The burning occupies about thirty hours, and the kilns are opened and the slabs, as soon as cool, are taken to the saw-mill and cut up into the dimensions required for floor-beams, between iron beams, roofing boards, partition blocks, and slabs for lining filters. Each piece is planed smooth on each side, and is squared at the edges, tongued and grooved, or cut to any shape required. For roofing, the slabs are laid on the iron rafters and the slates are nailed down upon the slabs. For partitions, the slabs are set on edge and nailed together at the corners. The material is so spongy that no lathing is required, and as the slabs are planed smooth and trimmed square, no plaster is needed, and only a thin finishing coat is put on, which dries hard and smooth in a few hours. If a door is to be cut in such a partition after it has been built, the opening is simply cut out with a saw and the trimmings nailed directly to the wall. For protecting iron columns and for covering steam-boilers and pipes, the material is formed into pipes that may be sawn in two and fitted to the pipes, columns, or other curved surfaces. For chimneys, the slabs are molded or cut into the form of long bricks that may be laid one over the other and nailed down; or, if the bricks are as long as the chimney is wide, they may be dove-tailed and fitted together, nails being used at the joints. The finished material examined was fitted into floor-beams, laid upon an iron roof, and used as a partition, having a facing of plaster (last coat only), and as plank laid on a floor, and in the rough, ready for resawing any shape, and it appeared to be admirably adapted to the work. It also makes an excellent lining for filters.

Pocket Photometer.

The study and comparison of electric lights implies the use of a photometer to measure the comparative intensities of different lamps. The ordinary apparatus is available only in a laboratory, and a small photometer that could be carried in the pocket would prove of value. Such an instrument has been devised and may be briefly described. It consists of a small, square box or frame open at two opposite sides and the top. The sides are covered with opal glass, care being taken to cut the glass from the same sheet, so that both pieces will be of equal translucency. On the top of the box is fitted a small telescopic tube, having a lens at the end, the whole being, of course, light-proof, except at the glass sides and the lens. Within the box are two small mirrors or two pieces of white cardboard placed at a right-angle with each other and forming a prism, the point or edge of which is opposite the lens. On holding the instrument between the two lights to be compared, each side of the prism is illuminated through the glass end; when the prism seen through the lens appears to lose its appearance of relief, or to be equally lighted on both sides, the two lights are equal at that point. By comparing the distance between the observer and the two lights, their comparative photometric value can be estimated according to the usual rules. The chief point of novelty in this apparatus is the use of the lens and telescopic tube, which makes it possible to reduce the photometer to a convenient size for the pocket.

Distribution of Power.

THE most recent experiments that have been made to meet the growing demand for low motive power in small shops and manufactories turn upon the familiar idea of moving air through pipes. Unlike the distribution of compressed air through pipes, the new system employs the natural pressure of the atmosphere as the direct source of power, and an exhaust, or suction air-pump, driven by a steam-engine, as the indirect source. At the central station, powerful air-pumps have been set up and provided with steam-power. Wrought-iron pipes, having rubber joints, are laid in the street to form the main, and from the main smaller lead pipes are laid into the buildings where the power is wanted. Upon each lathe, drill, sewing-ing machine, or other tool, is placed a small oscillating motor, connected with the tools by means of belts. Each motor stands upon a hollow cast-iron stand, or reservoir, that is connected with the air-pipe from the street. The air needed to move the motor is admitted directly, and by means of a simple stop-cock, that, in the case of a sewing-machine or lathe, can be controlled by the foot-pedal, thus leaving the hand free for the work. The admission of the air is cut off before the stroke is completed, and the air is allowed to expand in the piston. The exhaust is allowed to enter the reservoir under the motor, and is then drawn into the pipe. Oil or dust that might clog the pipes is caught in the reservoir, and can be removed as it accumulates. It will be seen that the plan is a negative one. It is not the positive transmission of power, but the creating of pressure in the cylinder of the motor by creating a vacuum at the exhaust. So far the experiments have been limited to a comparatively small space, the mains being only six hundred meters long. The mains are six centimeters (about two inches) in diameter, and the service-pipes much smaller. The power developed in the motors is low, the design being only to furnish light power for small shops, houses, etc. The experiments already made appear to be satisfactory.

Novel Application of Electricity.

THE familiar chemical telegraph has been for some time almost the only useful application of the staining or discoloring effects of a current of electricity. The ribbon of paper in the chemical systems of telegraphy is saturated with certain chemicals, and when the current passes through the paper, the solution is reduced and a blue stain is made on the paper. It is now proposed to use printing-blocks in place of the needle-point used in the telegraphic instruments, and to print designs, letters, and patterns on cloth and paper by electrolysis. From the experiments already made it appears that the fabric is impregnated with a solution of aniline salt, and is then placed on a metal plate that is connected by wire with a dynamo-machine. Another plate containing the lettering or pattern in relief to be produced on the paper is also connected with the dynamo, the two plates forming a circuit. When the printing-plate is laid on the paper under some pressure the circuit is closed, and the current passes from one plate to the other through the paper, the salt is reduced, leaving a permanent stain in aniline black in the exact form of the type or pattern on the paper. By substituting a carbon pencil, held in the hand by an insulated sleeve or handle, writing in black can be traced on the paper by means of the current. This last plan is thought to be likely to prove of great value, as the markings are in indelible black, or in a number of other permanent tints. Another plan is to use engraved rolls that form a part of the electrical circuit, and to pass the fabric between them while the current is passing. By a reversal of the system bleaching has been accomplished. Fabrics dyed indigo blue or Turkey red, impregnated with a solution of saltpetre, have been bleached out white by passing them between rolls that are in an electrical circuit, or under a press having type or a raised pattern and in a circuit. Whenever the current passes, the color is destroyed, leaving the fabric white. In passing such a press the colored fabric has a pattern picked out in white upon it. The process, both in printing in black or colors, and in bleaching dyed fabrics, is believed to promise a method of producing printed, or, more properly, stained fabrics of great sharpness and clearness of design, and in new shades of color.

Improved Gas-burners.

THE general introduction of electric lights has naturally led to the invention of improved gas-lamps. Some of these have already been described here. The direction taken by more recent inventions is not so much toward a larger consumption of gas, or the heating of the gas and the air needed for combustion, as in the regenerative systems, but toward the incandescent system. The idea sought is to obtain, first, heat, and then, indirectly, light. A small basket or thimble of platinum wire is placed in the flame of the gas-burner, and the flame is supplied with compressed air for combustion. The result of this blow-pipe arrangement is a non-luminous flame giving great heat. The platinum thimble becomes white-hot, and this gives the light. By another plan the supply of air is highly heated under pressure, and is then mingled with the gas and burned in the platinum thimble. This light is said to be well suited for lantern projections, the platinum taking the place of the lime cylinder of the calcium light. In another form of incandescent lamp, compressed air is driven through light hydrocarbons, as in the ordinary portable gas-machines, and the saturated air is used to heat the wire thimble. So far these lamps appear to be chiefly experimental, with a fair degree of promise for future usefulness.

Novel Grinding-Machine.

A new adaptation of rollers for crushing and grinding stone, ores, etc., has been brought out, that deserves mention for the ingenious arrangement of the rollers. The apparatus consists of four pairs of rollers, each pair turning independently of the others. The first pair are placed directly under the hopper, where the material is fed to the machine. The rollers are set near enough merely to crush and break up the larger lumps. Immediately under this pair is a ridge-shaped or double-inclined shoot, and the material, after passing through the first pair of rollers, falls upon this, and is delivered to the second and third pair of rollers. After passing these rollers, it falls upon a double-inclined screen. This screen is shaken rapidly, and the finer material falls through it, and the coarser pieces drop into the last pair of rollers, which are directly under the first pair. Each pair is set closer together than the preceding, and, after passing, all the material is reduced to powder. Inclosing this system of rollers is a cylindrical screen that may be continually revolved while the rollers are at work. By this arrangement the material is continually sifted out, and falls from the machine below. Just within this screen is a cylindrical elevator, that in turning with the screen lifts, in buckets, any of the coarser lumps that may have passed the rollers, and drops them between the first pair. A casing or shield covers the whole machine to keep in the dust. The design appears to be novel and to be well carried out in the construction.

New Fire-Grate.

THE idea of making the fire-box of a stove, or the grate of a fire-place, rotate or turn over upon its axis, has been made the subject of experiment. A basket grate, supported on trunnions at each end, has been tried with some success, and more recently an iron fire-grate has been made that can be turned over as often as may be needed. The grate is spherical, with an opening on opposite sides, each opening being closed by a cover having perforations. The fire is built inside the grate, and the grate is filled with coal, and the cover put on. When well started, the grate may be turned over, bringing the fire on top of the fuel. When it is desired to remove the ashes, the grate is turned round quickly by means of a handle on the outside of the stove. To hasten the fire, the grate may be turned over, bringing the fire under the fuel, and to extinguish the fire, it is only necessary to close the dampers and turn the grate swiftly for a moment or two. The grate is designed to be applied to any circular stove, and appears to be an improvement on the revolving basket grate.

BRIC-À-BRAC.

To Youngsters.

GOLDEN hair and eyes of blue,—
What wont they do? — what wont they do?
Eyes of blue and locks of gold —
My boy, you 'll learn before you 're old.
The gaitered foot, the taper waist—
Be not in haste, be not in haste;
Before your chin sprout twenty spear,
My word for 't, youngster, they 'll appear.

Raven hair and eyes of night
Undo the boys; and 't serves 'em right.
Eyes of night and raven hair,
They 'll drive you, lad, to sheer despair.
The drooping curl, the downward glance,
They 're only waiting for the chance;
At nick of time they 'll sure appear,
Depend upon it, laddie dear.

Shapely hands and arms of snow,
They know their charm, my boy, they know;
Flexile wrists and fleckless hands,
The lass that has them understands.
The cheeks that blush, the lips that smile—
A little while, a little while—
Before you know it, they 'll be here,
And catch you napping, laddie dear.

Hands, and hair, and lips, and eyes,
'T is there the tyro's danger lies.
You 'll meet them leagued, or one by one —
In either case the mischief 's done.
A touch, a tress, a glance, a sigh,
And then, my boy, good-bye — good-bye!
God help you, youngster! keep good cheer;
Coax on your chin to twenty spear.

John Vance Cheney.

The Lamp-post on the Corner.

LET Dante tell of Heaven and Hell,
Of meaner themes the scorner;—
'Tis mine to sing of a modester thing,—
The lamp-post on the corner.

Domestic Applications of Electricity.

THE use of electricity in dwelling-houses and offices—to ring a bell, sound an alarm, or light the gas, is now so general that the methods of applying it need no description. The making of the apparatus is now a regular business, and it only remains occasionally to note improvements in the methods employed and extensions of the field of usefulness. In burglar alarms, the more recent improvements relate to better connections and fittings at the doors and windows where the signals are placed, and better materials and apparatus in the annunciators. Clocks are now placed in the annunciators, and with each clock are one or more "time-sets," or apparatus for setting the alarm at any desired hour. For instance, by turning the time-set (which is a metallic ring marked with the hours) to any hour, say eleven o'clock, the burglar alarm will be disconnected and silent till that hour. At eleven o'clock, the movement of the clock brings the alarm system into play, and after that time none of the doors or windows can be opened without sounding the alarm and causing the annunciator to display its numbers. In like manner, the alarm can be disconnected at any hour previously decided upon. By this arrangement the burglar alarm may be silent during the evening when not needed, set in order at any desired hour, and disconnected again in the morning, and the arrangement may be automatically repeated every day for an indefinite time. By means of another time-set, a bell in any part of the house or grounds may be made to ring at any hour, for the purpose of waking servants, calling the carriage, etc. In electric gas-lighting apparatus, one of the later improvements is an annunciator for calling attention to breaks or defects in the system. The gas is designed to be turned on by hand, and is then lighted. The current is put on by pulling a cord attached to the lamp. The two wires or electrodes are brought up to the burner, and the circuit is closed by the same motion of the hand; and, when the cord is released, the electrodes spring back out of the reach of the gas-flame. By this device the wires are saved from rusting and burning, and are preserved in good order for a long time. If by any accident, such as throwing a towel over the lamp or hanging anything on the fixtures, the circuit is closed, the annunciator, by means of a clock-work system, automatically cuts out of circuit the affected lamp, and announces the location of the trouble (or room in which the lamp is placed). This cutting out of a section of the system is to prevent trouble and confusion in lighting the remaining lamps of the system, when one is found to be out of order. Time is allowed for other lights to be lit, and then the affected lamp is cut out, and the position of the disorder is announced.

Perhaps the most convenient and effective system of giving a burglar alarm yet introduced is a comparatively new one, in which the intruder's footsteps sound the alarm-bell. This is accomplished by means of mats placed on or under the carpet of the room to be protected. Each mat acts the part of a circuit closer, the slightest pressure upon it closing the circuit and bringing the alarm-bell into action. The mats are composed of thin strips of wood, glued or cemented to a stout canvas. On each strip are fastened two small copper wires, one end of each wire being joined to a larger wire that leads to the battery and bell. There is a small space left between the ends of each pair of wires, so that, while there are many branches or pairs spread over the under side of the mat, none touch, and the whole system of wires is an open circuit. At short intervals on each strip of wood are fastened light brass springs, each one being wide enough to cover and bridge the two wires. While the mat rests upon the floor, the springs have sufficient tension to keep clear of the wires. The moment a weight is laid on any part of the carpet, one or more of the springs are depressed, touching the wires, and closing the circuit. In one case the mats were arranged in narrow strips before the doors of the room, and out of sight under the carpet. Upon the wall were arranged alarm-bells and electric gas-lighting apparatus and switches for setting the system to work. When the switches were open, it was impossible to enter the room or even cross the floor without causing the alarms to sound. The alarms were arranged to give one stroke, or to ring continuously as long as any person stood on the mat, or to start a continuously ringing bell, that continued to sound even after the weight was removed from the mat, or to light the gas-lamp. The advantages of such a circuit-closing system are obvious, as the mats can be hid in any part of a room.

Improved Ventilating System.

IT appears to be well settled now that merely making an opening in the wall of a room into a ventilating shaft will not of itself ventilate the room. The column of air in the shaft must be made to move by mechanical means, as already described here (see page 796, vol. 19), or by heating the air till it expands and rises. This last is accomplished by means of gas-lamps, stoves, and hot-air flues. When a building, divided into a number of floors, is to be ventilated, it appears to be necessary to add one more feature to the system. This is to make the ventilating shaft larger in diameter as it ascends. From an examination of a ventilating system recently applied to a six-story office building in this city, there appears to be no reason why a large building, containing a great many tenants, may not be made perfectly safe in a sanitary sense. The building is six stories high, with basement, and is divided into small offices for business purposes. There is a hydraulic elevator, with a steam pump for lifting the water, and steam boilers for warming all the floors. The waste heat from these boilers is employed to move the air in the ventilating shafts. To accomplish this, the toilet-rooms on each floor are placed at one side of the building, and adjoining the air-shaft. This shaft is of brick, extends from the basement to the roof. The cast-iron smoke-pipe of the steam boilers is placed inside the shaft, dividing it into two equal parts. The heat of this stack warms the air of the shaft, and causes a steady and rapid upward current. The shaft increases in diameter at each floor, being three times larger at the top than the bottom. Openings are made near the ceiling on each floor, into one-half the shaft, while the lavatories and toilet-rooms are connected with the other half. This increase of section in the shaft seems to make the system perfect. The movement of air in the shaft is rapid, and the increased burden of air it must carry from each floor does not impede the current. To ventilate the basins, sinks, etc., a copper pipe is placed inside the shaft, close to the smoke-stack, and connected by short pipes with every closet and sink. This pipe is warmed by the smoke-stack up to the fifth floor, and above this point the exhaust steam-pipe from the steam pumps enters the pipe, and continues inside up to the roof. This is to heat the air in the pipe still more, and assist the upward movement. This pipe also increases in diameter at each floor. In summer, when the heating boilers are not used, a small fire is kept in a furnace at the foot of the smoke-stack for the purpose of warming the shaft. To warm the other pipe, argand gas-burners are placed at the bottom of the pipe. These can be lighted in warm weather, and assist the movement of the air in the pipe.

Novel Form of Elevator.

THE endless band, with buckets attached, used in ordinary grain elevators, has been adapted recently to a new purpose. In some old mines, there was at one time a rude kind of passenger elevator employed, in which two long rods were hung in the shaft. These rods were provided with steps and handles, and had an alternate up-and-down motion. The miner wishing to ascend the shaft grasped the handle on one of the rods, and stepped upon the foot-board, or step, attached to the rod. In a few seconds the rod rose a few meters, and then paused for a second or more, and then descended. The miner, standing on the rod, was raised with it till a platform was reached, and then, as the rod paused, he stepped off and waited till the rod moved upward again, when he repeated the operation, and in this way he was gradually lifted to the top of the shaft. These two ideas, the endless belt with buckets and the lifting rod, have been used to make a novel kind of passenger elevator. The shaft, or well, is made in two parts, and at the top and bottom, between the division-wall that separates the two wells, are placed large drums, the upper one being controlled by a steam motor. Over these drums is placed a strong endless chain, or wire rope, and under the influence of the motor the rope travels continuously down the center of one shaft and up the other. Attached to the rope at intervals are small passenger cars, each designed to carry two persons. At the top and bottom of the shafts, where the ropes pass over the drums, guides are arranged in such a way that the cars are always kept upright, passing over or under the wheel from left or right without altering their perpendicular position. The front of each well is open upon each floor of the building in which the elevator stands, and the cars move up and down past each floor. The passenger wishing to go up or down waits till a car comes in sight and is level with the floor, when, taking hold of a handle, he steps upon the car and is carried up or down. On reaching the floor where he wishes to get off, there is nothing to do but step off the instant the car reaches that floor. If by any accident the passenger does not get off in going up, he is simply carried to the top floor, and moves in the car over to the other shaft, and begins to descend. At first sight such a continuously moving elevator would appear to be exceedingly dangerous,— that unless the passenger stepped off just at the right moment, or if his foot extended beyond the edge of the car, he might be crushed against the floor above. To obviate this, the floor is cut away in front of the shafts, and a hinged flap, or cover, is laid down before the elevator. Anything projecting beyond the edge of an ascending car would strike the flap and lift it out of the way till all danger had passed. In a descending car, the only injury that could occur from this cause would be a gentle push back into the car as the passenger descended below the floor level. The mechanism used for controlling the elevator under the continually changing loads appears to be well designed, and the reports of the first machine in use are quite favorable.

Design for Fish-Curing Plant.

SOME modifications of the familiar fruit-drying plants have been suggested recently to adapt them to the drying and smoking of fish. In the fruit-dryers only one tower is used, and the trays are put in at the bottom, and are slowly raised to the top by endless travelling chains while a current of hot air rises through the tower. To adapt the system to curing and smoking fish three towers are used, and the double traveling chain passes through them all. In the new design, three towers under one roof are arranged side by side. The first is intended to be warmed by means of a stove at the bottom, precisely as in the evaporators. The second tower is the smoke-shaft, and is filled with smoke, while the last tower is for cooling the smoked fish. The endless chains start in a room outside the drying tower, where tables are arranged for preparing and loading the fish. For large herring the fish are threaded on narrow sticks or rods, and the ends of each rod are inserted in the links of the chains, so that the fish are always suspended vertically, whichever way the chains may travel. As the rods of fish are placed on the chains, they rise to the top of the shaft, and cross over and descend through the rising current of hot air. They then pass out of the tower and rise to the top of the smoke-tower, and descend in that. The fish is now cured, but to cool it off it is carried by the chains to the top of the next tower, through which it is carried to the packing-room, where the rods and loads are taken off. The empty chain then moves on, and passes through a sub-way under the towers back to the place where it started. For fish too small to be threaded on the rods, shallow carriers are provided, in which the fish are thrown loosely. On reaching the end of the trip these carriers upset automatically, and throw their contents out upon a traveling table ready for the packers. The carriers then pass under revolving brushes, that free them from the dirt or soot that may cling to them. While the design is apparently suggested by the common American fruit-dryers, it differs in one point. The traveling chains, in passing downward (the reverse of the American practice), pass over and under a series of rollers, going part way down and then up again, and so on, and making many turns in the shaft in order to gain time. Another plan is to make the chains travel forward and back horizontally in a zigzag course down the shaft. This may be necessary to keep the fish in the shaft till cured, but it evidently adds materially to the cost of construction, and enormously to the cost of maintenance, as the many convolutions of the chains would make necessary great power to move them.

Metallurgical Progress.

IN all metallurgical work the aim now appears to be to reduce the amount of heat required to do a given amount of work. For instance, the iron ore put in a blast-furnace to be cast in the form of pigs, is subjected to one heat in that step. The cast pigs are suffered to get cold before they are taken to the converter to be re-heated and cast into ingots of steel, or before they are re-heated in some other way to be worked into some new form. By placing the blast-furnace near the converter, the hot metal need not be cooled, but can be supplied while still hot to the next apparatus. The most recent step in this direction is the employment of the hot ingots of steel directly in the rolling-mill. There appears to be a moment when the hot ingot is in just the right condition for re-working on the outside, but is still too hot and fluid inside. If both the outside and inside could be cooled equally, there would be soon reached a moment when the whole ingot would be of the same temperature and fit for rolling. To accomplish this the ingots, as soon as they are taken out of the molds, are placed in brick pits. These pits are each just large enough to hold one ingot, and are closed at the top by a tight-fitting cover. The pits are heated red hot (by inserting hot ingots in them), and serve to keep the fresh ingots placed in them at an equal temperature till both the outside and inside have cooled down equally. The ingots can then be taken out and rolled without the expense and labor of re-heating. The pits have now been tried on a considerable scale, and appear to work well, and they suggest other fields of usefulness in the treatment of metals that require re-heating between the different processes to which they are subjected.

Improved Screws and Nuts.

THE common gimlet-pointed wood screw, at the time it was invented, was regarded as a most valuable invention. The gimlet-point made it possible to put the screw into the wood wholly by screwing and without the use of a gimlet. However excellent this idea, it was quickly perverted, for the carpenter found the gimlet-point enabled him to drive the screw part way in with a hammer, and then a few turns would set it firmly in position. This naturally led to a second and more recent invention — the pointed wood-screw. In this screw the gimlet point is replaced by a sharp conical point. To use it the screw is treated as a nail and driven in with a hammer nearly up to the head and then given a turn or two to bind it firmly in place. To make such a screw the metal rods or blanks are rolled instead of cut. The threads are forced up from the surface of the rod into a spiral ridge, adding to the outside diameter of the screw without decreasing its weight. This leaves the smooth part of the screw above the thread of less diameter, just the reverse of the ordinary cut screw, and preventing the binding or sticking that always occurs at the last strokes in sending the screw home. The screws examined appeared to be well made and to bear out fully the advantages claimed for them. Closely allied to this invention is another in which bolts and nuts may be made self-locking or less liable to rattle loose. The bolt is unchanged, and may be made of the usual standard sizes for car and carriage work. The threads cut in the nut are designed to fit the threads of the bolt for half the thickness of the nut, and then the angle of the thread is gradually changed without changing the number of threads in a given distance. This change in the shape of the nut thread acts as a spiral wedge, and tends to force the metal of the bolt to flow into the new shape of the nut and to make a firm and tight fit between nut and bolt. In the bolts and nuts examined the two pieces had been cut in two after being screwed up, thus showing the union between bolt and nut. The union seemed to be quite perfect, the thread of the bolt having everywhere conformed to the shape of the nut, making a firm and solid joint.

Waste Water Alarm.

AMONG minor appliances for preventing waste of water in cities is a simple mechanical signal for indicating a flow of water from cisterns or reservoirs. The ball-cock may be out of order, and the water running in and escaping in silence through the overflow for weeks without discovery. The new device prevents this by causing the overflow to ring a gong-bell continuously as long as the water flows. The apparatus is exceedingly simple, and consists essentially of a small, over-shot water-wheel of metal inclosed in a casing. The escaping water in passing the wheel causes it to revolve, and the movement of the wheel causes a hammer to strike on a gong-bell. Cheap and simple as is this invention, it deserves to be recognized as one more means of preventing the excessive waste of water so common in American cities.

friends come in often to spend a social evening. It is the care and extra work which make it impossible for the average family to entertain guests as its members would like. How often it prevents the informal sending to the neighbors to "Come this evening and have a dance," or to "Come and help us act charades." It has broken up many a "sociable" and given the death-blow to the good-fellowship of a whole neighborhood, filled with pleasant people who would have enjoyed one another very much and would have done one another a world of good.

It *is* a trouble to both mistress and maid to supplement all their various labors with the frequent preparation of even such a simple entertainment as sandwiches, coffee, and cakes. An extra amount of bread must be mixed, twice molded, and properly baked. A ham must be prepared, and boiled, and nicely cut into thin slices — a process that requires some skill and a good deal of time. The coffee must be roasted, ground, and then prepared with a nervous nicety that is somewhat wearing. The materials for the cakes must be collected from store-rooms and closets; and what a time of anxiety it is until the cakes come out of the oven! and then, though they look all right, there is the possibility that in cutting our loaves, with the eyes of our guests upon us, we may find them streaked with dark lines! But even this is not all. Perhaps the most arduous part, and decidedly the most disagreeable, is the cleaning up after the cooking and after the guests.

When we give large parties, much more than this is cheerfully borne; for the thought and the labor begin a long time before the event, and, usually, extra help is hired. But we are not now considering large parties. We want to meet our friends frequently. Cannot we do so without this interminable eating? We would not eat after our supper (or dinner) if we had remained at home. Why should we find it necessary when we go out? If we "drop in" at a friend's house for an evening we do not expect it or think of it. But if this same friend asks us to come to hear some music, or to look at some new engravings, or to do anything whatever, we look for something to eat in the progress of the evening. "She invited us," we say, "and, of course, there will be refreshments of some kind." Why "of course"? We don't need them,—often we would prefer to do without them,—and certainly we should be clearer in our minds in the morning if we were to do without them. Still the senseless custom goes on.

The surprise parties of a few years ago, which were so mercilessly condemned, arose out of a genuine feeling of friendliness, due to the naturally gregarious habits of mankind. After a day of housework, sewing, and "bother," after office hours are over, when the little folks are in the land of dreams, while Bridget or Dinah is quiet in the kitchen, with sewing, or a visitor, a yearning arises in our souls for some sort of recreation. And there is a need for it, too. But the surprise parties were a mistake for the same reason that we hesitate to accept the general invitation, "Come and spend an evening with us some time!" We do not go because the very evening we fix upon may be the most inconvenient one of the whole season to our hosts. But, were it not for those bugbears, "sandwiches and coffee;" or, "oysters and ice cream," instead of this vague, unmeaning phrase, one might give the specific invitation: "Come this evening, or next Wednesday evening!" for they would have nothing to think of in the meantime, in relation to the visit, but the pleasure of their friend's society.

Louise Stockton.

THE WORLD'S WORK.

Test for Fire-damp in Mines.

THE inflammable gas known as fire-damp has been made the subject of long study, and many plans have been tried to obviate, as far as possible, its destructive explosions when set on fire. It appears it can be removed by proper ventilation whenever it collects in dangerous quantities. Whenever it is known to be present in the mine, any method of indicating its presence in advance, or before it can become dangerous, would therefore be of value. Among the plans that have been proposed to accomplish this is a comparatively new one, that has the merit of indicating above ground or at the mouth of the pit the presence of the gas in the mine. On the roof of the galleries, where the gas may be known to collect, is placed a hollow ball of wire gauze. This is placed, by means of wires, in electrical communication with a bell at the mouth of the mine. The ball is supported by a suitable bearing, in such a way that, when free, it will revolve by its own weight, but is ordinarily kept in position by a plug of fusible metal, so that it cannot move. Upon the ball are arranged pins, or teeth, in such a position that when the ball is released by the melting of the fusible plug the teeth alternately make and break the electric circuit, and the signal sent to the station above indicates the number or position of the ball in the mine. Within the ball is a piece of spongy platinum, connected by a second wire with the station at the mouth of the pit. When it is desired to ascertain if gas has collected in the mine, say just before the men go to work, a current is sent through the second circuit, and the platinum sponge is raised to a white heat. If the air is pure, nothing happens. If gas has gathered in explosive quantities, the heat of the platinum sets it on fire, and there will be a small explosion inside the wire gauze ball. This will give heat enough to melt the fusible plug, and the ball will be released. It will by its own weight, or by means of a spring, make a revolution, and the teeth will cause the signal to sound at the station above. At the same time, the burning of the gas is limited to the ball, as the flame will not pass the wire gauze, and all danger of extensive explosions of the gas are avoided. While this system has not, as far as can be learned, been tried on a large scale, it has the merit of pointing the way in which it is quite possible to make these gases report their presence before they can become a source of danger. Something of this kind has long been needed, and this design has apparently much to recommend it.

New Photographic Process.

THE ordinary black-and-white photograph has the defect of being merely black and white, since all the colors of nature, from which it is taken, are lost. It seems hopeless to look for any photographic process that will give colors in the negative, and the attention of artists and inventors has been given wholly to efforts to find a method of coloring the photo-print by hand. The most obvious plan is to paint the silver print, and this is very largely done; but the result is never wholly happy, for the photograph is simply smothered and painted out of sight. Attempts to put the color on the back of a film have given better results, but even this has not been wholly successful. Recently a still different plan has been followed. In this process a negative is taken in the usual way, and a note is made of the chief colors of the subject, the dress, hair, and flesh tints of the portrait, or the grass, ground, water, etc., of a landscape. The negative may be retouched or not, as seems desirable, the only requisite being that it should be a good one. From this negative is taken a light silver print; that is, a print made with a very short exposure, so that only the main outlines of the picture are secured. This print is then painted roughly by hand, according to the colors of the subject, as described by the note made at the time the negative was taken. These colors are in the form of thin, transparent washes, and are laid on in broad masses, and without regard to the shading. For instance, in a portrait, the hair is given one color in a single mass, the flesh tints merely cover the face, hands, etc., and the colors of the dress are spread evenly over the whole of the costume. In a landscape, the foliage receives a coat of green, the soil a coat of brown or yellow, the sky blue, and so on. This work is simple, but at the same time, in a flower-piece, or an elaborate interior, or a copy of a painting, there may be room for considerable artistic skill. The colored print is then treated with certain chemicals, which fix the colors and make it possible to spread over the print a freshly sensitized silver film. The negative is then replaced in the printing frame, and the print is laid face-down over it. Care is taken to see that the print is exactly under the negative, and is properly "justified." An exposure is then made, and a new print is secured exactly over the first print. This second print is then toned and fixed in the usual way. The finished print is now a double photograph, with a film of color between the two. Wherever the second print is thin or white, the color shows through. Wherever the shades are deep or black, the color is blotted out. By this placing of a second print over a colored print all the detail of the original negative is secured; the picture shows gradations of light and shade, and the color is preserved, and yet smoothed and softened. The process will, no doubt, prove of value in business, because it gives pictures in their true colors, and pictures that may serve as samples of goods offered for sale. The pictures examined included colored portraits from life, copies of oil paintings, pictures of china and colored glassware, toys, carpets, and fabrics of all kinds.

Improved Signal System.

AS THE number of trains increases upon a railroad there always appears a proportionate increase in a certain class of accidents. These are rear collisions, or the running of one train into another in front of it. To prevent such accidents, one system divides the line into short sections or blocks, and forbids any train to enter a block till some signal has been given that the preceding train has left the block and the line is clear. The method of making these block signals has been the subject of much study, and a great number of signaling systems, both mechanical and electrical, have been tried. Some of these have already been described here. One thing now seems to be sought for in preference to anything else: to make the system self-reporting and wholly independent of human agency; that is, the passing train must cause the signals to be displayed, and without calling upon the aid of any flagman or signal or telegraphic operator. While a number of systems do this in greater or less degree, it appears to be accomplished by a new system in a manner that is worthy of notice. The idea upon which it is based is to enable the passing train to break an electrical circuit, this breakage causing all the signals, whether by sign or sound, to be made. The train also closes the circuit on leaving the block, and restores all the signals to their normal condition, thus showing that the line is clear. To accomplish this the section is provided with a single wire supported on poles, a suitable battery, and a number of signal targets, lamps, etc. If the section is a single line without switches, a target is placed at each end of the section and facing in both directions. If there is a crossing there is a target, bell, or some other signal there also. At each end of the section are placed under the rail two circuit-breakers, close together. On the entrance of a train either going forward or backing, the first breaker is operated by the weight of the first pair of wheels. This breaks the electrical circuit, and all the banners in every target in the section are displayed. In a second or less the first axle crosses the second circuit breaker and the circuit is closed again, and all the signals would be withdrawn were it not that the next pair of wheels arrives at the first breaker and resets the apparatus. Thus, so long as the train is passing, there is an alternate breaking and making of the circuit. This affects all the signals, and they quiver or hesitate, but so rapid is the alternate breaking and making of the circuit that practically they do not appear to move, but remain at "danger." When the last axle crosses the breaker the signals come to danger till the train leaves the section. At this end there is also the same momentary hesitation, but it is not apparent in the targets (except by very close observation), and, as the last axle leaves the section, the circuit is closed, and every signal is put to rest or "safety," and the line is reported clear. Simple as this device is, it has the merit of displaying the signals at both ends of the section at the same time, so that a train on the same track coming in the opposite direction is warned in time. The signals remain at danger from the time the first axle enters the section till the last axle leaves it. If the train breaks in two and leaves a car behind no other train can enter the section from either direction till it has been removed. If the car left behind should bodily leave the line the signals would still remain at danger, and if it ran back into the rear sections, it would display every signal in advance, even if left wholly unguarded. If, for any reason, the circuit is broken by the breaking of a wire, or fall of a tree, or the failure of the battery, the signals would be displayed at danger at each end of the section. It will be seen that this closed circuit plan may be operated free from human agency. The train and even an obstruction affecting the circuit in any way causes the signals to be made. Besides this, the movement of every switch-rod may break the circuit and cause every signal to be displayed so that the entrance of a train from a branch or siding automatically closes the block. In like manner the departure of a train upon a branch and the closing of the switch may place the main block clear in both directions at once, and at the same time display the signals on the branch. By a different arrangement of the targets the entrance of a train upon the main section where there is a branch may cause a danger signal to be displayed on the branch, so long as the train is on the section. In the working model examined, which, as far as the targets are concerned, was of the full size, the movement of the signals appeared to be prompt and regular. The manner in which the banners in the targets are displayed is very simple. The round disk of red cloth is cut in halves, each half being supported by a rod pivoted near the top. The top of the rod is connected by a short link with a lever pivoted at the lower end carrying the armature of the electro-magnet. When the circuit is closed the armature is drawn to the magnet, and this by means of the lever draws the rod carrying half the banner to such a position that it is hid by the sides of the target. There being two banners and magnets, the entire signal is drawn apart out of sight so long as the circuit is closed. Any break, from whatever cause,—the arrival of a train, the movement of a switch, or any failure or break-down,—releases the armature and the banner drops down by its own weight, and the danger signal is given. This system appears to be adapted to the most complicated lines, and to be at once simple and inexpensive. It leaves nothing to be done by trackmen, switchmen, or train-dispatchers, and if, for any reason, it fails, the signals are placed at each end of the section at danger. If now there is a rear collision it is the following engineer's fault; and, to prevent every accident, it would seem that our railroad companies should place a pilot or lookout on the engine whose sole duty it could be to look out for signals. This has been suggested elsewhere, and it deserves attention.

New Pulverizing System.

The tendency in all work having to do with ores, minerals, phosphates, fuels, etc., is to employ the materials in as finely divided a state as possible. This has led to the introduction of a great variety of attrition mills, disintegrators, and pulverizers, each having greater or less merit in its respective field. The invention of the sand-blast led to experiments with blasts of air or steam as a means of breaking up or disintegrating minerals. It was found that if a powerful jet of air, carrying particles of quartz, ores, or other minerals, was thrown against a hard surface, that the minerals could be dashed or broken to pieces very rapidly. The only difficulty was to get some substance hard enough to stand the impact of the particles driven against it, and it was not till a wholly different plan was tried that the work appeared to be successful. This new system has now been tried upon a commercial scale, and in actual operation appears to work in a satisfactory manner. The novel feature of the system is to have two jets of air or steam, both laden with the minerals in the form of coarse powder, and to place them in line facing each other. The particles thrown forward by one jet would meet those from the other, and they would be crushed and shattered by dashing against each other. The manner in which this novel idea has been carried out is simple and inexpensive. The ore, minerals, stone, phosphates, or other materials, are first crushed to a coarse powder; for the apparatus is not designed as a rock breaker, but a pulverizer for reducing powders to flour or impalpable "float." From the crashing rolls it is led by a spout into a hopper placed over the pulverizer. This hopper has two spouts or openings below that lead the material to two smaller hoppers on each side of the machine. At the bottom of each hopper is a brass nozzle or steam jet. Directly in front of it is a second nozzle or guide-way, there being a small space between the two. Practically these two nozzles form an injector. The two injectors are placed exactly opposite and facing each other, the ends being in an inclosed chamber between them. From the upper side of this chamber is a large pipe for conveying away the exhaust steam, and the floating powder and dust, and at the lower side is a spout through which the coarse particles that will not float in the steam may pass out of the apparatus. The large exhaust pipe leads to a dust chamber, where the powder settles while the steam escapes into the air above. In using this apparatus it is the custom to employ two, side by side, and to place an elevator between them. The coarser material that will not float away with the steam to the dust-room, is led through the spouts to this elevator, and may be raised to a bolting machine, or it may be returned to the apparatus and put through it again. In the plant examined in operation two pulverizers were in use at once, pulverizing crushed marble, and reducing it to flour. It will be seen that in this system no power is needed beyond that required for the elevator and the bolting machine. Air can be used in place of steam, if it is more convenient, as the process is the same—a jet to impel the particles one against the other. There is no hard surface to be worn out, as the particles meet in mid-air quite free from anything. The only wearing parts of the apparatus are the ends of the nozzles. These, for economy, are made of cast-iron, and can be replaced in a few moments and at small expense. The system has the merit of cheapness, and appears to have been thoroughly thought out and tested on a large scale.

New Refrigerating Apparatus.

THE increase in the demand for cold-air machines has naturally stimulated improvements in old, and the invention of new, refrigerating appliances. Among the more recent of these is one employing sulphuric acid as an absorbent of the vapor of water, the extraction of the vapor from a mass of water in a vacuum causing the lowering of the temperature. The idea is not new, for it is the basis of familiar experiments in school laboratories, yet its application on a commercial scale appears to be both new and quite successful. The plant consists essentially of a freezer, in which the ice is formed, an acid tank, through which the vapor of the water is drawn, and an air-pump for creating a vacuum. There is also an apparatus for condensing the acid when it becomes too heavily loaded with water. The freezers, of which a number may be grouped together with one acid tank, consist of cast-iron tanks of any convenient shape or size, according to the size of the blocks of ice that is required. There is a funnel closed by a stop-cock for admitting fresh water, and a hinged trap or door, at the bottom, for taking out the blocks of ice. The acid tank is a cylindrical vessel of iron, having a helix or stirrer inside for agitating the liquid whenever it is necessary. This tank is connected by pipes with the freezers, and over the top has a dome, which is connected with an air-pump. The operation of the machine is simple. The air-pump creates a vacuum in the dome over the acid, and indirectly, by means of the pipes, in the freezers. The water begins to evaporate, and the vapor pervading the pipes and tank is absorbed by the acid, the air partly freed from vapor being steadily drawn away by the air-pump. This evaporation and absorption of the vapor causes a lowering of the temperature of the remaining water, and it freezes into solid blocks in the freezers. The pump is then stopped, and the tanks are opened from below. The ice falls out, and the tanks are closed and again filled with water, when the process begins anew. The only pause in the work is the occasional removal of the saturated acid and the putting in a fresh supply. The acid is freed from water in a condenser, and may be used over again in the machine indefinitely. While this is the main idea of this refrigerating plant, it has many details, and requires a special kind of air-pump. Lead is used wherever it is necessary to protect the apparatus from the action of the acid, and ingenious appliances are added for preventing the ice from clogging the water-pipes that fill the freezers, and for releasing the blocks of ice when they are finished. In a small plant, demanding a six-horse-power engine and the services of two men besides the engineer, six blocks of ice, weighing six hundred weight each, can be made in one hour, or fifteen tons in twenty-four hours. The cost of production must depend on the price of coal and labor; but, so far as can be learned, it is as low as by many of the larger and more costly appliances now in use.

New Telegraph Sounder.

IN a new form of sounder for indicating by sound the dots and dashes of the Morse alphabet, bells have been substituted for the metal stops of the common sounder. The object of this is two-fold: to give two tones of different pitch or quality in the same instrument, and to enable it to be used with either an alternating current or an intermittent current of the same polarity. The armature is in the form of a metal ball suspended on a vertical rod that is pivoted above and carries a metal hammer at the top. There are two coils, each having an iron stop or elbow at the top, and so arranged that the armature hangs between the two ends of these stops. By this arrangement the armature is free to swing between the coils, and may be drawn by the current to one or the other. Above the pivoted armature are two gong-bells, one on each side of the hammer, each being pivoted so that it may be brought nearer or drawn away from the hammer as circumstances require. When the apparatus is to be used for simply telegraphing by sound with a Morse current, the armature is drawn against one of the stops on the coils and the hammer is in contact with one of the bells. An interruption of the current causes the armature to move slightly, and the hammer strikes on the opposite bell, giving the long and short sounds of the code. When the vibrating needle system is to be used, and currents of continually varying polarity are to be employed, the armature rests quietly halfway between the coils. On the arrival of the current it is drawn to the right for one polarity and to the left for the other, and the opposite bells are struck. As the two bells have a different pitch or tone the signals of the code are indicated (long or short) by the difference between the bells. Besides this, in either method the pivoted arm supporting the armature is plainly seen to vibrate so that the messages may be read by sight as well as by sound (in a noisy place where the bells cannot be heard distinctly) as in the old needle instruments and one form of cable instrument. The new sounder is said to be very sensitive, and to work well on long lines and with feeble currents. It is now under practical experiment on an important telegraphic system. The only objection to such an apparatus that appears at first sight is the use of a sonorous bell, as the ringing, persistent sound would be troublesome. This objection appears to be met by making the bell of a soft metal that gives an agreeable but rapidly vanishing tone.

New Methods in Tunneling.

MUCH attention has been given during the past few years to the work of making tunnels for railroads, aqueducts, and subways. Many experiments have been made with a view to substituting machinery for the common system of drilling holes by hand or power tools, blasting out the rock and removing the broken material in cars. The aim in these experiments appears to be to make some kind of cutting tool that, when pushed up against the end or head of the tunnel, shall cut or tear down the rock in the form of dust or powder. In one machine this appears to be successfully performed. The apparatus is designed to be used in cutting a circular heading or advance tunnel of small diameter. If even a small opening is secured in advance, it is comparatively easy to enlarge the heading to the full diameter of the tunnel. The new machine is therefore designed to bore a round heading about 2.20 meters (84 inches) in diameter. It consists essentially of a T-shaped cutting tool, having a cutting edge on top, and turning on its axis or stem. This cutter is laid down horizontally with the cutting edge toward the face of the rock, and by turning it around rapidly the face is gradually cut or shaved off in the form of fine dust. The stem carrying the revolving cutter is hollow, and rests on a sliding support, so that it can be pushed forward, or fed up to the work as it proceeds, by means of a hydraulic ram within the stem. The machine rests upon a suitable frame, and is operated by means of a pair of steam or compressed-air engines. When the cutting tool has advanced to the end of the stroke of the feeding system, the entire machine, motors and all, can be raised from the frame and supported by jack-screws. The frame, by means of the hydraulic ram, can then be dragged forward under the machine till it is in position for work again. The machine is then lowered upon the frame and the cutting is resumed. The apparatus is reported to work in chalk at a speed of one hundred revolutions a minute, with an advance of 0.8 of an inch a minute, or nearly 50 feet in 24 hours. The broken rock and dust from the cutting tool falls into a hopper that leads it to an endless belt carrying buckets, by which it is conveyed under the machine to the rear and dumped into a car.

Smoke Prevention.

THE general principles upon which all smoke-preventing or smoke-consuming furnaces must be built are now clearly understood. The formation of smoke may be prevented by adding a fresh supply of hot air to the fire just beyond the fire-box, or furnace proper. This has been accomplished in a number of ways already described here. One of the most recent and simple methods offered consists essentially of a pair of fire-clay cylinders, placed one within the other, and having a small annular space between them. This double cylinder is placed in the furnace just beyond the grate. All the products of combustion pass through the smaller central tube, or cylinder, thus imparting a portion of their heat to both cylinders. Fresh air is taken into the furnace through ducts under the fire-box and ash-pit, and through the annular space between the cylinders. In passing between the cylinders it is intensely heated, and is delivered hot into the combustion chamber, where it meets any unconsumed gases that may have escaped from the fire, and assists in burning them. The novelty of the invention consists simply in the use of the double cylinders as a means of heating the fresh supply of air needed for complete combustion.

BRIC-À-BRAC.

The Song of Sir Palamede.

" Came Palamede, upon a secret quest,
To high Tintagel, and abode as guest
In likeness of a minstrel with the king.
Nor was there man could sound so sweet a string.
* * * * * *
To that strange minstrel strongly swore King Mark,
By all that makes a knight's faith firm and strong,
That he, as guerdon of his harp and song,
Might crave and have his liking.
* * * *'O King, I crave*
No gift of man that king may give to slave,
But this thy crowned queen only, this thy wife.' "

SWINBURNE. *Tristram of Lyonesse.*

WITH flow exhaustless of alliterate words,
And rhymes that mate in music glad as birds
That feel the spring's sweet life among light leaves
That ardent breath of amorous May upheaves
And kindles fluctuant to an emerald fire
Bright as the imperious seas that all men's souls desire:
With long strong swell of alexandrine lines,
And with passion of anapæsts, like winds in pines
That moan and mutter in great gusts suddenly,
With whirl of wild wet wings of storms set free:
In mirth of might and very joy to sing,
Uplifting voice untired, I sound one sole sweet string.

Love, that is ever bitter as salt blown spray,
Yet sweet, yea sweet as wrath or wine alway,
As red warm mouths of Mænads subtly sweet;
Love, that is fleeter than the wind's fleet feet
Soft-shod with snowflakes; love, that hath the name
And fury and force of swift bright shuddering flame:
Fate, that is foe to love and lovely life,
Yea foe implacable, and hath death to wife;
Fate, that is bitterer than the salt spray blown
And colder than soft snow yet hard as stone;

country, it often happens that the tuner is also obliged to be a repairer of the actions of pianos.

The business of piano-tuning is another of the employments to which women are beginning to aspire. There is in Boston a school where, for some time, tuning has been regularly taught to both men and women. The objection that women have not the requisite fineness of ear is met by the fact that of the applicants for admission to this school only a small proportion fail to enter by reason of any aural defect. The sense of tune or harmony appears to exist in greater or less degree in the majority of civilized people, and, if there is but a germ, it can be educated into something practically useful, be the pupil man or woman. The objection that women have not the strength required in the art is nonsense, for, with the proper tools, a child can break a piano-string with ease. The time required by a young woman to perfect herself in the art of tuning the piano, the pipe and reed organ, is about one year. The course of study begins with a systematic training of the ear in pure unison. For this purpose the pupil is provided with a piano from which the action has been removed. The three strings for each note are plucked with the fingers, and alternately tightened or loosened with the proper lever or key, till the pupil's ear clearly apprehends the difference between unison and discord. No attention is paid to pitch, as the sole aim is to train the ear to a true unison of tones. If the pupil fails in this stage of the work, it is hopeless to go on. She is simply "harmony-blind," precisely as one may be color-blind.

The next step is the training of the ear in pure harmony. For this work a piano is used having a worm and gear in place of the usual friction-pin for tightening the strings, so that the work of tuning is very light, the slightest movement of the hand controlling the instrument perfectly. The pupil now learns the relations of tones in a true major third. Then thirds are added together till the (tempered) octave is reached. Here the pupil discovers that the pure harmony does not bring the unison she had expected (from her previous studies) in the octave. In this manner the pupil discovers for herself the science of temperament. She soon hears the growl of the "wolf," and learns to catch the wailing "beats" of the interfering sounds. Then the science of tuning must be explained, and this leads to the study of acoustics in their relation to keyed instruments. Lectures and demonstrations in harmony and music are a part of the course. Having made some progress in tuning pianos, the pupil then takes up the tuning of the reed and pipe organ, with daily practice upon both instruments. During the entire course there is also drill in the gymnasium, with proper appliances for strengthening the hands and wrist. A good tuner also should know how to repair a piano. To equip the young woman for this work, there is regular practice upon models of all kinds of piano and organ actions. These are taken to pieces and put together with the usual tools till the mechanism is clearly understood. The action of a piano is easily taken out for repairs, and, as all the parts are interchangeable (for the same style and manufacture), it is not difficult to purchase the various parts and put them in their place when necessary. It is true the action is heavy, but there is always some one near who will lend a hand in lifting it out of the instrument. Piano-tuning is both a healthful and a profitable occupation, and a study of tuning trains the ear to good music.

Charles Barnard.

THE WORLD'S WORK.

Substitute for Hydrogen in the Lime-Light.

THE rapidly increasing use of the lantern in schools, public lectures, and exhibitions has led to a number of experiments to reduce the cost of the lime-light. In point of power and general usefulness nothing better, except electricity, has been found than the combination of hydrogen and oxygen in a single flame thrown against a piece of lime. In a few large cities the gases are easily obtained in commercial quantities, stored in iron tanks, ready for use, and at comparatively low prices. The tanks are troublesome to carry, and in smaller towns the gases must be made on the spot as required, and this involves expensive and troublesome apparatus. Every effort has been made to find a substitute for one of the gases. Street-gas, alcohol, and other things have been tried in place of the hydrogen, but with a decided loss of light. Common ether has been tried several times, but has been considered too dangerous. More recently an apparatus for saturating the oxygen with the vapor of ether has been devised, that appears to remove all danger of explosion and to give an excellent light. The apparatus consists of two strong brass cylinders, placed side by side upon a wooden support. These are open at one end, and have brass nipples at the opposite ends for receiving the gas-tubes. In each tube is placed a cylinder or roll of loose fabric, like flannel, having a small hole in the middle. These rolls fill the cylinders completely, fitting tight, and leaving only the small passage for the gas through the center of the material. Common photographic ether may then be poured into the cylinders till the wick-like filling is completely saturated, and then the excess of liquid is poured off and put back in its bottle. Two rubber caps, joined together by a short tube, are then fitted over the ends of the cylinders, and to one of the nipples is fitted the gas-tube from the oxygen-holder or tank, and to the other a tube leading to the burner. The oxygen for the burner is supplied by a third pipe. To use the light the oxygen is first turned through the cylinders, entering the rear of one and passing, by means of the short tube, to the next, and so on to the light. On its passage enough vapor is absorbed from the wicking to give a good flame at the jet, and when the oxygen jet is added to it, a light is obtained that, as far as observation goes, is quite as good as the ordinary lime-light. The striking back of the flame, and consequent explosion of the ether gas, when the gas is suddenly shut off, is said to occur but rarely, and with proper care it need never happen. However, to prevent all serious results of such an explosion, the rubber caps and tube joining the two cylinders are put on very lightly, and if there is an explosion the caps will be blown off before any dangerous pressure is reached. The invention has the merit of saving all the trouble of making or carrying hydrogen, as the whole apparatus can be carried in the hand, while ether can be obtained anywhere. One filling of the cylinders will last about ninety minutes, and a quart of ether will give a light for five hours.

Fire-Proof Construction.

THE objection commonly raised against fire-proof materials and systems for dwellings is their cost. Wooden floor-beams and lath-and-plaster partitions are so much cheaper than any of the excellent fire-proof materials that have been described here within the last few years, that it is difficult to find any ordinary city dwelling that is in any sense fire-safe. To meet this objection a new system has been introduced, that aims to make ordinary floor-beams and walls fairly proof against fire. Nothing is absolutely fire-proof, and the aim of all methods now is to prevent the spread of fire by confining it to one place, and checking the actual speed of combustion. To accomplish this, it appears only necessary to exclude the air as nearly as may be from all wooden surfaces. In the new system the beams are laid in the ordinary manner, pains being taken to have the under side of the floor perfectly level. On each side of every beam next the lower edge is nailed a narrow strip or ledge. The fire-proof protection consists of slabs of plaster-of-Paris and broken coke or cinders, resembling the plaster slabs used for partitions, but somewhat lighter, thinner, and finer in texture. For protecting the sides of the beams the slabs, having a step or rabbet on one edge, are placed against the beams, supported by the ledge which fits the step on the slab, and are nailed securely to the beam. The slabs are of the same width as the beam, and when in place, and when the cracks between the slabs have been stopped with liquid plaster, the beam is cased in an air-tight covering on two sides. The top is protected by the floor, which rests on both beam and slabs: for it has been found that wood protected from the air at the sides burns very slowly downward from the top. Beneath, the beams are protected by nailing larger and thicker slabs directly to the under side of the beams. Each slab covers three beams in width, breaking joints in the middle of the beams, and when all the beams are covered and the cracks made air-tight, the unbroken sheet of plaster slabs may then be used as the ceiling of the room below, a finishing coat being all that is needed. As a further protection, and to deaden the floors, another slab is inserted between the beams a short distance above the lower slab, and resting on a ledge formed on the side slabs. This arrangement divides the floor into two parts or hollow air-spaces, and effectually prevents sounds from passing from one floor to another. It also serves as an additional protection. In case of a severe fire under the floor, the nails supporting the lower slabs might become heated, char the wood, and drop out, letting the slabs fall. The second slabs would prevent the flames from passing between the beams, and only the lower edges of the beams could burn. As the slabs can be easily cut and repaired, there is no difficulty in making repairs of the gas or water-pipes that may be laid in the floors, and in case of leaking gas, or even of fire from electric light wires laid in the floors, no harm can follow, as the pipes and wires are inclosed in the air-tight space between the slabs. At an experimental test of this system of fire protection a number of common floor-beams, protected by the slabs and a floor above, were exposed to a fierce fire below for over an hour without injury to the floor. A portion of the lower slabs then fell off, exposing the lower edges of two beams to the fire. They were burned somewhat, but the progress of the fire was so slow that the strength of the beam was not appreciably impaired, though the fire below was kept up twenty-five minutes longer. A fire was then built on top, and allowed to burn till the floor was destroyed. On putting out the fire the beams were found to be only slightly charred on the upper edge, and to be practically as strong as ever. As far as our inspection of the beams that were exposed to the fire on both edges could decide, they seemed to be sufficiently strong after the fire to carry any ordinary load that could be put upon them. Given sufficient time and heat, of course such a system would fail. This is not the aim. If the fire is checked, and the strength of the floor maintained till help arrives and the fire can be put out, the construction meets all practical requirements. This appears to be accomplished. To make a slow-burning partition, the usual scantling is replaced by rough boards, tongued and grooved and fitted together, and making a solid but thin wall of wood. At intervals on each side of the partition is nailed lathing, placed vertically and in the middle of a board. Upon these are nailed horizontally the ordinary lathing. This gives a lath-and-plaster wall, but with no large, hollow places in which fire may spread unseen. The rough coat is put on as soft as possible, and the mortar is forced between the laths, filling all the narrow space behind them. This gives a wall of solid plaster, with a solid wooden core, the laths and boarding being covered air-tight on both sides. An inspection of some partitions built in this way seemed to indicate that the system is as valuable as that just described. The wall was firm, solid, and stiff, and showed a decided gain in thickness over the ordinary style of partition. The plaster was carried close to the floor and ceiling to prevent the intrusion of fire and rats behind the mop-board and cornice, and the door-jambs were made solid to exclude the air from the ends of the wall. Both of these methods of construction are cheap, the cost of a fire-proof wall being only a trifle more than an ordinary lath-and-plaster partition.

The Electric Light in Photography.

THE arc light has already been made the subject of experiment in photographic portraiture, and is now regularly used to illuminate a number of studios in Europe. By a new arrangement of the lights and the studio, the source of light is placed completely within the control of the operator, and effects are obtained that cannot be secured in any other way. The studio examined is at the end of a low, dark store on the ground floor, and there is no dependence whatever upon daylight. Upon the sides of the room near the ceiling are two tracks carrying a wooden car that reaches from side to side of the room. On this car are laid tracks for a smaller car, that travels on across the room in the opposite direction. The arrangement, it will be seen, is the same as that used in stone-yards and machine-shops, and known as an overhead crane. On this crane is suspended a powerful arc light, and, by pulling cords at the side of the room, the light can be moved to any part of the ceiling, or raised and lowered, as may be desired. In front of this crane is another having only one motion, across the room, the car on top carrying five arc lights suspended beneath it. This crane is also controlled by cords in easy reach of the operator. The subject sits in front of these six lights, and by moving the lamps perfect control of the illumination is secured. The light may be concentrated at one side, or spread out in front, oı distributed in any manner that the artistic treatmen requires. To secure still more complete control of the light, a platform is placed in the middle of the room before the lights. This platform is large enough to contain a seat for the subject and the camera. It is also pivoted at the center, so that it can be turned completely round in a horizontal plane. In taking a portrait, the subject sits upon the platform facing the camera, and the lights are raised, lowered, or moved about till just the effects of lighting that are desired are obtained. The operator stands on the floor behind the camera, with one hand resting on a handle fastened to the platform. The instant the exposure begins, the operator slowly turns the platform round, keeping it in motion while the exposure lasts. It is plain that the camera keeps the same relative position to the subject during the time of exposure and while the platform is moving, while the relation of the subject to the light is continually changing. This arrangement gives a continually shifting play of light on the subject, and secures a portrait having a fine gradation of tone and excellent modeling of the features. Only dry plates are used with the apparatus, and the exposure is a trifle longer than with daylight. To secure a like degree of definition the plate must be exposed five seconds, where a dry plate in sunlight would require three seconds. The portraits made by this arrangement of electric lights were marked by an excellent degree of finish, so that retouching did not appear to be necessary. The complete control of the light makes it possible to carry on work at all hours of the day or night, and in any weather. For copying, the electric light appears to be excellent, a single arc lamp with a reflector of white paper being all that is required.

Rain-band Spectroscopes.

WHILE the spectroscope has proved to be one of the most remarkable inventions of modern times, and while it is an invaluable aid to nearly all scientific research, it has not proved of general use in the daily work of the world. It is too costly, and can only be employed in the study of light, and, withal, the spectroscopic department of this branch of physics is a limited one. In the use of the spectroscope in studying the light of the sun there has been noticed a peculiar darkening of the solar spectrum, that appeared to be due to causes in the air, and not in the sun. In the colored band of the solar spectrum there appear, between the orange and yellow, a group of dark lines, the largest of which is known as the sodium line, and is marked "D" on the spectrum maps. This line is due to the presence of sodium in the sun, and is one of the most familiar of the absorption bands. Near this line is the group of lines known as the rain-band, a series of absorption lines due to the presence of invisible watery vapor in the atmosphere. In large spectroscopes this rain-band, when at its best, appears as a group of lines and hazy bars, and, by studying the changes in the number and intensity of these lines, something can be learned directly of the amount of watery vapor in the air, and indirectly concerning the weather for the next following day. If all the lines are visible, there is much vapor in the air, and, though the sky may be cloudless, rain may be expected very soon. If all, or nearly all, disappear, the following day will be pleasant. From this study of the rain-band in the spectroscope, it appears possible to predict the weather one or two days in advance with tolerable certainty. A spectroscope showing all the details of the rain-band group of lines would cost too much for ordinary purposes, and smaller and cheaper instruments have been recently introduced. These are not intended to show a very fine spectrum, but only enough of the red and green where the rain-band may be found. These spectroscopes are inserted in a small brass tube, about three inches long, that can be easily carried in the vest pocket. In the one examined, provision is made for adjusting the focus of the eye-piece by drawing out a telescopic slide. To adjust the slit of the prism, a small screw is placed at the side of the tube. It was dull and cloudy at the time, but on pointing it to the sky and looking through it, the rain-band could be seen as a thin line between the orange and yellow. Heavy rain followed the next day. It was not convenient to make further study of the subject with the instrument, but it appeared to be well made and properly adjusted to its work. In using this form of spectroscope, it should be pointed to the sky at a few degrees above the horizon, a north or west aspect being the best. No rules appear to be laid down as to the study of the band seen in these small spectroscopes, for the group of lines is here condensed into a single band; yet there seems to be no difficulty, after a little practice, in learning to judge of the amount of vapor in the air, and from this to infer the probable behavior of the weather.